FY2007 PROGRESS REPORT

SOUTH DAKOTA SPACE GRANT CONSORTIUM

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INTRODUCTION

Overview

During FY2007 the South Dakota Space Grant Consortium (SDSGC) continued operations under the management guidelines developed as a result of the 15th Year Evaluation Program Improvement and Results (PIR) Report and as outlined in NASA's 2006 Education Framework, which established the following three major educational outcomes:

Outcome 1: *Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals (Employ and Educate)*
Outcome 2: *Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty (Educate and Engage)*
Outcome 3: *Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission (Engage and Inspire)*

The report that follows describes and evaluates SDSGC's progress in addressing these major education outcomes. The principal programs and activities that map to each outcome are summarized in the table below. In addition to the three major education outcomes, it will be shown that three additional themes are threaded throughout all SDSGC programs; these are workforce development, diversity and partnerships with minority-serving institutions, and evaluation and longitudinal tracking.

Outcome 1 *(Employ and Educate)*	undergraduate and graduate scholarships and fellowships, NASA internships, USGS EROS and industry internships, engineering design teams, robotics curriculum development, research infrastructure in remote sensing and internet-based telescope network, developing university-NASA contacts, coordinating efforts with SD NASA EPSCoR, alignment with state technology initiatives and entrepreneurial activities for STEM students	*Development of a highly trained STEM workforce* *Engagement of Native American students and Tribal Colleges* *Evaluation and longitudinal tracking*
Outcome 2 *(Educate and Engage)*	higher education programs for STEM students and high school-to-college bridge programs (especially Native Americans), pre-college STEM programs for students (especially Native Americans and women), teacher training and grant programs, pre-college robotics, coordination with three NASA Explorer Schools and NASA Aerospace Education Services Program	
Outcome 3 *(Engage and Inspire)*	NASA and STEM content at informal science centers, South Dakota Space Days, public presentations on NASA discoveries, support of astronomical societies, educational broadcasting featuring NASA content	

Description of Report Format

SDSGC's FY2007 program goals and objectives described below and in the Consortium's 2006-2007 **Strategic Plan**, which also includes the respective outcome measures, are closely aligned with NASA's Education Framework. Consortium outcomes reflective of each of NASA's three main education outcomes are listed below under Program Areas 2 through 6 (Fellowship, Research Infrastructure, Higher Education, Pre-college, and General Public and External Relations). Program Area 1 (Management) is discussed separately and first. *(Note: The Consortium's 2006-2007 Strategic Plan is available at the Consortium's website referenced on the cover page, but nothing on the website is necessary for this report. The parts of the Strategic Plan germane to this report are included here. During 2008, the SDSGC will revise and reorganize its Strategic Plan to align with the three NASA education outcomes; this will simplify the format of future progress reports).*

Each program area below begins with a **"Quantitative Outcome Measures Matrix"** indicating whether the outcome indicators from the Consortium's Strategic Plan (and based on the associated goals and objectives described in last year's FY2007 Program Plan) for each of the six Program Areas were either completed, partially completed, or incomplete.

Outcomes that are conceptually repeated in other program areas are shown in gray. Outcomes that were "one-time" outcomes that have been completed and need no further action are ~~shown in gray strikethrough~~. Highlights of selected program accomplishments are given after the tables. For the outcomes that were only partially achieved or incomplete during FY2007, an explanation will be given in the FY2008 Program Plan (upon submittal later this spring) of how and when the desired outcome will be completed during FY2008 or whether the intended outcome has been revised.

FY2007 student summary tables A.1, A.2, and B are included at the end as Appendix A.

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CONSORTIUM MANAGEMENT ACTIVITIES

This section summarizes progress toward achieving the FY2007 strategic outcomes for Management (Strategic Plan, Program Area 1).

Quantitative Outcome Measures Matrix (Program Area 1: Management)

Objective	Outcome indicator(s)			
1.1	All reports will be submitted on time and in accordance with NASA guidelines.	√		
1.2	At least two faculty will visit NASA Centers or EROS each year to promote collaborative research	√		
	At least three students will participate in internship programs at NASA Centers.	√		
	At least five student interns will be placed at EROS (SAIC)	√		
	Representatives of the Management Team will be present at biannual national meetings and the Western Region Space Grant Meeting.	√		

	Members of the Management Team also hold positions on the Technical Advisory Committee and the Steering Committee of the state NASA EPSCoR Program	√		
1.3	Announce one position (one of two rotating 2-year positions) on Management Team to all Consortium members and affiliates and select one member by the start of the program year (May 15, 2007)	√		
	Relevant electronic communication sent to all member institutions, affiliates, teachers, and interested parties, as appropriate.	√		
1.4	Members of the Management Team meet once per year with representatives of state government to discuss alignment with state priorities, such as the Governor's 2010 Initiative	√		
	At least one additional representative of state government will be maintained on the advisory board.	√		
1.5	~~At least one additional representative of state industry will be appointed to advisory board by February, 2006~~	~~√~~		
1.6	Electronic databases maintained and updated/reviewed as necessary thereafter.	√		
	~~Consortium website completely redesigned by faculty and students at the Center of Excellence in Computer Information Systems at Dakota State University by November, 2006~~	~~√~~		
1.7	Draft annual Development Plan complete by November 2006		√	
	At least 20 targeted announcements of opportunity will be disseminated through electronic newsletter and website each year	√		
	Facilitate at least one multi-partner proposal each year to NASA or other agencies	√		
1.8	Diversity will be modeled in all aspects of the Consortium and participation by underrepresented groups will increase – (in participating organizations, programs, fellowship and scholarships, faculty awards, Management Team members)	√		
	NASA content or other STEM educational opportunities are expanded at the South Dakota School for the Deaf and the South Dakota School for the Blind and Visually Impaired	√		
1.9	Program evaluator will continue to participate in quarterly meetings [and monthly teleconferences]	√		
	In consultation with the Program Evaluator, the Management Team will continue to determine appropriate data collection and evaluation procedures that are consistent with available resources.	√		
	~~Consortium website completely redesigned by faculty and students at the Center of Excellence in Computer Information Systems at Dakota State University and/or use of National Space Grant Foundation longitudinal tracking system so as to collect evaluation data consistent with national longitudinal tracking requirements.~~	~~√~~		
	Strategic Plan and Roles and Responsibilities document (appendix of Strategic Plan) updated at an annual performance audit meeting.	√		
	The advisory board [REACH Committee] will be convened for an annual meeting by November 15, 2006 [and three times annually thereafter].	√		

Selected Management Activities/Accomplishments for FY2007

- At the Consortium's April 20, 2007 quarterly affiliate meeting, the Management Team selected two 2-year **"rotating" members to the Management Team** in follow-up to a March 3, 2007 announcement of opportunity that was sent to all affiliates. Chris Rossing of the Washington Pavilion's Kirby Science Discovery Center in Sioux Falls and Diane Melvin of the Journey Museum in Rapid City were both selected from among the candidates. Kristie Maher of the SD Discovery Center & Aquarium in Pierre was moved up from a rotating to a permanent position on the Management Team. The Consortium has **partnered with the three major museums/science centers** in the state in order to bring additional **outside resources to our pre-college, informal education programs**. SDSGC now has a very effective 9-member Management Team consisting of a representative cross-section of it membership. The Management Team meets quarterly in person at the consortium-wide quarterly meetings, as well as monthly during monthly Management Team teleconferences.

- After careful consideration during summer 2007, the Management Team decided to **drop six inactive affiliate members** pursuant to the Consortium's July 2005 *Roles and Responsibilities of Members* document. This effort was undertaken to maintain a highly-participatory affiliate membership and to continue improving Consortium operations. Affiliates to be dropped were notified in writing and given an opportunity to appeal the decision. It was clearly explained to them that this action did not preclude SDSGC from collaborating on an informal basis with them on any projects that may be deemed beneficial in the future. It was also explained that the expectations of formal affiliation would no longer have to be met, such as requirements for meeting attendance, reporting, responding to surveys, etc. As a result of this action, SDSGC's membership dropped from 26 to 20 during FY2007.

- Representation on the Management Team from **Sinte Gleska University** located on the Rosebud Indian Reservation continued during FY2007. This allowed the Consortium to forge even closer collaborations with minority-serving institutions and it helped exceed the targeted goal of 10% of Space Grant awards to minority students.

- SDSGC completed its second year of a formal subcontract with **St. Francis Indian School (SFIS)** to enhance STEM education for underrepresented Native American students on the Rosebud Indian Reservation and prepare them for college. This formal partnership is anticipated to last at least 3-5 years. Additional details are discussed later on page 24 under the section on NASA Education Outcome 2 (Pre-college Education).

- SDSGC continued its services of an **independent qualified evaluator**, Ms. Shannon Lane, a Ph.D. candidate in SDSU's Rural Sociology Department. Through sustained self-evaluation of the Consortium and its programs, SDSGC's long-term evaluation strategy continues to act a means of improving program offerings. With the guidance of Ms. Lane, it does so by evaluating program impacts on participants and assessing overall needs through participatory evaluation techniques. Ms. Lane maintains an active presence at all Consortium meetings and teleconferences of the Management Team, and she is part of all major program planning

committees. These efforts follow SDSGC's commitment to both formative and substantive evaluation procedures that began in 2005.

- SDSGC's Management Team is beginning to develop an improved, quantitative data-gathering instrument that will allow us to collect information on how the Consortium's student-based education programs increase enrollment in STEM. This instrument will be developed before the end of the current program year and implemented during FY2008.

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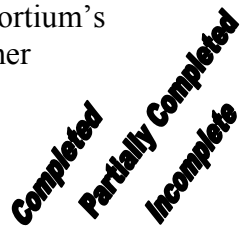
NASA EDUCATION OUTCOME 1
(EMPLOY AND EDUCATE)

Education Outcome 1 seeks to *"Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals."* This section summarizes the status of SDSGC's FY2007 strategic objectives related to Outcome 1. These include the Consortium's Program Areas 2 (Fellowships/Scholarships), 3 (Research Infrastructure), and 4 (Higher Education).



Outcome 1 – Fellowships and Scholarships

Quantitative Outcome Measures Matrix (Program Area 2: Fellowships)

Objective	Outcome Indicator			
2.1	A centralized, Consortium-wide annual Call for Fellowship/Scholarship Applications shall be implemented in 2005 and made available in subsequent years to all of the Consortium's higher educational members and affiliates via e-mail and the SDSGC website	√		
	Competitive review and selection of awardees	√		
	Awards reflect the diversity of the Consortium's membership and statewide balance	√		
2.2	Augustana College will provide opportunities for three students for research projects at EROS in 2007.	√		
	At least two SD Space Grant Fellows will participate in SD NASA EPSCoR research projects annually.	√		
	Offer research fellowships that support SDSGC initiatives (Badlands Observatory astronomical research or "Dark Skies, Bright Minds" program, robotics, NASA's "Microgravity University: Reduced Gravity Student Flight Opportunity Program, SDSM&T Aero Team, SDSU ACE Camp, etc.) At least three fellowships offered each year.	√		
2.3	In 2007, at least three interns will be placed at NASA Centers and at least five student interns will be placed at EROS-SAIC	√		
	~~At least two STEP fellows receive supplemental funding through SDSGC each year.~~			
2.4	100% of all student researchers funded through NASA South Dakota Space Grant will present results each year.		√	
	Opportunities will be offered to 100% of SDSGC student fellows to take advantage of professional development training.	√		
2.5	Awards to women/minorities equal or exceed 10% to minorities and 40% to females	√		
	At least three fellowships awarded annually to a student at a Tribal College or to a Tribal College student seeking to transfer to another SDSGC university	√		

2.6	Use of a web-based system will improve SDSGC's ability to assess the impact of its student programs and to maintain better contact with graduates of the program	√		
	~~Finalize arrangements with National Space Grant Foundation by December 2006 to include SDSGC in the longitudinal tracking system so that students funded during FY2005 and beyond can continue to be tracked in subsequent years at least through first employment.~~	~~√~~		
2.7	Adjustments are made to the fellowship and scholarship program to strengthen activities that are working and drop or correct activities that are not having the intended impact.	√		

Selected Fellowship/Scholarship Activities/Accomplishments for FY2007

Fifty-seven (57) applications were received from students from five of the Consortium's universities in competition for the $104,000 in NASA funding available through the FY2007 Fellowship/Scholarship Stipend Program and possibly $18,000 in funding from SDSGC's ESMD Space Grant internship program. **Forty (40) student awardees** were selected and offered a total of $107,450 in stipend funding. Three of those may receive most of their awards from ESMD Space Grant funds if their summer '08 internships are deemed "ESMD-relevant", but some of those three student stipends will likely come from regular Space Grant and are thus reported here.

- Engaging Minority Serving Institutions and Minorities:
  - In an effort to maintain meaningful partnerships with minority-serving institutions, James Rattling Leaf of Tribal College affiliate Sinte Gleska University remained on the SDSGC Management Team throughout FY2007. **Three Tribal Colleges** remain educational affiliates of the Consortium.

  - Of the 40 students funded through SDSGC's Fellowship/Scholarship program in FY2007 with regular Space Grant funds, **seven (18%) were minority students (Native American.)** Three of the seven Native American students attend Tribal College affiliate Oglala Lakota College (a minority-serving institution).

Diversity in Fellowship/ Scholarship Program

- 7/40 awards to Native Americans
- Three students at a Tribal College
- Native American female graduate student attends '07 JPL internship

  - Of the $107,450 of NASA funds offered to students under the administration of SDSGC's Fellowship/Scholarship Program during FY2007, $15,000 was awarded to minority students (the exact amounts of seven awards to be issued this spring are yet to be determined pending upcoming summer '08 internship status). [redacted]

  - Eighteen percent (18%) of the total number of funded students were minorities and 14% of the total funds awarded to students during FY2007 went to minorities (Native Americans). South Dakota's minority enrollment in degree-granting institutions is *11.3% (*8.1% Native American), and the Consortium's targeted goal is 10% of awards to minorities. The

Consortium **exceeded its targeted goal of 10% of awards to minorities** in both number of awards and amount of funding.
**Source: National Center for Education Statistics*
http://nces.ed.gov/programs/digest/d05/tables/dt05_208.asp

- Thirty-five percent (35%) of the total "number" of awards and 48% of the total "amount" of stipend funding was awarded to female students.

- SDSGC provided professional development training to 12 SDSM&T and **Tribal College students** who worked on National Science Foundation **Research Experience for Undergraduates** (REU) research projects during summer 2007.

- **Internship Placements at NASA Centers and Industry** - In the summer of 2007, SDSGC placed **seven (7) student interns at four NASA Centers and one aerospace industry** (Paul Cooney and Garry O'Donnell at **Goddard**, Jessica Weidenbach and Neil Patel at **JSC**, Mark Hofacker at **Marshall**, Connie Giroux at **JPL**, and Ashley Vayer-Jenkins who completed an aerospace industry co-op at **Hamilton Sundstrand**). These students are reported here because the internships occurred during SDSGC's FY2007 Program Year and were administratively supported by the Consortium's Fellowship/Scholarship Program, although direct funding to six of the seven students came from FY2006 Space Grant stipends. Although Neil Patel was funded directly through NASA USRP, his JPL internship is mentioned here because that program is promoted throughout the state by SDSGC's fellowship program.

Workforce Development in Fellowship/Scholarship Program
- Seven NASA/industry interns 2007
- Eight pending NASA/industry interns 2008
- One aerospace industry co-op
- Eleven USGS/EROS interns from SDSU, DSU, and SDSM&T
- Native American intern may be offered job at JPL

Eight (8) additional students have been offered FY2007 Space Grant funds for NASA or industry internships during summer 2008 pending their acceptance by NASA or industry.

This equates to **at least 7 and perhaps up to 15 students conducting internships** at NASA Centers or industry with direct stipend and/or administrative support from FY2007 Space Grant Fellowship/Scholarship Program funds as of this writing.

- In an effort to bolster longstanding relationships and collaborative research with the USGS Center for Earth Resource Observation and Science (EROS), SDSGC's Management Team facilitated the placement **of eleven (11) student interns at EROS during summer 2007**, over double the targeted number of five set in the Consortium Strategic Plan. Five students were from SDSU, four from Dakota State University, and two from SDSM&T.

- **Longitudinal Tracking** – During FY2007, SDSGC continued its formal arrangement with the National Space Grant Foundation (NSGF) such that all students provided with "significant support" from Space Grant (defined as over $1,000 in a single award) were tracked per NASA's longitudinal tracking requirements. Students funded during FY2005 and beyond are tracked at least through first-employment. This web-based, automated system allows self-reporting of post award educational history, employment history, anecdotal, and other information by former award recipients. Participants involved in Space Grant programs during each program year are added to the system before the end of the spring semester to ensure contact by the system prior to graduation. As is illustrated in the adjacent **Figure 1, 100% of the students significantly supported by Space Grant during fiscal years 2006-2007 who have completed the degree in which they received their Space Grant support, went on to either pursue advanced STEM degrees or to be employment in STEM disciplines.**

Longitudinal Tracking Results Summary

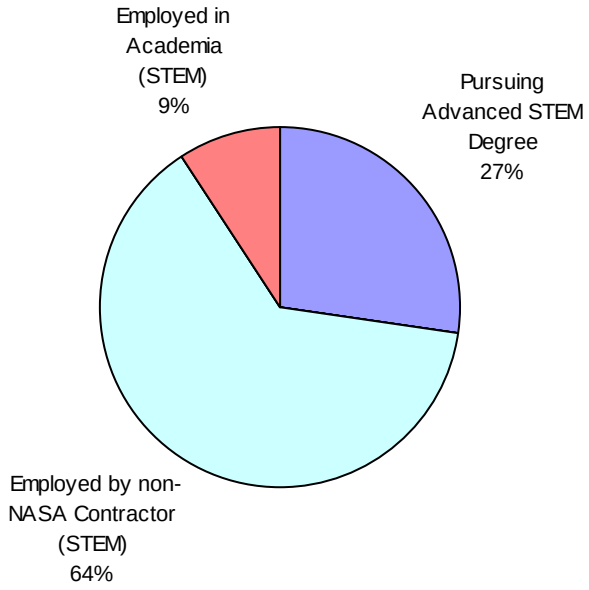


Figure 1: Next step taken by students who received significant support from Space Grant and whose funding ended in fiscal years 2006 and 2007.

Tables A.1 and A.2 summarize the student awardees from Augustana College, Oglala Lakota College, SD School of Mines & Technology, and SD State University who were provided funds through SDSGC's FY2007 Space Grant Student Fellowship/Scholarship Stipend Program.

Table B provides the **"FY2007 Summary of Longitudinal Tracking Data"**.

Tables A.1, A.2 and B are included at the end of this report as Appendix A and they are also included as a separate Excel file in the electronic submission of this report to NASA.

At the time of preparing the SDSGC FY2006 Progress Report, 36 students had received significant support form Space Grant from FY2006 funds. Since that time, an additional 12 students were supported from FY2006 matching funds. Twelve of the FY'06-funded students were also supported in FY2007 and are still enrolled in the degree program in which they received their support; thus they have been rolled forward to the FY'07 "Still Enrolled in Current Degree Program" column of the FY2007 Longitudinal Tracking Summary Table (Table B).

Table 1 on page 9 lists the students funded in FY2007 and their award amounts.

Numerous anecdotal points of success are discussed under **"2007 Student Accomplishment Highlights / Anecdotal Point of Success"** on pages 10-13.

Table 1: FY2007 Student Fellowship/Scholarship Stipend Awardees (from "regular" Space Grant, unless otherwise noted)

Last Name	First Name	Gender	School	Major	TOTAL
Harbaugh	Christina	F	Augustana	Computer Science	[redacted]
Ihry	Robert	M	Augustana	Biology	[redacted]
Belile	Donald	M	OLC	Environmental Science	[redacted]
White Eyes	William	M	OLC	Information Technology	[redacted]
Wilford	Devon	M	OLC	Environmental Science	[redacted]
Barker	D'Ann	F	SDSM&T	Electrical Engin. & Physics	[redacted]
Barth	Michael	M	SDSM&T	Civil Engineering	[redacted]
Boschee	Jacob	M	SDSM&T	Physics & Computer Science	[redacted]
Brech	Alex	M	SDSM&T	Computer Engineering	[redacted]
Bultsma	Christopher	M	SDSM&T	Electrical Engineering	[redacted]
Byram	Dana	M	SDSM&T	Physics	[redacted]
Chretien	Jessica	F	SDSM&T	Industrial Engineering	[redacted]
Cooney	Paul	M	SDSM&T	Mechanical Engineering	[redacted]
Dell	Adam	M	SDSM&T	Pre-medicine	[redacted]
Dodd	Melody	F	SDSM&T	Mathematics	[redacted]
Douglas	George	M	SDSM&T	Nanoscience and Engineering	[redacted]
Ewy	Katie	F	SDSM&T	Atmospheric Sciences	[redacted]
Farke	Joseph	M	SDSM&T	Mechanical Engineering	[redacted]
Giroux	Connie	F	SDSM&T	Technology Management	[redacted]
Heiberger	John	M	SDSM&T	Mechanical Engineering	[redacted]
Johnson	Andrew	M	SDSM&T	Mining Engineering & Mgmt.	[redacted]
Luick	Kegan	M	SDSM&T	Mechanical Engineering	[redacted]
O'Donnell	Garry	M	SDSM&T	Computer Engineering	[redacted]
Oleson	Mark	M	SDSM&T	Mining Engineering & Mgmt.	[redacted]
Oursland	Jacob	M	SDSM&T	Math & Computer Science	[redacted]
Priegnitz	Nathaniel	M	SDSM&T	Mining Engineering & Mgmt.	[redacted]
Rodriguez	Mitchell	M	SDSM&T	ME and MET	[redacted]
Rowe	Aryn	F	SDSM&T	Geology	[redacted]
Rowe	Becci	F	SDSM&T	Geology	[redacted]
Sanovia	Jim	M	SDSM&T	Geological Engineering	[redacted]
Schaefer	Patrick	M	SDSM&T	Computer Science	[redacted]
Stulken	Kelsey	F	SDSM&T	Applied & Computational Math	[redacted]
Vayer-Jenkins	Ashley	F	SDSM&T	Metallurgical Engineering	[redacted]
Weidenbach	Jessica	F	SDSM&T	Mathematics	[redacted]
Wiesner	Brady	M	SDSM&T	Civil Engineering	[redacted]
Bienfang	Cory	M	SDSU	Civil Engineering	[redacted]
Bressler	Lindsay	F	SDSU	Geography & GIS	[redacted]
Lahrs	Nathan	M	SDSU	Mechanical Engineering	[redacted]
Lane	Shannon	F	SDSU	Rural Sociology	[redacted]
Oswald	Anna	F	SDSU	Geography	[redacted]
TOTAL Awarded					**127450**

KEY

Undergraduate Student

Graduate Student (Masters)

Graduate Student (PhD)

Potential for "partial" ESMD Funding. Stipend Amount and Source are Pending.

2007 Student Accomplishment Highlights / Anecdotal Points of Success

Jessica Weidenbach, Senior Computer Science and Math major at SDSM&T, conducted a summer 2007 internship at Johnson Space Center (JSC) in Houston, TX under NASA's Undergraduate Student Research Program. She was assigned to NASA's Chief Scientist/Deputy Manager of the Engineering and Science Contract Group for the Astromaterials Research and Exploration Science Directorate. Jessica's task was to help complete a lunar database by merging several different lunar links and archived databases together in one website. One program that caught her interest at JSC was the Orbital Debris Program and Satellite Situation Report which reports every satellite, cataloged debris, and aeronautic equipment that is outside of the Earth's atmosphere. This report can be used for statistical purposes including launch dates and orbit information. Jessica wrote: "*My internship at JSC was an incredible experience. Not only was I able to understand more about my career field, I was also able to take part in several key projects that showed a large collaborative effort between all of the NASA centers. I had an amazing summer, and I hope that I can become a part of the NASA workforce or the Graduate Research Program following my May 2008 college graduation."*

Ashley Vayer-Jenkins, Metallurgical Engineering student and Space Grant fellow at SDSM&T, conducted a six-month aerospace industry co-op at Hamilton Sundstrand at their plant in York, NE in 2007. For the first four months her time was spent in the Metallurgy Lab where Ashley learned to a) identify the different metals used in parts manufactured on site by their microstructure, and b) run several machines used in the analysis process. The company then had her work on several projects. Ashley wrote: *"Overall, my experience at Hamilton Sundstrand could not have been a bigger blessing. The practical knowledge, friendships, and networking contacts I gained go beyond what any textbook can teach. I would recommend anyone to take a co-op when given the opportunity."* Ashley has accepted another aerospace industry internship for summer 2008 with Spirit Aerosystems, for which she was again provided stipend assistance from SD Space Grant.

LT Angie Monheim, Electrical Engineering graduate of SDSM&T (BS in 1998 and MS in 2000) and former SDSGC fellow, is currently serving in the US Navy. She is a designated Helicopter Aircraft Commander currently assigned to the Naval Satellite Operations Center (NAVSOC) as the Assistant Program Manager for the Mobile User Objectives System (MUOS), a new satellite constellation due to launch in 2009. While at SDSM&T, she completed two summer internships with NASA's Goddard Space Flight Center. She also served as the graduate student in charge of SDSM&T's first project to fly aboard NASA's KC-135 Weightless Wonder aircraft. LT Monheim contacted SDSGC in October 2007 and wrote: *"The SDSGC fellowship program was very beneficial for me and has paid dividends throughout my career. I was extremely fortunate to be allowed to manage SDSM&T's first KC-135 project, which gave me project management and systems engineering experience straight out of school. That experience directly applies to*

everything I'm doing right now at NAVSOC and enabled me to step into this position and be effective from the very start, even after a five year departure from engineering while assigned duties as a pilot. The opportunities provided by the Space Grant programs were absolutely invaluable, and I am very thankful and proud to have that experience."

Connie Giroux, a Native American Space Grant fellow who graduated from SDSM&T in Dec. '07 with an MS in Technology Management, completed a summer 2007 internship in the Mission Assurance Office of NASA's Jet Propulsion Laboratory (JPL). Connie's work included assessing the identified risks for the Mars Science Laboratory Project and the Aquarius Project, as well as reviewing risk management plans for these and one other project. Connie said: *"Overall, the internship at the Jet Propulsion Laboratory was a very positive and educational experience. I am very grateful to have had this opportunity. This internship allowed me to obtain experience in a field that was related to my field of study as a graduate student. I am considering continuing my education to obtain a Ph.D. I have applied for a position at the NASA Jet Propulsion Laboratory, and if selected, will strongly consider accepting it and beginning my career with NASA JPL."*

Garry O'Donnell, a Dec. '07 graduate of SDSM&T with a BS in Computer Engineering and minor in Computer Science and a keen interest and gift in working with robotics, was a summer 2007 Research Associate in NASA's Student Internship Program with Goddard Space Flight Center's Advanced Architectures and Automation Branch. Garry worked with his NASA mentor on research and analysis of artificial intellegence requirements and implementation methods for lunar robotics as part of NASA's Vision for Space Exploration. Garry said: *"The South Dakota Space Grant Consortium has provided me with multiple invaluable educational opportunities. The support provided has allowed me to grow both as an engineer and a professional, as well as given me industry contacts that are a priceless career resource."* Under additional Space Grant funding for work during his senior year, Garry conducted a senior design project titled "In-Situ Resource Utilization (ISRU) Surface Robot Behavior". The project involved a robotic behavioral programming algorithm to allow multiple robotics platforms to wander, search for and locate interesting locations, protect themselves, and interact with humans and other robots. His work provided a model for multiple robots mining regolith in a lunar situation.

Paul Cooney, an undergraduate Mechanical Engineering student at SDSM&T, participated in NASA's summer 2007 Student Internship Program at Goddard Spaceflight Center. He worked for the Lunar Reconnaissance Orbiter (LRO) project office. The LRO satellite is scheduled to launch in October 2008 and will orbit the moon for at least one year, creating a detailed map of the moon. Paul was responsible for several projects including designing paper and Lego models of the LRO spacecraft used for visual tools for project members as well as for education and outreach. He gained firsthand experience with research projects which helped educate him on the organization of a complicated space mission. He also

organized the creation of a rapid prototyped model of a spacecraft component to be used by an instrument team in Russia in order to solve a thermal blanketing issue. Paul said: *"All of these projects were exciting to me. I learned a great deal about project management, spacecraft design, and spacecraft integration and testing. I hope to work on this project again before it launches, perhaps doing some of the integration and testing. Working for NASA has been a dream of mine for a long time, and it is the reason that I am studying engineering. This internship was certainly one of the best experiences I've ever had."*

Mark Hofacker, a May '07 graduate of SDSM&T with a BS in Mechanical Engineering was so well-appreciated by his NASA mentors during his summer 2006 internship at Marshall Space Flight Center that they wanted him back again in the same office for summer 2007. SD Space Grant provided Mark with a stipend for this second internship. His summer '07 project titled "Polyethylene-Carbon Hybrid Composite" was conducted to help provide a new material that is strong and that will protect crews during long-duration, deep-space missions from harmful and potentially lethal exposure to ionizing radiation and from potential hazards associated with temperature and impact. Mark is currently attending graduate school at Vanderbilt University and is applying for the summer 2008 NASA Academy. He had indicated that he hopes to eventually gain full time employment at Marshall after completing his graduate studies. Mark recently wrote: *"Working at NASA showed me that being an engineer can be exciting and rewarding. I am now pursuing graduate school so that I can work for NASA when I graduate. [Space Grant] enabled me to take an internship with NASA, which helped in getting accepted into every graduate program that I applied to."*

Megan Burke, a graduate of affiliate Black Hills State University, was recently asked as part of SDSGC longitudinal tracking program "How did participation in these programs impact your education and life?" Megan replied: *"Profoundly. When I was awarded the Space Grant Scholarship, I had just changed my academic focus from visual arts to physical science. My participation in the Space Grant program [in 2005] not only afforded me the opportunity of conducting scientific research as an undergraduate, it also gave me the confidence to know that I can be a successful scientist. I am now in my second year in a PhD program at UCLA, studying Hydrology & Water Resource Engineering. … I believe this to be a direct result of my participation in the Space Grant Program."*

Debbie Entenman, a graduate of SDSU currently employed at SAIC (contractor to USGS EROS), recently wrote: *"My participation in the Space Grant program lead to my employment in my field of study at the USGS/EROS. The program had a large impact on the opportunities offered to me during and after my college experience. I am working with satellite data to produce national landcover data sets and applying the land information to document change of the earth's surface over time."*

Josephine Santiago, a graduate of SDSU and past Space Grant student fellow employed at NASA Kennedy Space Center wrote: "*[Space Grant] opened doors for me to pursue a career in the aerospace industry. I have been employed as an Electronics Design Engineer for the Constellation program."*

Jeremy Banik, a graduate of SDSM&T and previous Space Grant student fellow currently employed as a contractor with the Air Force Research Laboratory Space Vehicles Directorate as a Research Aerospace Engineer recently wrote: *"Participation in the Space Grant program enhanced my exposure to the space community and the types of work performed and the job opportunities available. This exposure helped to motivate me to take a space related engineering job. And the experience I gained during my time as a space grant [student fellow] gave me a head start in my space career. My [current] responsibilities include identifying and developing the new technologies necessary for future large deployable space structures for the Air Force. This work currently includes developing an innovative retractable payload to be demonstrated on a future space flight."*

Outcome 1 – Research Infrastructure

Completed
Partially Completed
Incomplete

Quantitative Outcome Measures Matrix (Program Area 3: Research Infrastructure)

Objective	Outcome indicators			
3.1	At least ten research announcements are distributed among appropriate SDSGC institutions each year	√		
	At least one NASA-related research proposal is submitted each year as a result of SDSGC coordination (see also 1.7.4)	√		
3.2	At least five Program Initiation grants are supported each year from SDSGC and/or state NASA EPSCoR funds	√		
	At least five travel grants for research development are awarded each year from SDSGC and/or state NASA EPSCoR funds (see also 3.3.2)		√	
	At least two SDSGC fellowships or scholarships are awarded each year for students to work on NASA EPSCoR or other NASA-related research projects (see also 2.2.2)	√		
3.3	Members of Management Team also hold positions on Technical Advisory Committee [REACH Committee] and Steering Committee of the state NASA EPSCoR Program (see also 1.2.3)	√		
	At least five planning trips to NASA Centers or EROS are supported each year from SDSGC and/or state NASA EPSCoR funds (see also 3.2.2)		√	
	An initial research needs and capabilities assessment of SDSGC academic institutions is completed by June, 2006			√
	~~An initial survey of state industries with potential aerospace capabilities is completed by May, 2005 (see also 1.5.1)~~	~~√~~		
	At least five announcements of research opportunities at state and federal agencies are distributed annually to faculty at SDSGC academic institutions	√		
3.4	Full or partial funding for new equipment and facilities is awarded to SDSGC institutions through SD NASA EPSCoR or SDSGC	√		
	~~At least three test sites are developed using imagery from the NASA-USGS EO-1 satellite (Hyperion and Advanced Land Imager sensors); two of the sites are located to support Tribal College research projects~~	~~√~~		
	~~A physical or electronic catalog of the remote sensing library holdings at EROS is prepared and distributed to SDSGC institutions and other interested parties~~	~~√~~		
	SDSGC members receive information on satellite imagery available through SDView	√		
3.5	At least two college or pre-college research or design teams receive SDSGC funds each year	√		
	SDSGC industrial and state government affiliates will be contacted regarding the needs and benefits of pre-college engineering design programs	√		
3.6	Work with admissions officers at SDSGC academic affiliates and with SDSGC's network of K-12 and informal education contacts to improve recruitment of qualified female students and students from underrepresented groups into STEM careers through activities such as Women in Science Conferences, FIS Success Academy, NES, and Space Day.	√		
	SDSGC fellowship/scholarship funds for research or design experiences at SDSGC academic institutions, EROS, and NASA Centers will equal or exceed 10% to minorities and 40% to females (see also 2.5.1)	√		
	~~A uniform system for longitudinal tracking of SDSGC scholars and fellows will be in place by December 2006.~~	~~√~~		
3.7	Adjustments are made to the research infrastructure program to strengthen activities that are working and drop or improve activities that are not having the intended impact	√		

Selected Research Infrastructure Activities/Accomplishments for FY2007

In FY2007, SDSGC supported the following research infrastructure programs conducted in alignment with the goals and objectives described in the FY2007 Program Plan submitted last year and as will be reported in CMIS: 1) faculty development to enhance research opportunities, 2) faculty/student research fellowships at NASA Centers and EROS, 3) research capability enhancement through program initiation grants and travel support, and 4) Research Experience for Undergraduates (REU) professional development training.

Workforce Development in Research Infrastructure Program

- Engineering design teams
- New university-NASA contacts at five NASA Centers
- Travel to two NASA Centers
- Research seed grants
- Eleven new proposals or "white papers" on NASA research

Diversity in Research Infrastructure Program

- Remote sensing test site aligned with Tribal College research
- Seed grants and travel grants offered at three Tribal College affiliates

- For several years, the SDSGC has utilized the SD NASA EPSCoR Technical Advisory Committee (TAC) as an advisory board. There is a great deal of redundancy, however, between the advisory role and the membership of the TAC and that of the state's **REACH Committee ("Research Excellence a Critical Hallmark")**. The REACH Committee oversees all federal EPSCoR programs in the state (NSF, NIH, NASA, DOE, DoD, EPA) and is charged with developing the state's Science and Technology Strategic Plan. Effective December 10, 2007, the SDSGC Director replaced the 17-member TAC with the 29-member REACH Committee as the advisory board for SDSGC and NASA EPSCoR. The SDSGC Director was appointed to the REACH Committee as a non-voting member and reports on NASA activities at meetings held three times each year. The REACH Committee includes the presidents and research vice presidents of all the state's public universities, the executive director of the South Dakota EPSCoR Office, representatives of tribal universities and EROS Data Center, state legislators, the executive director and other members of the state Board of Regents, the secretary of education, directors of the state Office of commercialization, state director for SBIR, the director of the SD Science and Technology Authority, and several leaders of state industry and commerce.

- Dr. Dan Swets, member of the SDSGC Management Team and Associate Director of SDSGC at Augustana College remained chair of the NASA EPSCoR Steering Committee in South Dakota. Dr. Swets worked with SDSGC Director Dr. Ed Duke in assuring close connection between Space Grant and NASA EPSCoR.

- Nine (9) new proposals for **Research Initiation Grants** were received during FY2007 by the SD NASA EPSCoR program. Five projects, representing four SDSGC university affiliates, were selected for support totaling $80,000 (NASA funds). These research projects are aligned with NASA activities at GRC, JPL, GSFC, ARC, and JSC, as well as with university collaborators at Auburn University and Kansas State University.

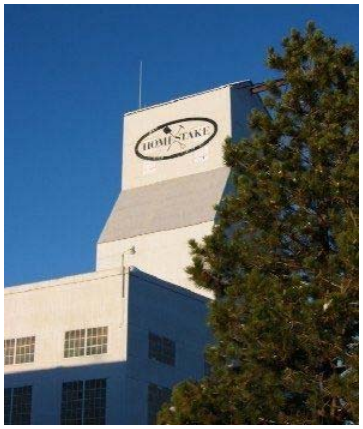
- Four (4) researchers, representing two SDSGC university affiliates, received **Travel Grants** through SD NASA EPSCoR during FY2007. These funds supported planning trips to meet with NASA researchers at GSFC and JPL.

- Twenty-five (25) "**targeted announcements of opportunity**" were distributed to SDSGC affiliates in 2007 that involved NASA-related research.

- Dr. Daniel Swets of the Augustana College Computer Science Department continued an ongoing collaboration with EROS to promote collaborative research on the joint NASA-USGS-Center for Drought Mitigation project. Augustana's Dr. Craig Spencer met with EROS scientists for remote sensing collaborations.

- Likewise, the affiliation between SDSU and EROS in the **Geographic Information Science Center of Excellence (GISc)** provides for frequent visits among seven SDSU faculty and eight EROS scientists aligned with the Center, promoting collaborative research between the two facilities. The SDSGC staff members at SDSU and faculty at SDSM&T are collaborating with two GISc faculty members on an Unmanned Aerial Vehicle project to evaluate low volume gravel roads by attempting to assess the 'crown' or shape of the road and detect washboarding or corrugation. Dalsted is also investigating a proposal with another GISc staff member to evaluate particulate matter exposures to rural populations as affected by the influence of land cover, weather, and topography, among other variables. A proposal is expected later in 2008.

- **Homestake Deep Underground Science and Engineering Laboratory (DUSEL) –** Considerable progress on this effort was made in July 2007 when the National Science Foundation (NSF) selected the former Homestake mine in the northern Black Hills as the site to be developed as the proposed Deep Underground Science and Engineering Laboratory (DUSEL). This designation does not provide any guarantees that the NSF will provide funds to fully develop the underground lab. However, it is a very positive step toward the goal of a large, extremely capable laboratory that will support long-lived experiments in particle physics, geosciences, engineering, and geomicrobiology. The NSF indicated their intention to provide $5 million per year for the next three years to develop a more specific technical design for the laboratory. The NSF Science Board, Congress and the President must approve the DUSEL project, estimated at ~$500 million, half of which would be used to develop scientific instrumentation for the laboratory.



The photo at the left shows Dr. Ray Davis and his neutrino detector installed in the mid-1960's at the 4,850 foot level of Homestake. Dr. Davis shared the Nobel Prize in Physics in 2002 for his work dealing with solar neutrinos. The Homestake Mine is a vast site capable of hosting a comprehensive suite of experiments in all major fields of science: low background experiments and very large detectors in particle and nuclear physics and

multidisciplinary deep sub-surface studies in geosciences, geoengineering and microbiology.

Work is currently progressing toward safe re-entry underground and pumping out water that has resulted from inflow since the gold mine closed in 2000 after 124 years of operation. Successful re-entry and control of the water will allow experiments to begin prior to the development of the larger, federally-funded laboratory. This early phase is known as the Sanford Laboratory at Homestake in honor of Mr. Denny Sanford and his generous $70 million donation in support of development of the lab and science outreach center at Homestake.

- **NSF Research Experience for Undergraduates (REU)** – SD Space Grant provided $1,300 to allow Dr. Al Boysen (SDSM&T English Dept.) to provide professional development training to 12 SDSM&T and Tribal College students who worked on REU research projects during summer 2007. The SDSGC-supported professional development training project was part of a larger $290,000 three-year (2005-2007) NSF-funded program called "Research Experience for Undergraduates (REU) Site: Mechanics, Materials, and Manufacturing (3M)".

For the professional development component funded by Space Grant, students turned in an analysis of graduate school (including their analysis of SDSM&T and one other graduate school of their choice), their resume, and biographical sketch for review and feedback. Writing and speaking rubrics were provided to all students to use as a basis for developing a professional poster and presentation at the conclusion of their research project. Students were evaluated on presentation quality in preparation for presenting their research at professional conferences. On July 13, 2007, SDSGC's Tom Durkin presented "NASA Funding and Research Opportunities" and "Mars Mania" to the REU students.

- **Design Team Support** – As explained in detail under the pre-college and higher education program areas, SDSGC provided significant support to university and pre-college design teams for participation in regional and national competitions. University team support includes SDSM&T's IEEE Tech **Robotics Team** and **Unmanned Aerial Vehicle Team** and Augustana College's **Robotics Team**. Pre-college support was provided to middle and high school **Lego robotics** teams at South Middle School and St. Thomas More High School in Rapid City.

Outcome 1 – Higher Education

Quantitative Outcome Measures Matrix (Program Area 4: Higher Education)

Objective	Outcome Indicators	Completed	Partially Completed	Incomplete
4.1	~~Reorganize the "Educational Opportunities (Higher Education)" section of SDSGC website to make it more user friendly; add a web counter to monitor access and an online feedback section (see also 1.6 and 1.9)~~	~~√~~		
	At least ten NASA education announcements are distributed among appropriate SDSGC institutions each year	√		
4.2	At least two faculty or students from SDSGC affiliates will participate in NASA education programs each year	√		
4.3	Directors of new research centers and new Ph.D. programs are informed of SDSGC fellowship/ scholarship and other programs	√		

	~~At least two STEP fellows will receive supplemental funding through SDSGC each year (see also 2.3.2)~~			
4.4	At least one representative of SDSGC will attend state's annual GIS users conference and promote partnerships between industry and academic affiliates	√		
4.5	Participation by women and minorities will equal or exceed 10% to minorities and 40% to females (see also 2.5.1)	√		
4.6	Adjustments are made to the higher education program to strengthen activities that are working and drop or improve activities that are not having the intended impact	√		

Selected Higher Education Activities/Accomplishments for FY2007

During FY2007, SDSGC supported the following higher education programs conducted in alignment with the goals and objectives described in the FY2007 Program Plan submitted last year and as will be reported in CMIS: 1) student and faculty travel support to present technical papers, 2) American Indian Science and Engineering Society (AISES) student chapter support, 3) Project Initiation Grants for Higher Education, 4) Space Grant Student Fellow Coordination, 5) Tribal College Relations Program, 6) SD GEAR UP Program, 7) Flandreau Indian School (FIS)/SDSU "Success Academy", 8) Diversity Coordinator at SDSU, 9) Robotics Team Support, 10) South Dakota View, and 11) Space Grant Internet Telescope Network.

Workforce Development in Higher Education Program

- Three engineering design teams
- Robotics integrated into math programming curriculum

Diversity in Higher Education Program

- Tribal College representative on Management Team
- Four STEM support programs for Native American students
- Higher Education opportunities offered to all three Tribal College affiliates

- SDSGC programs continue to focus on developing strong undergraduate programs in aerospace and earth science through fellowships/scholarship program support. Of the $107,450 awarded under the Consortium's FY2007 Fellowship/Scholarship Stipend Program, 79% of the funds were offered to undergraduates and 21% to graduates.

- In FY2007, SDSGC provided seven (7) **Space Grant fellowships to Native American students** at Oglala Lakota College and SDSM&T. The Consortium plays a vital role in SDSM&T's goal to achieve and maintain national prominence for the recruitment, retention and graduation of American Indians seeking mathematics, science, and engineering at the graduate and undergraduate levels. *(To avoid duplication, see additional details in the "Fellowship/Scholarship Program" section of this report for percentages of awards to Native American students and students at minority-serving institutions.)*

- As a member of the SD NASA Space Grant Consortium management team and the SD NASA EPSCoR Technical Advisory Committee, James Rattling Leaf plays an invaluable role in representing Native American needs and perspectives in the state decision-making processes. Since 2003 he has also been a principal investigator on the **NASA REASoN** (Research, Education and Applications Solutions Network) grant titled "**Using Geospatial Information to Enhance Tribal Rangeland Management through Education and Understanding**." The project is implemented in cooperation with USGS/EROS and focuses on the sustainability of natural resources on the Rosebud Indian Reservation. Rattling Leaf is also a co-principal

investigator on the state's current NSF EPSCoR Research Infrastructure Improvement grant, providing essential continuity in the diversity goals of the NASA and NSF research infrastructure programs.

- SDSGC staff continued to partner with a three-year, $250,000 award through the **NSF program Opportunities for Enhancing Diversity in the Geosciences**. The funded proposal that resulted in this award was written by SDSGC staff several years ago. The program allows SDSGC and Tribal College personnel to engage a larger segment of the Native American community with earth and space science education and research, all within a Lakota cultural framework. The "He Sapa Bloketu Woecun Pilot Experience" (Black Hills Family or Community) was held in the Black Hills on June 19-22, 2007 and was based at SDSM&T. **SDSM&T, Sinte Gleska University, and Humboldt State University in CA** sponsored a series of camps for eight Native American (Lakota) youth and their families. The intent was A) to nurture a geoscience learning community linked to culturally significant sites in the Black Hills sacred to the Lakota and other Plains tribes, and B) to increase the participation of Native people in the geosciences. The camps provide outdoor, experiential learning experiences to integrate indigenous knowledge and science with contemporary western science. Four major themes include:

    - **Earth (Wanji)** – understanding the geology of the Black Hills and Badlands.
    - **Fire (Nunpa)** – contemporary and historic roles of fire in the forest and prairie.
    - **Water (Yamni)** – function and importance of surface waters, aquifers and hydrology.
    - **Wind (Topa)** – meteorology of the Black Hills, a unique climatologic system of the Northern Great Plains.

SDSGC's StarLab Planetarium was provided for a presentation by a Lakota Elder on the subject of Lakota Star Knowledge. Concepts of modern astronomy were also worked into the presentation by SDSGC staff. Based on the 2007 pilot project, a summer 2008 camp is planned for a much larger group.

- **American Indian Science and Engineering Society (AISES)** – A national organization founded to increase the number of American Indians in STEM fields that continues to be supported by Space Grant through stipend support to member students, notification of NASA educational opportunities, and professional development training.

- SDSGC again supported the **SDSU-Flandreau Indian School (FIS) Success Academy** in 2007 by providing funds in conjunction with Citibank for ten FIS seniors to complete six credits of **university coursework as part of the Academy's "Countdown to College" program**. The SDSU-FIS Success Academy is an early and intensive college preparatory program for 206 Native American high school students (9-11 grades) are participating in the spring semester 2008. Success Academy began in SDSU's College of Engineering eight years ago and since has

expanded to involve the entire university. Success Academy exposes students not only to college, but also to the careers open to college graduates. The program emphasizes career areas identified by tribal leaders as being of critical need to their communities (e.g., engineering, agriculture, education, pharmacy, nursing, journalism and nutrition.) Success Academy has two goals: 1) to help more American Indian students prepare for and succeed in college, and 2) to make SDSU into the kind of place where that can happen. SDSU-FIS Success Academy has served over 1,000 American Indian students. It has evolved into a comprehensive, four-year college preparatory program serving all freshmen, sophomores, juniors and seniors attending FIS. Each individual FIS student visits SDSU 15 times before he or she is a senior in high school. Fifty- two (52) Success Academy students have enrolled for classes at SDSU as concurrent high school students. In the 2006/2007 school year five of these students enrolled at SDSU as college freshmen. This is a **500% increase over the number of FIS students continuing their education at SDSU before the start of Success Academy**. In addition, many Success Academy graduates have continued on with post-secondary education at other institutions throughout the state and nation. This program is another excellent measure of SDSGC's success at recruiting and training underrepresented minorities for academic and professional careers in science and technology.

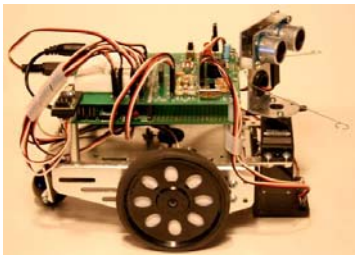
- **SD GEAR UP Program** – For the 15th consecutive summer and bigger than ever, the SD GEAR UP Program was held during the summer of 2007 on the SDSM&T campus with 175 high school students from grades 9-12, several college students, and 20 staff members some of whom are the college students. It is a **six-week residential college-preparatory program for Native American students interested in engineering and science**. Much of the funding for the program comes from a federal GEAR UP grant through the South Dakota Department of Education. Previous names of the program included "Scientific Knowledge for Indian Learning and Leadership" (SKILL) and NASA Honors. The SD GEAR UP program boasts some very impressive statistics. Of those students who graduate from the program, virtually 100% also graduate from high school, 85% attend college, and 7% enter the military.

SDSGC ramped up the NASA component of the GEAR UP program this year by providing five space-related activities. Tom Durkin presented four separate programs to all 175 GEAR UP students in June 2007. Presentation topics included the solar system, NASA's Mars Exploration Rover Mission, and the Hubble Space Telescope. An evening Star Party was hosted by the SD Space Grant Consortium and the Black Hills Astronomical Society. To complete the NASA component of the program, a **live videoconference with NASA JPL** was set up. Native American graduate student Connie Giroux from SDSM&T, who conducted a summer 2007 internship at JPL, gave a live presentation on her research experience from JPL. This was a great way to connect a large number of Native American high school students with a successful Native American graduate student from South Dakota that is in the NASA pipeline.

- **South Dakota View (SDView)** is a consortium of educational institutions, government agencies, and private sector organizations in South Dakota with a common goal of building **partnerships and infrastructure to facilitate the availability, timely distribution and utilization of remotely sensed satellite data**. SDView is a charter member of AmericaView, a nationwide program that focuses on satellite remote sensing data and technologies in support of applied research, K-16 education, workforce development, and technology transfer.

AmericaView is administered through a partnership between the U.S. Geological Survey and the AmericaView Consortium. During FY2007, more LandSat satellite data was added to the SD archive for scientific and other uses.

- **SDSM&T and Augustana Robotics Team Support** – SDSGC provided $6,000 in support of SDSM&T's "Tech Robotics Team" to prepare for and participate in the annual IEEE robotics competition to purchase materials to construct the robots, and to help cover travel expenses to the competition site. Robotics team members gain hands-on application of theoretical knowledge in mechatronics, electrical circuits, and programming. Augustana College was also provided support from Space Grant to incorporate robotics into computer programming exercises. Eight student members of the SDSM&T and Augustana College Robotics Teams provided separate robotics exhibits to pre-college students at SD Space Days 2007.



- **Robotics Laboratory, Senior Design, and Robo Camps** – The Interdisciplinary Robotics Initiative (IRI) began in 2006 through a Space Grant Project Initiation Grant (PIG) and has seeded additional growth in robotics education during FY2007 at both the university and pre-college level. A robotics sequence introduced to an entry level computer programming course at SDSM&T last year through the Space Grant PIG is now incorporated into a higher-level Software Engineering / Senior Design sequence. Five senior design robotics software projects resulted in designing a complete graphical robot training program for middle school students that will be used as a basis for a summer '08 middle school Robotics Camp. Plans are underway for an NSF Research Experience for Undergraduates (REU) program to train undergraduate students to teach pre-college Robotics Camps. The plan is to use the Space Grant-initiated project to launch the NSF funding. The entry level computer science class that was the test bed for the IRI program received its highest attendance and retention level in the history of the course. The professor who taught the course received his highest instructor/class evaluation rating by the students (4.8/5.0). These statistics show how the Space Grant-supported robotics program has significantly improved the educational success of this computer programming course.

- **South Dakota CAMP Student Teams Compete Across Disciplines with Distinction** – SDSM&T offers students a unique opportunity to participate in a student-centered, hands-on, engineering program called CAMP (Center of Excellence for Advanced Manufacturing and Production). A key part of this experience involves designing, building, testing, and competing in a variety of engineering challenges. SD Space Grant continued to support several of the 11 CAMP teams and individual student team members in FY2007 (e.g., Robotics, Aero Design, and Unmanned Aerial Vehicle teams.) CAMP teams produce visibly striking projects as they weave technical prowess through real-world projects with logistics, planning, resource development, and deadlines. Multiple student teams competed nationally and internationally from discipline-specific to multi-disciplinary projects. Highlights from the SDSGC-supported FY2007 CAMP teams include:

- **Aero Design** – The 2007 Aero Design team placed second in design at the Aero Design West competition. They also took fourth place in flight points and sixth place overall. The Aero team also won and award for their technical paper this year. The 2005 and 2006 teams placed first overall, respectively.
- **Robotics** – The School of Mines Robotics team entered four robots in competition against twenty-six teams at the 2007 IEEE Region 5 competition. Two of the robots successfully moved to the finals, eventually placing fourth and sixth. Robotics has been part of the tech campus since 1999 and earned numerous top three honors at IEEE competitions.
- **Unmanned Aerial Vehicle** – The 2007 International Aerial Robotics competition at the McKenna Urban Operations Site at Ft. Benning, GA placed the SDSM&T Unmanned Aerial Vehicle (UAV) team in a tie for second place. The UAV team placed second in the static events by winning the award for best technical paper with a perfect score of 100; the first time in the history of the competition that any team has scored 100. The team also received honorable mentions for their presentation and for innovation of design. Funded by SDSGC, Dr. Al Boysen provided professional development training to Space Grant students and teams, has worked with the UAV team over the years to improve their communications. The team placed first overall in 2006.

- **Space Grant Internet Telescope Network (SGITN)** – Conceived during FY2006, the SGITN program began operations in North and South Dakota in August 2007. Five graduate student and faculty projects were initiated when the SGITN began operations and observers have used observatories in both states. Also, a poster for the SGITN was presented at the 2008 American Astronomical Society (AAS) meeting in Austin, Texas, on January 8, 2008. Discussions are underway to add observatories in Utah and Alabama to the Network. The Network is also receiving interest from potential observers in Connecticut and Puerto Rico. SDSGC-affiliate Badlands Observatory with its high-quality, research-grade 26 inch f4.8 Newtonian Telescope is the participating entity in South Dakota. The primary goal of this **multi-consortium project** is to provide university undergraduate/graduate students and faculty with greater access to research quality astronomical observatories for both research and educational projects. SDSGC committed $5,000 during FY2007 for this ongoing project.

Due to the busyness of setting up the new SGITN program, "Dark Skies, Bright Minds" collaborative educational program between Badlands Observatory and SDSGC had very limited participation in FY2007. In spite of that, a new supernova search program was begun in December 2007 and shows great promise. After using the Badlands Observatory telescope for only a month, a student from Brandon Valley High School, in Brandon, SD has already achieved an **independent discovery of the new supernova SN 2008a**. It is hoped this program will be expanded in 2008 to include more student participation from other SD schools and colleges.

- **Publications and Higher-Education Presentations related to Space Grant (FY2007)**
  - A. Boysen, 2007, "Multicultural Issues at SDSM&T: A New Beginning", Presentation for South Dakota Council of Teachers of English, March 23-24, 2007, Chamberlain, SD.

- A. Boysen, 2007, "Developing a Career-Communications Strategy: Packaging, Assessing, and Marketing Yourself", Presentation for South Dakota Society of Professional Land Surveyors, January 11, 2008, Chamberlain, SD.
- A. Liu, G. Leptoukh, D. Ostrenga, H. Rui, J. Hulka, L. Carlaw, 2006, "NASA GES DISC Hurricane Web Portal", *Eos Trans. AGU, 87*(52), Fall Meeting Supplement, Abstract
- S. Mannel, M. Price, and D. Hua, Feb. 10, 2006, "A method to obtain large quantities of reference data", *International Journal of Remote Sensing*, v. 27, no. 3, February 2006, pp. 623–627.
- J. Clang, D.E. Clay, L. Leish, D. Aaron, K. Dalsted, and M. Volz. 2007. Atmospheric correction: Errors associated atmospheric calibration of Landsat data. Comm. Plant and Soil Anal. (In press).
- U. Mishra, D. Clay, T. Trooien. K. Dalsted, D.D. Malo. 2007. Using remote sensing based ET maps to assess landscape processes impacting soil properties. Geoderma (In review).

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NASA EDUCATION OUTCOME 2 (EDUCATE AND ENGAGE)

Education Outcome 2 seeks to *"Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty."* This section summarizes the status of SDSGC's FY2007 strategic objectives related to Outcome 2. These correspond to the Consortium's Program Area 5 (Pre-college).

Outcome 2 – Pre-college Education

Quantitative Outcome Measures Matrix (Program Area 5: Pre-college Education)

Objective	Outcome indicator(s)			
5.1	Electronic databases of pre-college contacts available updated as necessary	√		
5.2	SDSGC members will participate in at least one pre-college education proposal by the end of 200[7]	√		
5.3	SDView will conduct and publish the results of a K-12 geospatial education needs assessment survey		√	
	At least 100 teachers will participate in workshops facilitated by SDSGC such as NASA AESP training, GIS/GPS training, E-missions, GEMS, StarLab Planetarium astronomy training, UMAC's Earth Science Tools for Educators workshop, and NASA Speaker's Bureau	√		
	Website is updated at least monthly~~: add a web counter to monitor access and an online feedback section (see also 1.6 and 1.9)~~	√		
	At least two South Dakota schools (at least one Tribal school) apply for the 200[7] NASA Explorer Schools Program	√		
5.4	[At least 1,000 people will attend *"NASA South Dakota Space Days 2007"* on Oct. 18-19, 2007 in Sioux Falls]	√		
	Over 3,000 students each year participate through Women in Science Conferences, K-12 science fairs, Aerospace Career and Education Camp, Flandreau Indian School Success Academy, Badlands Observatory's "Dark Skies, Bright Minds" educational program, RoboCamp, and related programs	√		
5.5	These teacher-training programs embrace state education standards in math, science,	√		

	and language arts and will introduce at least 50 teachers to NASA and space science curricula			
5.6	Over 1,000 females and students from underrepresented groups participate each year through Women in Science Conferences, K-12 science fairs, Aerospace Career and Education Camp, Flandreau Indian School Success Academy, Badlands Observatory's "Dark Skies, Bright Minds" educational program, RoboCamp	√		
5.7	Adjustments are made to the pre-college education program to strengthen activities that are working and drop or improve activities that are not having the intended impact	√		

Selected Pre-college Activities/Accomplishments for FY2007

During FY 2007, SDSGC supported the following pre-college education programs conducted in alignment with the goals and objectives described in the FY2007 Program Plan submitted last year and as will be reported in CMIS: 1) Regional Science Fairs, 2) Badlands Observatory's "Dark Skies, Bright Minds" program, 3) Robotics Support, 4) Engineer's Week, 5) K-12 Informal Education Program, 6) St. Francis Indian School Partnership Project, 7) NASA Teacher Training, 8) Women in Science conferences, 9) Aerospace Career and Education (ACE) Camp, 10) Flandreau Indian School Success Academy, and 11) NASA Explorer Schools (NES).

- **NASA Explorer Schools (NES)** –Three NES schools are present in South Dakota, two of which are located on Indian Reservations with near 100% Native American student populations and the third with over 50% minority enrollment. SDSGC continued to support these schools during FY2007 with invitations to South Dakota Space Days and to robotics teacher-training opportunities in conjunction with NASA AESP trainers.

- **St. Francis Indian School Partnership** – SDSGC continued its formal collaboration with pre-college Tribal school St. Francis Indian School (SFIS) to enhance STEM education for underrepresented Native American students on the Rosebud reservation and prepare them for college. Approximately 600 Native American students attend SFIS and 97% of them receive free or reduced lunches. It is likely that SFIS may apply for NASA Explorer School status.

Workforce Development in Precollege Program
- Engineers' Week
- NASA teacher training
- Aerospace Career and Education Camp
- Space Camp
- Lego Robotics

Diversity in Pre-college Program
- Intensive STEM education programs at Tribal schools
- Three NASA Explorer Schools with near 100% Native American enrollment
- Women in Science and Engineering

This collaborative partnership leverages resources from Space Grant and the SFIS Gifted and Talented Program to bring educational opportunities to students that inform, inspire, and motivate them about educational and career options in aerospace, earth science, and other STEM disciplines. The program encourages students to use leadership skills in acquiring the education that enables them to have the opportunities to succeed. The SDSGC/SFIS collaborative program sponsored the following three projects during FY2006:

1) **Summer of Action Research** (SOAR) – Developed by SFIS teachers, the SOAR program provides on-campus training and team building as well as off-campus research at Yellowstone National Park that combines scientific inquiry and technical writing.

2) **Career Explorations/College Visits** – Students travel to colleges and technical school campuses to expose them to varied post-high school educational opportunities.
3) Other Activities – Includes a **science fair**, **rocketry classes** for grades 9-12, and an after-school **robotics program** for grades 4-8.

On Feb. 20, 2008, SDSGC's Tom Durkin will provide a daytime program titled "What's in the Night Sky" followed by evening star party with the Consortium's telescope for SFIS's annual "Parents/Family Night". SDSM&T's Director of Multicultural Affairs was present for SFIS's college fair that same evening. Affiliate SD Discovery Center also provided their StarLab Planetarium as one of many STEM exhibits.

- **Science Fair Support to 1,100 Students**
  - **SDSU's 2007 Regional Science and Engineering Fair** hosted 278 student exhibits and 422 participants. SDSGC Associate Director Kevin Dalsted judged the science fair exhibits and provided SDSGC-related display materials at the College of Engineering booth.
  - **SDSM&T's 53rd High Plains Regional Science and Engineering Fair** will be held on April 4, 2008 where an estimated 400 students will compete for prizes and the opportunity to compete at the 2008 Intel International Science and Engineering Fair in Atlanta, GA.
  - **23rd annual Augustana Science Day** was held at Augustana College on October 12, 2007 for all junior and senior high school students and teachers in the Sioux Falls, SD area. The purpose of this successful event is to provide hands-on science experiences for high school students in the areas of Biology, Chemistry, Computer Science, Health, Physical Education and Recreation, Mathematics, Nursing and Physics. About 275 students attended.

- **Ready Set Go** – At this 2007 workshop held at SDSU, 47 high school girls participated in a day of learning about STEM career opportunities from professional women in various STEM fields. GIS technology and other hands-on activities were provided to encourage them to pursue science and technology in college.

- **Pre-college Robotics Support**:
  - **$5,000 Pre-college Robotics Grant** – Beginning in FY2007, the Management Team of SDSGC established a new budget line item of $5,000 to be awarded as a pre-college robotics grant. The FY2007 grant winner, David Ireland, is a sixth-grade teacher from **South Middle School** in Rapid City. He was provided the grant in November 2007 in support of his proposal to incorporate a robotics unit into his science curriculum. Approximately 100 students participate in the program annually. Robotics was found to be ideal for meeting the SD State 6th Grade Physical Science Standards. Connection to real-world robotic ventures such as NASA's Mars Exploration Rovers gives students a sense of how this technology is cutting edge and is used in many scientific applications. The middle school students are encouraged to participate in their school's science club, summer science and robotics camp at SDSM&T, and advanced placement science at the high school level. This program uses robotics as a viable tool to increase student

enrollment in STEM by teaching science concepts that motivate students to pursue further science education. This middle school robotics program **integrates with SDSM&T's Interdisciplinary Robotics Initiative (IRI)** described earlier in this report and it provides a pipeline for science and technology bound students.

- **NASA Summer 2007 Teacher Academies** – SDSGC supplied funding and organizational support for four, two-day teacher-training academies for K-12 teachers. The academies were hosted by **SDSGC informal education partners** in cooperation with NASA Aerospace Education Specialist Angelo Casaburri from Johnson Space Center in July 2007. Two academies were held in Rapid City at the Journey Museum and two were held at the SD Discovery Center in Pierre, SD. About 30 pre-college teachers (some of whom teach at South Dakota's NES schools) attended the academies. At each location, one academy was on NASA curriculum content for the classroom and the other was specifically on Lego NXT **Robotics training**. Teachers took part in a live learning event via **NASA's Digital Learning Network** where a real-time link was established with educational specialists at **NASA Ames**. Graduate credit and certificate renewal credit was made available. At the NASA Curriculum workshop topics included Robotics, Plants in Space, Space Nutrition, Rockets and Rocket Launching, Aeronautics, Rocks from Space, and Engineering Design Challenges. At the robotics workshops, teachers were provided with Lego NXT robotics kits and software for programming their robots. In April 2007, SDSGC purchased 12 Lego NXT robotics kits for teacher-training during summer 2007 and beyond. As a result of the increase in trained teachers, SDSGC envisions that enough schools will participate to allow for a Lego robotics competition in SD within the next year or two. Teacher's were very engaged in and excited about the robotics training, which indicates that it should work well in the classroom as a hands-on method of teaching technology and other STEM disciplines.

- **SDSU's Office of Remote Sensing offers help to South Dakota teachers** - Mary O'Neill, manager of SDSU's Office of Remote Sensing, attended a summer 2007 NSF workshop in Massachusetts that brought together several teams to design learning activities that show educators and students how to obtain and analyze data from the NASA Earth Observations image data portal. The activity that O'Neill's team assembled helps measure concentrations of atmospheric particulates and carbon monoxide and looks for relationships between the data gathered and events such as fires, dust storms and human-generated pollution. O'Neill returned with information for K-12 teachers that she presented in a recent workshop at the USGS National Center for EROS called Geospatial Technology for Educators. "We strive to show educators how they can incorporate geospatial technologies -- things like remote sensing, geographic information systems and global positioning systems -- into their existing curriculum," said O'Neill. In addition, Mary O'Neill was involved with Natural Resources Conservation Service

(NRCS) personnel in coordinating **Adventures in Geospatial Technology** sessions. Educators learned how to bring GPS and other technologies into South Dakota classrooms.

- **Aerospace Career and Education (ACE) Camp** – South Dakota State University's (SDSU's) 15th annual ACE Camp was held on July 15-19th, 2007 with 17 high school students, 13 males and 4 females. The primary goal of the ACE Camp is to create an aviation-aware society that understands and respects the importance of aviation and aeronautics at the federal, state, and local level. ACE academies were introduced to colleges and universities by the FAA in 1989. Hosted every year since 1992, SDSU, through SDSGC, continues to support ACE Camp. NASA funding and support from numerous other sponsors provide an unforgettable experience for high school students. Actual flying time, hot air ballooning, and tours of scientific facilities include discussions with professionals and experts from diverse fields. 2007 ACE Campers were treated to a model aircraft demonstration and air show at the Brookings radio-controlled airplane field. They toured the Air National Guard Base in Sioux Falls where they flew an F-16 flight training device. Before actual flights, students were introduced to flight principles via a computer lab flight simulator. They then flew aboard an aerobatic plane, a Cessna 172SP, and a glider. Campers were exposed to aviation maintenance at Consortium affiliate Lake Area Technical Institute. Other activities included telescopic stargazing and building and launching model rockets. Students from grades 9 - 12 from SD, ND, MN, NE, WY, IA and the surrounding areas have attended ACE Camp.

ACE Camp Evaluation in FY2007 – This year, ACE Camp was evaluated using a hands–on approach in which the Consortium evaluator, Ms. Shannon Lane, participated in all camp activities as a member of camp staff. With increased contact to campers, first impressions of activities, accommodations, and presentations were captured and communicated with the ACE Camp Director and shared with the Consortium's Management Team. In addition, campers completed an end-of-camp evaluation form that ranked activities and provided for written comments/feedback.

- **St. Francis Indian School Science Consulting –** The SDSGC continued to support science consulting services to the St. Francis Indian School by the SD Discovery Center. Through the consulting, St. Francis has institutionalized an annual science fair. Student projects are increasing in number and quality each year. All students from 3rd through 8th grade participated in a two-day Microscopic Explorations festival during which they investigated many types of magnifiers and used them to learn about many living and non-living things. The students were so involved in the activities, a 7th grade teacher commented, *"I wish science class could be like this every day."* The consultant will work with these teachers to help them make that wish a reality. Currently the consultant is working with the school staff to link their FOSS science teaching kits and the SD Discovery Center's GEMS kits to the curricula and science standards for each grade level and team-teaching lesson using the kits so that teachers feel comfortable using them.

- **Women in Science Conferences** – Through its subcontract and partnership with the SD Discovery Center, SDSGC continues to financially support and participate in the highly successful **"Women in Science" (WIS) conferences** held throughout South Dakota. Five WIS conferences are scheduled for March and April 2008 in Aberdeen, Rapid City, Watertown, Sioux

Falls, and Pierre to introduce pre-college girls to careers in science. An estimated 1,350 girls will attend. During the events, professionals visit with the girls and answer questions about particular careers and the education that is necessary for those jobs. Business cards are distributed and contacts are made. The conferences are designed to teach girls how to successfully "network" with science professionals. Many outside resources of funding and talent are brought to these workshops through the partnership with SDSGC.

- **Teacher Professional Development** at **SD Discovery Center –** SDSGC supported the following teacher development opportunities offered by the SD Discovery Center during FY2007. Sixty-one teachers participated.
    - **Great Explorations in Math & Science (GEMS) training** (6 participants)
    - **Three Rivers Cooperative 21st Century Community Learning Centers** – Held at Kadoka School (NASA Explorer School) - These teachers work with students from impoverished rural and reservation schools (16 participants)
    - **Belle Fourche School District & 21st Century Learning Centers** (13 participants)
    - **Sinte Gleska University** – Trained 13 education majors, some of whom will be hired by the SD Discovery Center to conduct GEMS outreach for 21st Century Programs in central South Dakota.
    - **NASA Teacher Academy** – Taught by Angelo Casaburri, NASA AESP (7 participants)
    - **Robotics Teacher Training** – taught by Angelo Casaburri (NASA AESP) and Arnold Lund of Kadoka School District (6 participants)
    - **Inventing to Learn** – taught by Ed Sobey of the Northwest Invention Center – (6 participants). Due to the positive response from the workshop participants, the SD Discovery Center created a teaching loan kit filled with non-consumable supplies and teacher's guides needed to teach these activities.

This year, the SD Discovery Center has become involved in a new project titled **"Advancing Teacher Learning in Space Science (ATLaSS.)** This NASA-funded project of the University of California – Berkeley Space Science Laboratory and their Lawrence Hall of Science will institutionalize a system within the state for continually upgrading teacher knowledge of current space science and methodologies for teaching the concepts of space science.

The SD Discovery Center in Pierre will host an **Astronomy Workshop for Teachers** in May 2008 incorporating South Dakota science standards. The workshop will be led by Dr. Nahide Craig and Dr. Laura Peticolas of the University of California Space Science Laboratory in Berkeley, CA. Teachers will engage in NASA activities and "Great Explorations in Math and Science" (GEMS) programs from four teacher guides: 1) *Exploring Magnetism, 2) GEMS Living with a Star, 3) GEMS Invisible Universe*, and 4) *GEMS Real Reasons for the Seasons*. Registration fees and an $80 stipend will be provided by SD Space Grant to teacher participants. Dr. Craig is a research astronomer with over 10 years experience with the Experimental Astrophysics Group at the Space Sciences Laboratory. She has worked for the EUVE and the ORFEUS missions, specializing in ground-based observations for studies of late-type stars, cataclysmic variables, white dwarfs, and the local interstellar medium. She is currently Director of the SEGway Project and Lead Education and Public Outreach (E/PO) Scientist for numerous NASA missions including FAST, RHESSI, CHIPS, STEREO/IMPACT and THEMIS. Dr. Peticolas conducts research on the aurora and works to share NASA science with students,

teachers, and the public. Her work involves many diverse projects from designing lessons around space physics to working with the Berkeley music department to map solar wind data to music.

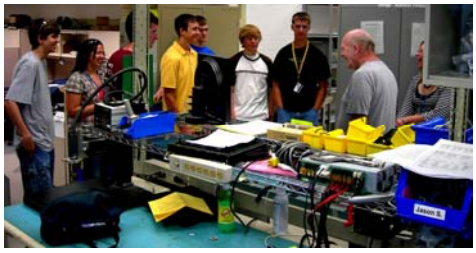
- **Kelly Lane Earth & Space Science Grant** – This $5,000 grant is be awarded annually by the SDSGC to science or math teachers in South Dakota in recognition and support of outstanding teaching and innovative educational programs at the pre-college level in the fields of STEM. The 2008 award winner is Julie Olson, science teacher at Mitchell Senior High School, Mitchell, SD for her project titled "Analyzing Energy Use Now and Preparing for the Future". The project will impact over 350 students per year and Ms. Olson plans to present the outcomes of her project at the SD Science Teachers Association annual convention.

- **Team American Rocketry Challenge** – Two South Dakota schools are registered for the 2008 Team America Rocketry Challenge: 1) Red Cloud High School on the Pine Ridge Indian Reservation, and 2) O'Gorman High School in Sioux Falls, SD.

- SDSGC will again support the **31st Annual Engineer's Week** from February 17-23, 2008 on the campus of SDSM&T by providing ongoing presentations on NASA's Mars Exploration Rover Mission.

About 1,500 grade school and middle/high school students from SD and WY are estimated to attend the 2008 Engineer's Week. Numerous hands-on, STEM-related activities are provided by all campus engineering departments and the SD Engineering Society. This popular annual event is designed to show teachers and students that science, math, and engineering are fun and exciting.

- **Youth Engineering Adventure (YEA)** – Three YEA programs were offered at SDSGC affiliates SDSM&T and SDSU during summer 2007. YEA is intended for high school students, freshman to seniors, interested in math and science. Approximately 375 students have participated in YEA during the program's first six years. The program provides an introduction to engineering as a career and encourages students to have fun while learning about technology and engineering. Students also toured local engineering firms and explored engineering career opportunities. Tom Durkin of SDSGC presented a talk on NASA Mars Rover Mission to a group of 34 YEA high school students (22 male, 12 female) at SDSM&T on June 21, 2007. The 2007 YEA program at SDSM&T recruited students from six new states that have not yet been represented in the six-year history of YEA (GA, MO, NV, WA, IL, and MT), bringing the total number of states represented to 19.



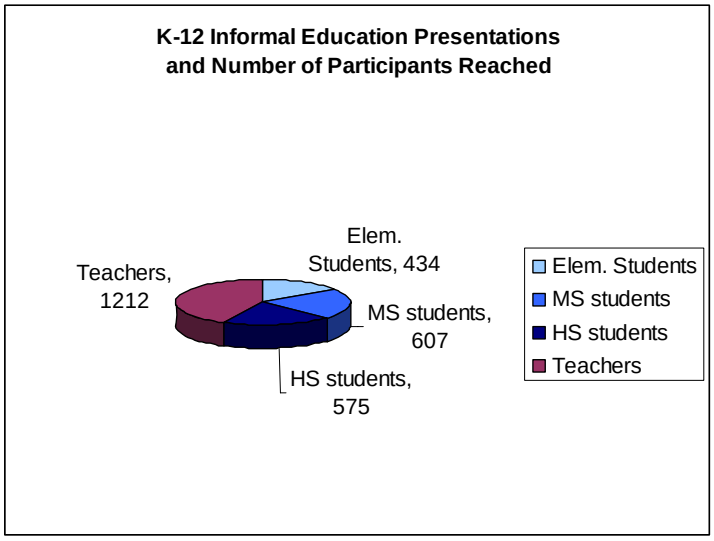
- **Space Adventures! Camp 2007** – The Consortium sponsored a two week-long Space Camps by providing $15,500 through a competitively-awarded, pre-college "Program Initiation

Grant" (PIG) project at SDSM&T. Although the funding was provided from FY2006 Space Grant funds, the project is reported here because it was held during the FY2007 program year. The two *Space Adventures! Camps"* were co-ed, residential camps offered during summer 2007 for 23 middle school and 19 high school students from SD, NE, WY, IL, OH, VA and MT. This represented a four-fold increase in the number of students from the summer 2006 Space Camp. The students learned about the birth of the universe, the life cycle of stars, black holes, relativity and time travel, star mythology, satellites and GPS. Field trips were provided to the Air & Space Museum at Ellsworth Air Force Base and the Black Hills Astronomical Society's Hidden Valley Observatory for an evening star party. Students also built and launched rockets at an event at which their families were invited. The Space Camp provided an atmosphere of discovery and guidance for students making critical decisions about college courses that will prepare them for science-based professions. Tom Durkin gave a popular presentation on NASA's Mars Exploration Rover Mission and discussed NASA student opportunities. Students completed a detailed 18-point, post-course evaluation which highly rated the course and instructors.

- **Youth Day at the Pow Wow** – On October 5, 2007 SDSGC reached about 300 Native American elementary through high school students attending the Youth Day activities of the Black Hills Pow Wow (He Sapa Wacipi) organized by SDSGC affiliate Oglala Lakota College, SDSM&T, and the Pow Wow Committee. The event provided the students with a series of interactive, high-tech, hands-on STEM-related exhibits and activities. These activities included StarLab Planetarium shows focusing on Lakota Star Knowledge, Lego NXT robotics and Mars Rover demonstrations, physics experiments, satellite remote sensing and geospatial technologies, and exhibits on space travel and exploration. Space Grant provided its NASA exhibit booth and a spacesuit cutout where students could get their photo taken as an astronaut. The focus of the event was to promote STEM education among American Indian students and to provide information that assists them with college preparation. Native American SDSM&T graduate student and Space Grant Fellow Connie Giroux, who attended a summer 2007 internship at JPL, shared with students about her experience at NASA.

- **K-12 Informal Education Presentations** – SDSGC staff and students conducted 18 pre-college informal education events since last year's progress report, reaching about **2,800 students and teachers** with presentations on various space-related topics including NASA's Mars missions, Hubble Space Telescope, the International Space Station and Space Shuttle, and other space-related topics such as general astronomy. These events were held at schools, teacher conferences, and museums around the state. Some of the events collaborated with NASA AESP

teacher-training courses in summer 2007. The following chart shows the breakdown of the types and number of participants reached.



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NASA EDUCATION OUTCOME 3
(ENGAGE AND INSPIRE)

Education Outcome 3 seeks to *"Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission."* This section summarizes the status of SDSGC's FY2007 strategic objectives related to Outcome 3. These correspond to the Consortium's Program Area 6 (General Public and External Relations).

Outcome 3 – General Public and External Relations

Completed
Partially Completed
Incomplete

Quantitative Outcome Measures Matrix (Program Area 6: General Public and External Relations)

Objective	Outcome indicator(s)			
~~6.1~~	~~Reorganize the "General Public" section of SDSGC website to make it more user friendly: add a web counter to monitor access and an online feedback section (see 1.9.3)~~	~~√~~		
	NASA and SDSGC will be featured daily during the work week in 200[7] in space/science education broadcasts	√		
6.2	SDSGC staff will produce and give formal and informal presentations to various civic and other public groups, and will generate press releases about Consortium activities	√		
	At least 1,000 students, parents, and teachers will hear from NASA speakers and experience hands-on demonstrations and exhibits from SDSGC academic, government, and industry affiliates	√		
	Approximately 2,500 middle and high school students across the state will have been engaged with hands-on science activities and SDSGC will have awarded prizes at all three science fairs		√	
6.3	Participants in South Dakota Space Days and science fairs will include at least 10% Native Americans and 40% females	√		

6.4	Adjustments are made to the public service program to strengthen activities that are working and drop or improve activities that are not having the intended impact	√		

Selected General Public and External Relations Activities/Accomplishments for FY2007

In FY2007, Space Grant supported the following programs that promote the excitement of space exploration and scientific discovery to several thousand people each year: 1) South Dakota Space Days 2007, 2) Black Hills Astronomical Society public meetings, 3) Public Relations/Visiting Scientist Program (General Public), and 4) *StarDate* on South Dakota Public Radio.

- SDSGC sponsored **"South Dakota Space Days 2007: To the Moon, Mars & Beyond"** on Oct. 18-19, 2007 at the Washington Pavilion of Arts and Science, Kirby Science Discovery Center in Sioux Falls, SD. This highly successful, annual public service event draws thousands of students and teachers from throughout South Dakota who then participate in "hands-on" educational activities in science, technology, engineering and math (STEM). 1,130 people attended Space Days 2007. Students visit with experts in aerospace, aeronautics, earth science, engineering, computer science, physics, and other STEM fields about their careers. Guest speakers with nationally recognized credentials such as NASA astronauts, scientists and managers present programs and meet with the students. Numerous exhibits on space and earth science and technology are provided by members of the SD Space Grant Consortium and other organizations. Educational handouts including about 700 NASA posters, informational handouts, and standards-based NASA educational curriculum were provided to students and teachers. Students are exposed to the excitement and opportunities of various STEM careers and they learn firsthand about the impact that NASA has on their lives. A **robotics theme** was made part of the ~20 exhibit booth during Space Days 2007. A NASA AESP teacher-trainer staffed one of the robotics exhibits and SDSM&T and Augustana College had university students staff other robotics booths. Two of four robotics exhibits are shown in the above photos, along with a photo of one of the exhibit areas. Several college booths were provided consisting of university members of the Consortium.

A **Space Days VIP luncheon** was provided by the Washington Pavilion and attended by the Consortium's **Management Team**, **NASA keynote speaker**, **Sioux Falls Mayor**, representatives from **South Dakota's Congressional delegation**, and several local **State legislators**. Media coverage for Space Days was provided by local TV, radio, and newspaper reporters.

SD Space Days 2007 featured speaker **Eddie Benowitz from NASA's Jet Propulsion Lab** who presented *"Extreme Computers: The Brains Behind the Mars Rovers"*, introducing students to the inner-workings of the computer systems that operate the Mars Rovers. Doug Daniels and Dennis Jorgenson of the USGS Center for Earth Resources Observation and Science (EROS) presented *"How to Design a Spacecraft"*. SDSGC Deputy Director Tom Durkin (photo) presented *"Mars Mania"*, a popular overview of NASA's current Mars Exploration Rover Mission.

ITT Corporation was a major contributing sponsor for SD Space Days 2007, providing $15,000. This was combined with $10,000 provided by Space Grant and several thousand in in-kind matching provided by the Washington Pavilion. In addition to ITT's exhibits and other contributions, their sponsorship allowed continuous public showings of the educational film *"Cosmic Voyage"* in the Pavilion's Cinedome theater.

Workforce Development in General Public and External Relations Program

- 1,130 attend Space Day
- NASA content in public astronomy programs
- NASA content on Public Radio

Diversity in General Public Service Program

- St. Francis Indian School and other Tribal schools attend Space Days 2007

Space Days 2007 was the first year that SDSGC provided an onsite evaluation form to school group leaders. Data gathered from these survey forms were reviewed by the Consortium's evaluator and provided scores/ratings for the various programs offered, travel time to the event, a determination of underrepresented members of the community at the event, and mean age of participants. As a result, SDSGC's Management Team began discussing how future SD Space Days events would provide specific programs for targeted age groups so that the programs are age-relevant and to ensure that underrepresented groups are targeted through specialized advertising. The 2007 evaluation will serve as a model for future Space Days evaluations.

- **Black Hills Astronomical Society (BHAS) Public Presentations** – SDSGC continues to support presentations given to the general public by members of the Black Hills Astronomical Society. Monthly presentations are given on astronomy and NASA/space-related issues during the school year at SDSGC affiliate The Journey Museum and near-weekly public Star Parties at BHAS's Hidden Valley Observatory during the summer months. On September 17, 2007 Tom Durkin provided SDSGC's 11 inch Celestron Schmidt Cassegrain telescope for a public program on various types of telescopes by recently retired NASA Solar System Ambassador Dr. Bob Polcyn. On behalf of SDSGC and BHAS, Tom Durkin presented Dr. Polcyn with a plaque inscribed as follows: *"Awarded to Dr. Robert E.*

(Bob) Polcyn on September 17, 2007 by the South Dakota Space Grant Consortium and Black Hills Astronomical Society in recognition for outstanding service as South Dakota's Solar System Ambassador, for presenting numerous educational programs throughout the state on NASA's missions and space-related subjects, and for enthusiastically helping to inspire the next generation of explorers."

- **Public Relations/Visiting Scientist Program –** This program provides information to local reporters who call the Consortium with questions about NASA missions and astronomical events. The Consortium also provides technical staff to meet with various public service groups and to give presentations about Consortium opportunities and space-related subjects such as:
    - An April 26, 2007 community event where Mr. Arnold Lund and other staff from Kadoka School District's NASA Explorer School Program provided a highly successful "NASA Night" for 300 members of the Kadoka community. SDSGC's Tom Durkin presented two talks on NASA's Mars Exploration Rover mission and met with many of the local residents. Angelo Casaburri of NASA AESP was also present with exhibit and hands-on educational materials.
    - A Jan. 3, 2008 evening star party and presentation on the Hubble Space Telescope by SDSGC's Tom Durkin for a 4-H program at the Central States Fairgrounds.

- ***StarDate* on South Dakota Public Radio** – SDSGC continued its support of *StarDate* throughout FY2007. *StarDate* is a daily SD Public Broadcasting (SDPB) Radio broadcast provided by McDonald Observatory's astronomy program which provides NASA content on a frequent basis. SDPB provides a very effective means of informing the public about the Consortium's resources and educational programs. The NASA SD Space Grant Consortium and its website address are acknowledged during each broadcast, thus facilitating the acquisition of students into the NASA pipeline through the Consortium's programs. *StarDate* plays after a popular morning show where 62% of SDPB's daily listening audience of 155,700 people is tuned in. Thus, it is estimated that 96,500 people hear *StarDate* daily.

Appendix A
(Student Summary Tables A.1, A.2, and B)

Table A.1. All Students receiving funding during the FY 2007 reporting period – demographics

FY 2007 Student Award Summary	Number of Students	Number of Awards to Female Students	Number of Awards to Male Students	Number of Awards to Underrepresented Minority Students	Number of Undergraduate Awards	Number of Graduate Awards (Masters Level)	Number of PhD Awards
Fellowship/ Scholarship	40	14	26	7	36	2	2
Higher Education							
Research Infrastructure							
Total Awards	***40***	***14***	***26***	***7***	***36***	***2***	***2***
Calculates Automatically		***Total for both columns = Total Awards***		***Subset of total***	***Total for 3 columns = Total Awards***		

Summary Data (Calculates Automatically)	Total Number of Awards	Percentage of Awards to Female Students	Percentage of Awards to Male Students	Percentage of Awards to Underrepresented Minority Students
	40	35%	65%	17.5%

Note: Although 35% of the total "number" of awards went to female students, approximately 48% of the total "amount" of stipend funding in FY2007 was awarded to women.

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Table A.2. All Students receiving funding during the FY 2007 reporting period – by affiliate

FY2007 Student Awards by Affiliate	Number of Students Funded	Minority Serving Institution
Augustana College	2	
Oglala Lakota College (OLC)	3	✓
SD School of Mines & Technology (SDSM&T)	30	
South Dakota State University (SDSU)	5	
Total Student Awards	40	

Table B - FY 2007 Summary of Longitudinal Tracking Data

FY 2007 LONGITUDINAL SUMMARY		STATUS - ENROLLED		NEXT STEP STEM EDUCATION	NEXT STEP STEM EMPLOYMENT					NEXT STEP NON-STEM OTHER
For all students who received a "significant" award in Fellowships/Scholarships, Higher Education and Research Infrastructure	Number of Significant Awards in FY2007	Still Enrolled In Current Degree Program From FY2006	Still Enrolled In Current Degree Program FY2007	Graduated and Pursuing Advanced STEM Degree	Graduated and seeking STEM Employment	Employed in STEM (Aerospace Contractor)	Employed in STEM (non-aerospace) Position	Employed by NASA/JPL	Employed in STEM Academic Field	All Other (e.g. non-STEM employment, non-STEM academic degree)
Fellowship/Scholarship										
Number of Students	40	27	38	3	0	0	7	0	1	0
Number Underrepresented	7	5	6	0	0	0	1	0	0	0
Number Male	26	15	26	2	0	0	3	0	1	0
Number Female	14	12	12	1	0	0	4	0	0	0
Number of Undgrad	36	23	36	2	0	0	5	0	0	0
Number of Masters	2	4	1	1	0	0	2	0	1	0
Number of PhD	2	0	1	0	0	0	0	0	0	0
Higher Education/ Research Infrastructure										
Number of Students					0	0	0	0	0	0
Number Underrepresented					0	0	0	0	0	0
Number Male					0	0	0	0	0	0
Number Female					0	0	0	0	0	0
Number of Undgrad					0	0	0	0	0	0
Number of Masters					0	0	0	0	0	0
Number of PhD					0	0	0	0	0	0

***Summary Data**	Number of Significant Awards in FY2007	Still Enrolled FY2006	Still Enrolled FY2007	Pursuing Advanced STEM	Seeking STEM Employement	Employed STEM Aerospace Contractor	Employed STEM non-Areo Position	Employed NASA JPL	Employed STEM Academia	ALL NON-STEM NEXT STEP
Total Awards	40	27	38	3	0	0	7	0	1	0
Total Underrepresented	7	5	6	0	0	0	1	0	0	0
Total Male	26	15	26	2	0	0	3	0	1	0
Total Female	14	12	12	1	0	0	4	0	0	0
Percent Underepresented	17.5%	18.5%	15.8%	0.0%	#DIV/0!	#DIV/0!	14.3%	#DIV/0!	0.0%	#DIV/0!
Percent Male	65.0%	55.6%	68.4%	66.7%	#DIV/0!	#DIV/0!	42.9%	#DIV/0!	100.0%	#DIV/0!
Percent Female	35.0%	44.4%	31.6%	33.3%	#DIV/0!	#DIV/0!	57.1%	#DIV/0!	0.0%	#DIV/0!

Calculates Automatically

Table B. Continued – Column Headings and Definitions for Longitudinal Tracking Summary Table

Column Headings and Definitions	
Significant Awards in 2007	A significant award is a monetary award, internship or experience which includes one or more of the following: (a) has a value of greater than or equal to $5,000; (b) participation of greater than or equal to 160 hours; and/or © through a cost-benefit analysis proves to have significant impact on the student's academic achievement and employment.
STATUS - ENROLLED	
Enrolled - FY2006	Students whose status in the FY2006 Longitudinal Tracking Summary was "Still Enrolled in Current Degree Program" whose status remains unchanged.
Enrolled - FY 2007	Students who received significant awards during FY 2007 and whose status is still enrolled in their current degree program; have not made their "next step".
NEXT STEP - EDUCATION and EMPLOYMENT (Includes students from FY2006 Currently Enrolled Column who made their "next step" AND Students who received significant awards during FY 2007 and made their "next step")	
Graduated - Pursuing STEM Degree	Students who have graduated and are pursing an advanced STEM degree
Graduated - Seeking STEM Employment	Students who have graduated and are pursing STEM Employment
Employed in STEM (Aerospace Contractor)	Specifically NASA or NASA-related Aerospace Contractor
Employed in STEM (Non-Aerospace) Position	Non-Aerospace Employment in STEM position with government, for profit, or non-profit organization
Employed by NASA/JPL	NASA Civil Service Employee or Jet Propulsion Lab Employee
Employed in STEM Academic Field	Faculty, teacher, or other academic position (K-Higher Education) in a STEM field
Other -- All Other Non-STEM	Employed or Pursuing advanced degree in a non-STEM field (industry, academia, or other government)