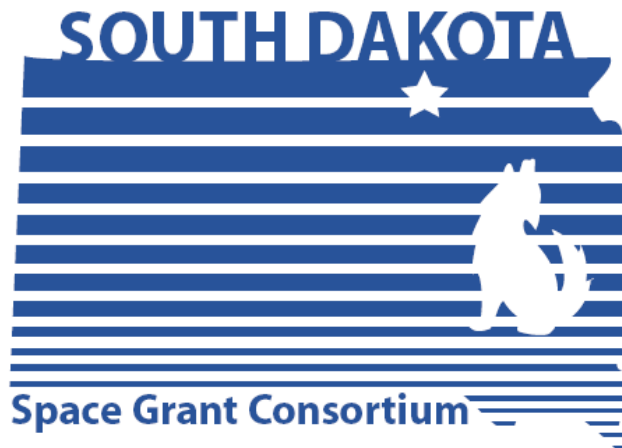


# South Dakota Space Grant Consortium

20<sup>th</sup> Year Program Evaluation  
National Space Grant College and Fellowship Program

## **Program Performance and Results (PPR) Report**



<http://sd.spacegrant.org>

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**Submitted**

**October 2, 2008**

(Resubmitted October 20, 2008)

**Statement of Consortium Concurrence**

The South Dakota Space Grant Consortium’s nine-member Management Team consists of representatives from the SD School of Mines and Technology (Lead Institution), SD State University, Augustana College, USGS Center for Earth Resources Observation and Science (EROS), the SD Discovery Center and Aquarium, Sinte Gleska University, the Journey Museum, and the Kirby Science Discovery Center. This team has attended meetings, teleconferences, and had e-mail discussions regarding the Program Performance and Results (PPR) Report.

Additionally, all other affiliate members of the Consortium were invited to participate in a consortium-wide quarterly meeting held on August 8, 2008 to discuss the draft PPR Report and provide input at the meeting or via e-mail (as well as to provide input on a subsequent major revision distributed on September 19, 2008). By their signatures below, the lead institution and affiliate representatives indicate their agreement with the contents of the PPR Report.

*(Signatures were included in the document submitted to NASA. One representative was unavailable)*

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SD School of Mines & Technology (Lead)

Gregg Johnson – Program Manager, \*ASRC  
Research & Tech. Solutions, EROS Contractor

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RESPEC

Out of the office and unavailable for signature  
Mark West, President and Chief Engineer  
Aerostar International, Inc. (Raven Industries)

\* SAIC representative from 2003-2007. ASRC initiated a separate EROS contract in 2008.

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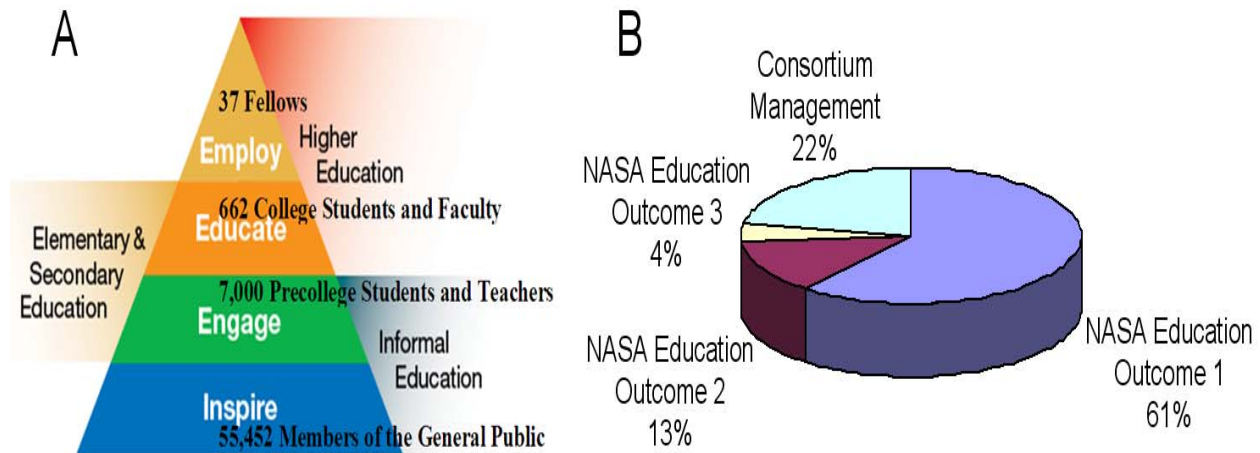
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## Executive Summary and Consortium Impact

The South Dakota Space Grant Consortium (SDSGC) is committed to expanding opportunities for all South Dakotans through education, research, and public service in the fields of aerospace, earth and space science, and related fields of science, technology, engineering, and mathematics (STEM) that are essential for the development of the nation’s workforce. SDSGC specifically seeks to include women and members of underrepresented groups in all of its programs and activities. In the case of South Dakota, Native Americans constitute the largest minority, and SDSGC pursues a broad range of strategies to engage this group.

In the five program years covered in this report (2003-2007), NASA’s Office of Education invested \$1,830,500 in South Dakota through its support of SDSGC. This support has maintained a statewide network of 19 organizations representing public, private, and tribal universities, informal education centers, technology-based industry, and a federal research facility that supports NASA missions. In keeping with its status as a Capability Enhancement Program, emphasis is on NASA Education Outcome 1, especially in the areas of undergraduate and graduate student support, student involvement in interdisciplinary engineering design teams and summer internships, targeted programs at Tribal Colleges, and higher education curriculum enhancement including robotics programs that are integrated with precollege robotics activities. Support of NASA Education Outcomes 2 and 3 includes an internal network of informal education providers across the state, educator professional development in collaboration with NASA’s Aerospace Education Services Program, and targeted teacher and student involvement programs at tribal schools, including three NASA Explorer School schools. Additionally, SDSGC oversees the NASA EPSCoR program in South Dakota and maintains close continuity between the research focus of EPSCoR and the broader educational and workforce development focus of the Space Grant.



**Figure 1:** A. Annual impact of NASA funding with respect to the Education Strategic Framework. B. Distribution of NASA investments among the three NASA Education Outcomes and Consortium Mgmt.

Figure 1A depicts the average annual impact that SDSGC has had in terms of the number of participants in South Dakota from 2003-2007. From the top of the pyramid down, the figure embraces the extent of SDSGC programs ranging from university student fellowships and other higher education programs that prepare students for the STEM workforce, to K-12 educational programs for precollege students/teachers, to informal education programs that inspire the general public. Figure 1B illustrates the percentages of NASA funds that were used to support

the three Education Outcomes and Consortium Management. Over 60% of NASA funds went to the “*Employ and Educate*” portion of the pyramid, with the direct goal of contributing to the development of the STEM workforce.

Unquestionably, the formative event of the five-year period was the probationary status that resulted from NASA’s 15<sup>th</sup> Year Evaluation of the Consortium and which was effective in 2004. Through a year-long effort, with extensive assistance from Space Grant Headquarters and other state consortia, SDSGC redesigned its management structure and policies from the ground up. For this reason, the analysis that follows focuses on the contrast between 2003 (before this fundamental transformation) and 2005-2007 (after). The improvement process resulted in a new focus on NASA and state needs, achievable steps toward reaching the Consortium’s goal, and evaluation methods that guide the Consortium in continuing to improve the effectiveness of the program. Significant improvements during the five-year period are summarized here.

■ **Consortium Management:** Since 2004, SDSGC management has focused on formalizing its strategies and policies, broader engagement of affiliates, increasing diversity, setting realistic goals consistent with available resources, improving alignment with NASA and state priorities, and implementing assessment and evaluation of all programs. The Consortium developed its first *Strategic Plan* and a document on *Roles and Responsibilities of Members*; the Management Team was expanded from five to nine members, including two rotating positions; three females and two Native Americans have served on the Management Team; SDSGC adopted a 29-member state advisory committee consisting of state leaders in education, research, industry, and government; and Management retains a Program Evaluator to provide continuing assessment.

■ **NASA Education Outcome 1 (*Employ and Educate*):** Since 2004, SDSGC has intensified efforts to implement a broad and equitable Fellowship/Scholarship program, to recruit students from diverse backgrounds into STEM higher education and research, to improve alignment with NASA Mission Directorates, and to acquire accurate long-term measurements on the impact of the programs on participants. A competitive, consortium-wide Fellowship/Scholarship process was instituted; the number of institutions receiving awards increased from four to eight, including awards to students at three Tribal Colleges; students participating in NASA internships increased from 3 during 2003-04 to 16 during 2005-07; and the Consortium maintains a longitudinal tracking system for participants receiving significant direct support.

■ **NASA Education Outcome 2 (*Educate and Engage*):** Since 2004, SDSGC has sought to prioritize teacher training and partnerships in its Precollege program, to integrate NASA content, and to increase diversity in the STEM pipeline. The state’s three major informal science education centers are SDSGC affiliates, and all are represented on the Management Team; in partnership with these three Informal Education affiliates and NASA’s Aerospace Education Services Program, SDSGC supports standards-based teacher-training workshops across the state that focus on precollege earth and space science and robotics curriculum; SDSGC entered into formal subawards with two Tribal K-12 partners to support gifted and talented student programs; SDSGC supports three NASA Explorer Schools located on the Pine Ridge and Rosebud Indian Reservations; and SDSGC launched a \$250,000, NSF-funded program in Opportunities for Enhancing Diversity in the Geosciences.

■ **NASA Education Outcome 3 (*Engage and Inspire*):** Beginning in 2007, SDSGC has re-evaluated its Public Service programs to ensure that they are aligned with NASA guidelines for Informal Education. SDSGC has placed greater emphasis on partnerships with its Informal Education affiliates and NASA Aerospace Education Specialists, and SDSGC has reduced funding in some Public Service areas that were not having a significant impact and has moved funding of other programs to non-NASA sources.

## Foreword

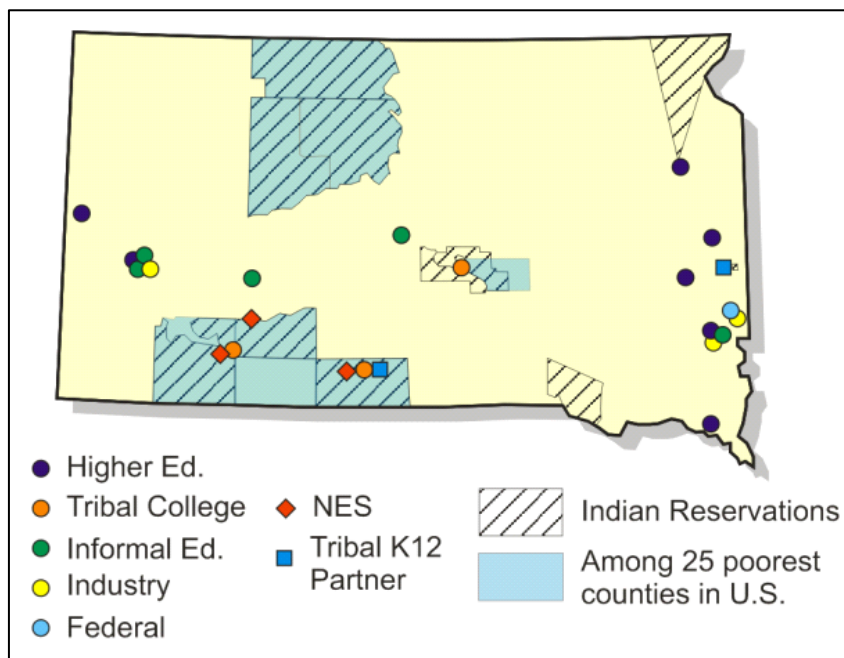
South Dakota faces many challenges in efforts to develop a competitive and sustainable science and engineering (S&E) infrastructure. The state ranks 47<sup>th</sup> in population, and has the fifth lowest population density.

South Dakota has five of the seven poorest counties in the nation, all of which are located on or adjoining the state's nine Indian reservations (see Fig. 2). Among the 52 federal jurisdictions, South Dakota ranks between 49 and 52 in the following S&E indicators:<sup>1</sup> federal R&D (51); industry R&D (49); academic R&D (52); S&E doctorates awarded (50); science, engineering and health (SEH) post-docs in doctorate-granting institutions (50); and employed SEH doctorate holders (51). Enrollment at the state's six public universities for fall 2007 was 32,148 of which

only 3,407 were in graduate programs. There are no degree programs in aeronautics or aerospace, nor is there a significant aerospace industry in the state. Despite having low R&D ranking, the K-12 education ranking and results are generally highly rated (10 in ACT Science and 19 in ACT Math for 2007), thus indicating an unrealized potential for developing well educated scientists and engineers. Space Grant is a good investment in education by helping develop interest among these student to pursue STEM education and careers.

South Dakota's demographics and limited research capacity make sustained Space Grant funding vital to improving STEM education, research, and economic activity. The impact of Space Grant support is far-reaching, comprising one of the largest sources of fellowships funding in the state. SDSGC acknowledges this opportunity along with the responsibility to invest these funds to maximize the benefits to NASA and the citizens of South Dakota. At the same time, the Consortium recognizes the limitations of its financial and human resources and the need to prioritize goals and leverage funding.

Using these NASA funds as a catalyst, SDSGC has forged a unique alliance of public, private, and Tribal Colleges and has led the way in linking these institutions with the state's only major federal research facility (USGS Center for Earth Resources Observation and Science, EROS). Building on this foundation, SDSGC is currently promoting strong relationships with NASA Centers and will continue to advance the goals of the Governor's *Research 2010 Initiative*. This unprecedented state initiative has fostered new Ph.D. programs and research centers that expand opportunities for NASA-related R&D, new state offices for Research and for Com-



**Figure 2:** Map of South Dakota showing SDSGC affiliates, Indian reservations, and eight counties ranked among the poorest 25 counties in the U.S. in per capita income.

<sup>1</sup> National Science Foundation, Science and Engineering State Profiles: 2005-2007, August 2008

mercialization, and a first-ever state *Science and Technology Strategic Plan* to coordinate the educational, research, and entrepreneurial goals of the initiative.

The five-year period 2003-2007 included the transformative shift in NASA priorities that followed the announcement of the *Vision for Space Exploration*. Also during this interval, the National Science Foundation selected the former Homestake mine in Lead, South Dakota, as the preferred site for the nation's Deep Underground Science and Engineering Laboratory, which has focused the attention of state government and the public on the potential benefits of a research-based economy. Construction of an interim lab has begun with \$85 million in federal, state and private funds. Funding for the deep lab at the 7,400-foot level will be provided through a \$300 million Major Research Equipment grant, which will be submitted in the federal FY2010 budget. The 2006 *State Science and Technology Strategic Plan* singles out DUSEL and collaboration with EROS as the two highest research priorities in the state, and SDSGC actively supports both endeavors.

During this period, SDSGC experienced its own major changes in leadership, management, and priorities, which have resulted in significant adjustments to its programs in order to improve their effectiveness and improve alignment with NASA and state priorities. Important improvement strategies include:

- 1) Increasing alignment with the *Vision for Space Exploration* and the Exploration Systems Mission Directorate;
- 2) Increasing resources in the Higher Education and Research Infrastructure programs (NASA Education Outcome 1);
- 3) Advancing STEM workforce development through more NASA and industry internships and through university-based, interdisciplinary engineering design teams;
- 4) Greatly increased support for state-wide robotics programs and curriculum that link university faculty with precollege teachers and community-based organizations;
- 5) A comprehensive approach to increasing diversity through affiliation with three Minority-Serving Institutions, Precollege partnerships, and Public Service programs;
- 6) Increased collaboration with Informal Education affiliates and partnership with NASA Education Specialists to implement training of precollege teachers; and
- 7) A new emphasis on demonstrating the value of NASA's investments through improved methods to acquire accurate data on participants and evaluate the impact of the programs on individuals, affiliates, the state, and NASA.

Unlike other capability enhancement programs in the state (e.g., NSF EPSCoR), Space Grant is in a unique position to have a comprehensive impact across all educational levels and across all sectors – public, private, tribal, government (see Fig. 1A). During the past five years, SDSGC has attempted to use this opportunity to advance two major themes across its programs: development of the state's STEM workforce, and improving educational and research opportunities for the state's Native American population.

In this report, note that reference to a given year (e.g., 2005) refers to the fiscal year FY2005 which corresponds to SDSGC's program year. SDSGC's program year runs from mid-May through mid-May. As a Capability Enhancement Consortium, SDSGC received between \$332,500 and \$410,000 in annual NASA funds during this period; funding increased gradually over the five years except for a slight decrease in 2005. In addition to the changes in funding level over the five years, there were several changes in CMIS data-reporting practices in response to guidance from NASA or the Sponsored Programs office at SDSGC's lead institution. These data-reporting changes result in anomalies in the trends shown in the CMIS data tables, and where space permits these are addressed in the corresponding sections of the report.

## Programmatic Elements

### Consortium Management

#### Description

*Management structure* – SDSGC’s management structure, goals, and policies and procedures are clearly defined in two documents: the *SDSGC Strategic Plan* (last updated Aug. 15, 2008, 18 p.) and the *SDSGC Roles and Responsibilities of Members* (adopted July 22, 2005, 11 p.). The organizational structure consists of the Director and Deputy Director (Program Coordinator) at the lead institution, four Associate Directors, and designated Space Grant representatives at each of the remaining 14 affiliates. Fundamental changes in the past five years are: (1) expansion of the Management Team in order to provide broader input into decision-making, and (2) addition of two rotating positions on the Management Team. The Consortium currently operates under a nine-member Management Team (compared with five members in 2003-04) consisting of the Director, Deputy Director, four Associate Directors, and two, two-year rotating positions filled by affiliate members.

*Operational policies and procedures* –The *SDSGC Strategic Plan* lays out nine strategic objectives of management (see box at right); these address responsiveness to NASA Headquarters and the national Space Grant network, responsiveness to the state network and state government and industry needs, relations with the public, resource management, diversity within management and the Consortium, and mechanisms to ensure continuous improvement. Associated with each objective are specific operational strategies and outcome targets to aid in implementation and assessment of the management goals and objectives.

#### **Management Objectives**

- A.1: Reporting
- A.2: National network
- A.3: Consortium network
- A.4: State government
- A.5: State industry
- A.6: Link to public
- A.7: Increase resources
- A.8: Diversity
- A.9: Evaluation

*Decision-making and policy-making processes* – Regarding specific management operational procedures, the *SDSGC Roles and Responsibilities of Members* clearly defines the Consortium’s decision-making process. For example, all decisions are made by a vote of a quorum of the Management Team; most votes are subject to a simple majority, but some decisions, such as changes in membership, or change of Director or lead institution, require a two-thirds vote.

*Self-assessment and evaluation* – The Consortium contracted a faculty-level professional evaluator during 2004-05 in order to develop an Evaluation Logic Model, which is directly linked with the *Strategic Plan*. Since completion of this contract and adoption of the evaluation approach, SDSGC has continued to maintain an independent Program Evaluator position filled by a graduate student with expertise in evaluation methods. The evaluator is present at all monthly Management Team and quarterly affiliate meetings, as well as other Space Grant functions, such as Space Days.

*Participation of members in development of PPR Report* – See Statement of Consortium Concurrence (p. 2).

#### Analysis of Core Criteria

##### *Strategic Plan*

*Process by which the strategic plan was developed* – Prior to 2004, SDSGC operated without a strategic plan. During 2004-05, SDSGC developed its plan based on a thorough analysis of National Space Grant program objectives, plans of other consortia in the network, and relevant NASA and state documents. The plan spells out the Consortium’s overall goal for each program



area and specific objectives associated with that goal. For each objective, operational strategies and outcome indicators or targets are specified, reflecting both short-term and long-term priorities. The *Strategic Plan* was realigned in 2007 to put special focus on the key programs and national emphases and thereby facilitate the Consortium's self-assessment, data collection, and reporting. (See box at right.)

*Changes in Strategic Plan over past five years* – The *Strategic Plan* is reviewed annually and updated as necessary in accordance with SDSGC's self-assessment practices and any guidance from NASA that would significantly impact Consortium programs. While maintaining adherence to its fundamental vision and goals, SDSGC has been responsive to significant directives from NASA Headquarters in modifying and updating its *Strategic Plan*. For example, in 2004-05 specific goals and objectives were added addressing workforce development, and starting in 2006, some Precollege and General Public objectives and strategies were reduced in scope as a result of NASA guidance to place greater emphasis on Outcome 1 of the Education Strategic Coordination Framework.

*Consortium Structure/Network (Internal)*

*Consortium composition and demographics* – There are currently 19 organizations that make up the membership of SDSGC (see box following page). In keeping with Space Grant's focus on higher education, over 50% of the Consortium's membership (10 organizations) is in this category. The remaining members include five informal science education affiliates, three industrial affiliates, and one federal government affiliate. Three of the 10 higher education affiliates are Tribal Colleges or Minority-Focused Organizations, and one is a technical institute with an aviation and robotics emphasis. In addition, SDSGC currently has long-standing relationships with two Tribal K-12 partner schools that have successful STEM preparation programs, and with the state's three NASA Explorer Schools; however, these are not among the 19 formal affiliates. The USGS Center for Earth Resources Observation and Science (EROS) is the designated NASA Land Processes Distributed Active Archive (LPDAAC).

*Changes in consortium membership over past five years* – In 2004-2005, the consortium formalized criteria for minimum affiliate participation and developed a policy for dropping inactive affiliates. At the same time, new policies were implemented to ensure that affiliates that wanted to increase their involvement had opportunities to provide input in decision-making and to benefit from network participation. As a result of these changes, membership has been reduced from 35 in 2003 to 19 in 2007. Of the current 19 affiliates, eight are represented on the Management Team, and ten of the remaining 11 are or have been actively involved in Consortium programs. This level of engagement contrasts with 2003, when decision-making, fellowships, and other program benefits were largely restricted to the lead institution and two of the 34 remaining affiliates.

**Strategic Plan Organization**

- A. Consortium Management
- B. **NASA Education Outcome 1:**  
Consortium Programs:
  - B.1. Fellowship/Scholarship
  - B.2. Research Infrastructure
  - B.3. Higher Education
- C. **NASA Education Outcome 1:**  
National Program Emphases:
  - C.1. Diversity of Participants
  - C.2. Workforce Development
  - C.3. Longitudinal Tracking
  - C.4. Minority Serving Inst.
- D. **NASA Education Outcome 2:**  
Consortium Programs
  - D.1. Precollege Education
- E. **NASA Education Outcome 3:**  
Consortium Programs
  - E.1. Public Service: General Public & External Relations

*Roles and responsibilities of affiliate representatives* – The expectations of the designated Space Grant representative at each affiliate are clearly defined in the *SDSGC Roles and Responsibilities of Members*. All Space Grant representatives must respond to an annual survey in which they provide data for program evaluation and improvement.

*Examples of coordination and cooperation among affiliates* – Coordination and cooperation among the current 19 SDSGC affiliates is very good, despite the fact that affiliates are spread widely across a geographically large state. The following are a few examples of this cooperative approach:

- Almost all affiliates have taken part in, or have hosted, South Dakota Space Days, an annual event held at different venues across the state (see p. 30).
- The lead institution and affiliate Sinte Gleska University collaborated to win a three-year, \$250,000 grant in 2005 from the National Science Foundation’s program titled Opportunities for Enhancing Diversity in the Geosciences.
- The lead institution, along with Dakota State University and Oglala Lakota College, collaborated in 2007 to win a Space Grant Consortium Development Competition award in the amount of \$177,000. This project is significant because it marks the first major participation of these universities in Consortium programs (see p. 21).
- Though technically a 2008 activity, three SDSGC affiliates are submitting collaborative proposals to following NASA solicitations: 1) Competitive Program for Science Museums and Planetariums, 2) K-12 Competitive Grants Opportunity, 3) INSPIRE Collegiate Experience Space Grant Solicitation.

*Effective strategies to ensure affiliate engagement* – Prior to 2004, there was no broad engagement of consortium members. Successful strategies that have lead to significantly broader and more meaningful engagement are:

- Expansion of the Management Team from five to nine members, including two rotating positions.
- Aggressive marketing of the Fellowship/Scholarship program at all Higher Education affiliates and adoption of a single, consortium-wide application and review process.

## **SDSGC Members and Partners**

### Higher Education

South Dakota School of Mines and Tech\*  
 South Dakota State University\*  
 Augustana College\*  
 University of South Dakota  
 Black Hills State University  
 Dakota State University  
 Lake Area Technical Institute

### Tribal College and Minority-Focused

Sinte Gleska University\*  
 Oglala Lakota College  
 Lower Brule Community College  
Informal Science Education (non-profit)  
 SD Discovery Center and Aquarium\*  
 Kirby Science Discovery Center\*  
 The Journey Museum\*  
 Badlands Observatory  
 Black Hills Astronomical Society

### Industry

Science Applications Int’l Corp (SAIC)  
 Raven Industries (Aerostar Int’l Inc)  
 RESPEC

### Federal Government (Other)

USGS Center for Earth Resources  
 Observation and Science (EROS)\*

### Tribal K-12 Partner Schools†

Flandreau Indian School  
 St. Francis Indian School

### Three NASA Explorer Schools †

\* represented on Management Team  
 † non-member

- Formalizing the *SDSGC Roles and Responsibilities of Members*, which includes annual affiliate feedback surveys.
- Opening consortium-wide competitions for funding new and creative programs, including SDSGC Program Initiation Grants and NASA Consortium Development Competition grants.

*Description of consortium meetings* – SDSGC’s Management Team meets monthly via teleconferences to a) conduct business, b) evaluate program success, c) make/revise policy, d) plan future activities, e) develop the budget, and f) make selections of Fellowship/Scholarship and Program Initiation Grant awards. Quarterly meetings are open to all affiliates; these are face-to-face meetings held at different venues in order to encourage participation of affiliates.

#### *Diversity*

*Strategies to increase and maintain diversity in management* – Prior to 2004, the SDSGC Management Team was composed of five white males and no specific strategy was in place to increase the diversity of management. Beginning in 2004, in order to become more representative of the diversity of its affiliates, the Consortium opened two rotating positions on the Management Team to representatives of any affiliate organization. The first set of “rotators” included one female and one Native American (Tribal College affiliate). One has since assumed permanent status and the second is in the process of applying. The second set of “rotators” includes another female who is currently serving. Additionally, during 2004 and 2005, when NASA funds included a special augmentation for workforce development, the SDSGC headquarters maintained a position titled Workforce Development Coordinator, which was filled by a Native American female with a doctorate in education who also served on the Management Team. The active participation of two Native Americans in decision-making since 2004 has had an extremely positive impact on SDSGC’s engagement with its three minority-serving higher education affiliates, all of which are Tribal Colleges (note: Lower Brule Community College is classified in CMIS as a minority-focused organization).

#### *Consortium Operations*

*Office space and facilities* – The SDSGC Headquarters Office has about 250 square feet of dedicated office space and 100 square feet of closet/storage space in Mineral Industries Building room 228 at SDSM&T in Rapid City, SD. The office accommodates SDSGC’s full-time Deputy Director, Consortium files, displays/exhibits, a small conference area, and various NASA educational materials and informal education equipment. The office is equipped with standard office computer equipment, telephone, and fax.

*Staffing levels at lead institution and support provided by other institutions* – At the lead institution, the Director’s staffing level was increased from 0.20 to 0.25 FTE (Space Grant plus match) in 2005 in response to comments received from the 15<sup>th</sup> Year Evaluation. The Deputy Director (Program Coordinator) is supported at 0.9 FTE (Space Grant funds). Each receives additional support from the state’s NASA EPSCoR funds which ensures alignment and collaboration between the two programs. The 0.1 FTE for "Clerical (Lead)" in CMIS represents the cost-sharing input from SDSM&T clerical staff to assist the headquarters office. The four Associate Directors at affiliate institutions are staffed at a combined total of 0.35 FTE.<sup>2</sup>

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<sup>2</sup> CMIS Table III-B, “Staff Levels,” contains an apparent error. Total FTE for “Supervisory/Technician (Affiliates)” for 2007 shows .00 when the figure that was actually reported in CMIS is 0.1. Since the Management Team member from the SD Discovery Center has been elevated to Associate Director status this past year, the missing 0.1 FTE should be added to the “Associate Directors (Affiliates)” box, bringing the total FTE to 0.35.

*Change in leadership* – The leadership of SDSGC changed hands in July 2004. Former Director Sherry Farwell stepped down to become Program Manager of the NSF EPSCoR Office in Arlington, VA, and Edward Duke was approved as new director. The transition did not involve a change in the lead institution or other consortium staff. The timing of the transition was roughly coincident with the probation period following NASA’s 15<sup>th</sup> Year Evaluation, and the leadership change proved instrumental in helping SDSGC redesign its organizational structure, policies, and overall management approach.

*Internal and external executive and advisory boards* – The “internal” advisory/executive committee for SDSGC is the nine-member Management Team as previously described (see p. 8 and p. 11). The Management Team holds monthly meetings via teleconference and at least four face-to-face meetings annually. The Consortium’s independent Program Evaluator is present at all meetings. The “external” advisory/executive committee for SDSGC is the 29-member state REACH<sup>3</sup> Committee which meets three times per year and provides the advisory function for both Space Grant and NASA EPSCoR as well as oversight of the state’s other federal STEM capability enhancement programs.

*Policy for adding and removing members* – SDSGC’s *Roles and Responsibilities of Members* document specifies the policy and procedure for adding and removing members of the Consortium, including specific policies for change of director and lead institution (as provided by NASA Headquarters), change of associate director, and addition/removal of affiliates.

#### *Resource Management*

Because significant changes in Consortium management and data-gathering/reporting techniques were implemented starting in 2004, some of the CMIS data for 2003 appear anomalous when compared to Consortium trends from 2004 forward.

*Matching fund sources and amounts* – CMIS Table III-A, “Match and other Federal Funds (Cash and Non-Cash),” shows that “Other Federal Funds” were reported in 2003-2004, but subsequently not reported based on guidance from the Sponsored Programs office at the lead institution. Other than this point, the CMIS data indicate that match is primarily from affiliates and the lead institution, and that the levels were fairly consistent over the five years.

*Trends in distribution of funds among affiliates and management* – Roughly 40% of the consortium’s budget was provided to affiliate institutions from 2003-2007. Over the five-year period, management and administrative costs trended slightly downward from 18.8% to 15.3% of NASA funding with an average of 16.0% (22.2% if indirect costs are included in administration). Considering both NASA and matching funds, the management/administrative costs averaged 11.3% (17.9% if indirect costs are included in administration).

*Trends in allocation of funds across project elements* – Figure 3 on the follow page shows the trends in allocation of NASA funds across programs during the period 2003-2007. The spike in Fellowships to 41% in 2005 is due to funds remaining from the previous grant cycle that were

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<sup>3</sup> REACH, 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. 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.

awarded as fellowships. The high percentage of Higher Education NASA funding in 2003 (32%) is because the majority of Higher Education funding that year came from the infusion of Workforce Development funds added to the base Space Grant. The spike in Precollege projects in 2006 is due to the onset of subawards with SD Discovery Center and St. Francis Indian School (\$20,000 each). Since 2006, SDSGC has been reducing Precollege expenditures in keeping with NASA’s directive to not support Precollege programs at the expense of Higher Education or Research Infrastructure.

This strategic shift began to take effect toward the end of the five-year period, as funds for Outcome 1 programs increased 2.7% and combined funds for Outcome 2 and 3 programs decreased 3.9% between 2006 and 2007. CMIS Table III-A, “Program Allocation (NASA Plus Match Dollars),” shows that

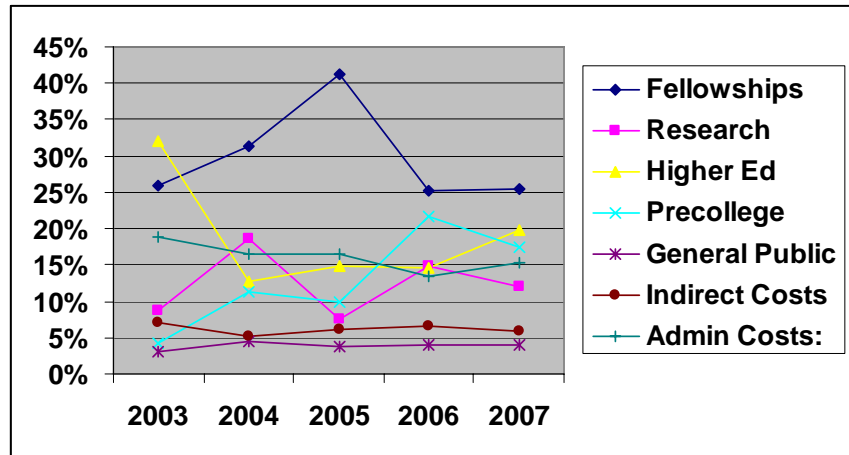


Figure 3: CMIS Table III-A Program Allocation (NASA Dollars).

SDSGC matching funds follow basically the same trends except for 2003-2004, because overmatching and other federal funds were reported during those years (see p. 12).

*Staff resource allocation* – As noted above, SDSGC’s headquarters office at the lead institution is staffed by the Director (0.25 FTE, NASA and match funded) and Deputy Director (0.9 FTE, NASA funded). Approximately 50% of Directors time is allocated toward administration with 25% allocated to higher education and 25% to research infrastructure projects. About 50% of the Deputy Director’s time is allocated toward administration, with 25% to higher education (including fellowship), 15% to precollege, and 10% to general public.

#### *Collaborations and partnerships outside the Consortium*

SDSGC has developed the following combination of formal and informal partnerships with non-consortium entities for the purpose of promoting STEM education and workforce initiatives.

- During 2003-05, SDSGC participated in the multi-consortia “NativeConnections” Workforce Development grant (see p. 26).
- Beginning in 2006, SDSGC collaborated with several other state consortia to develop the Space Grant Internet Telescope Network (SGITN) program, which began operations in August 2007 (see p. 21).
- SDSGC has partnered with several precollege tribal schools in a variety of formal and informal partnerships in order to increase training and recruitment of underrepresented minorities in STEM (see p. 27).
- Three SDSGC affiliates collaborated with Humboldt State University in California, and the Upper Midwest Aerospace Consortium on the three-year, \$250,000 grant from the National Science Foundation’s program titled Opportunities for Enhancing Diversity in the Geosciences. This partnership helps the Consortium fulfill many of its objectives under NASA Education Outcome 2.

## Impact/Results

Since 2004, SDSGC has radically changed its Management with new personnel, new structure, new policies, and, most importantly, a new outlook. These improvements have resulted in a new focus on NASA and state needs and achievable steps toward improving research capability. Through improved evaluation methods and affiliate feedback, SDSGC will continue to improve the effectiveness of the program. Since the Evaluation Logic Model was adopted in 2005, the Management program has increased the percentage of achieving its strategic outcome targets from 77% in 2005, to 85% in 2006, to 95% in 2007.

Prior to 2004, almost all SDSGC funds went to the lead institution and two affiliates; there was no diversity in Management; and most affiliates had little input or engagement. Since adoption of the new *Strategic Plan* and guidelines on *Roles and Responsibilities of Members* in 2004-2005, Management has expanded and become more diverse; decision-making is more open; inactive affiliates have been dropped and remaining affiliates are more engaged; and program funding and student support has been shared by 14 affiliates, including three Minority-Serving Institutions.

### **NASA Education Outcome 1: Consortium Programs**

#### **Fellowship/Scholarship**

##### Description

The goal of the SDSGC Fellowship/Scholarship program is **“To administer a Fellowship/Scholarship program that offers educational and research opportunities to students from diverse backgrounds who are pursuing degrees in fields of science, technology, engineering, and mathematics (STEM) that align with NASA’s mission and those of SDSGC members and affiliates.”** The 2007-08 *Strategic Plan* identifies seven specific objectives for achieving this goal (box at right); associated with each objective are operational strategies and outcome indicators that the Consortium uses to measure the success of the program.

##### **Fellowship/Scholarship Objectives**

- B.1.1: Competitiveness
- B.1.2: NASA & EROS ties
- B.1.3: Industry ties
- B.1.4: Mentoring and professional development
- B.1.5: Diversity
- B.1.6: Long. tracking
- B.1.7: Evaluation

*Program characteristics* – Over the past five years, SDSGC has awarded 184 university students with NASA-funded Fellowships/Scholarships; with matching funds from Augustana College, the number of students who received awards increases to 220 students. The number of total awards increased from 32 in 2003 to between 42 and 51 during 2005-2007.<sup>4</sup> Space Grant has funded students pursuing degrees within 36 different STEM disciplines ranging from mechanical engineering to biology to computer science.

*Percentage of consortium budget* – The CMIS data shown in Figure 3 show that the Consortium dedicated a minimum of 25.2% of its NASA funds to the Fellowship/Scholarship program between 2003 and 2007 with a five-year average of 29.5%.

*Assessment and evaluation* – See *Self-assessment and evaluation* (p. 8).

<sup>4</sup> The anomalously high number of “total awards” in 2004 (71) in the CMIS Table IV-A, Award Recipient Demographics, is due to the fact that NASA required that Workforce Development (WFD) awards be reported separately in CMIS that year, even if a student received both regular Space Grant funds and WFD funds. SDSGC also broke out and reported individual semester/summer awards separately in 2004. For this reason the 71 “awards” shown for 2004 were distributed among only 37 individual students.

*Support of graduate and undergraduate students* – On average, 25% of the Fellowship/Scholarship awards have been to graduate students. The average award size for graduate students is \$3,385, or about 18% higher than that for undergraduates. Only two of the participating universities have significant graduate programs in STEM fields, and enrollment in those programs is generally small.

### Analysis of Core Criteria

#### *Diversity*

*Women* – The challenge of engaging female students in STEM is highlighted by enrollment at the Consortium’s major engineering-focused school, where female enrollment is only 29%. Based on guidance from NASA Headquarters in 2004-05, SDSGC adopted a target of 40% of Fellowship/Scholarship awards to women. Prior to setting this target the percentage of the number of awards to women were 25.0% and 28.2% in 2003 and 2004, respectively. That increased significantly in 2005-2007 and has averaged 38.8% over the three year period (counting only NASA-funded students, the three year average is 40%). Although there was a drop to 33.3% in 2007, the “dollar amount” of 2007 NASA-funded awards to women was 45%.

*Underrepresented minorities* – According to the most recent National Center of Education Statistics Digest, South Dakota’s minority enrollment in degree-granting institutions after removing the Asian student percentage is 8.9% (6.6% Native American). In 2004, SDSGC set a target of 10% of awards to minorities and has exceeded it every year since then in terms of NASA-funded awards. According to CMIS Table IV-A, “Award Recipient Demographics,” the percentage NASA-funded awards to underrepresented students increased from 9.4% to 16.7%.

*Persons with disabilities* – Whereas the SDSGC Fellowship/Scholarship announcement clearly encourages applications from persons with disabilities, the consortium has not required awardees to provide information on disability status and, therefore, CMIS Table IV-A shows no students in this category. The decision not to require this information was based on the lack of specific criteria for what constitutes a disabled person, the lack of a clear mandate from NASA Headquarters to collect these data, privacy concerns, and guidance from the ADA Coordinator at the lead institution.

*Recruitment of targeted groups* – Since the 2004, SDSGC’s expanded Management Team has included three female and two Native American members who have been instrumental in developing more effective recruitment of women and Native American students. Space Grant representatives at each Higher Education affiliate are directed to assist in recruitment of underrepresented students. As discussed below under the Higher Education and Precollege programs, SDSGC supports eight projects that target either women or Native American students, and these projects promote opportunities related to the Fellowship/Scholarship program to current and future college students.

#### *Competitiveness*

*Recruitment of applicants* – SDSGC invites applications from all undergraduate and graduate students of U.S. citizenship enrolled at any South Dakota institution of higher education who are engaged in the study of STEM disciplines that align with NASA’s mission and those of SDSGC affiliates. The Consortium specifically encourages applications from women, underrepresented and Tribal College students, and persons with disabilities. The announcement for the Fellowship/Scholarship program is released at the start of the fall semester. The announcement is distributed through the designated Space Grant representatives, and where campus regulations permit, the announcement is sent directly to all student e-mail addresses. The announcement is

also posted on the state NSF EPSCoR website along with links to other statewide STEM fellowship and internship opportunities.

*Selection of awardees* – Applications are reviewed by SDSGC’s nine-member Management Team and selections are made based on academic excellence, alignment with the goals of NASA and SDSGC, and an assessment of the applicant’s motivation toward an earth science, aerospace, or engineering career or research. Special consideration is given to applicants interested in internships at NASA Centers, EROS, or other federal or aerospace industry internships. As a result of broader promotion of the program and an increase in applications, the selection process has become more competitive. In 2006, 85% of the applicants who requested NASA funding received awards (36 awardees from 42 applicants), whereas that percentage dropped to 71% in 2007 (40 awardees from 56 applicants).

*Distribution of awards among the affiliates* – Prior to 2004, SDSGC lacked a consistent, formalized process for application and selection of Fellowship/Scholarship awards. The process was not competitive, and awards went primarily to the lead institution and two affiliates. In 2004, the Consortium adopted strategic objectives regarding competitiveness and broader distribution of awards and developed and implemented a uniform, consortium-wide application process for competitive review and selection of awards. Since 2004, the number of institutions receiving SDSGC Fellowship/Scholarship awards increased from three to eight including three Tribal College affiliates.<sup>5</sup>

#### *Consortium Specific*

Since 2004, SDSGC has stepped up efforts to provide hands-on, tangible research experiences to fellowship awardees through internships at NASA Centers and EROS. NASA Center placements increased from 3 during 2003-04 to 16 during 2005-07 (internships, NASA Academy, Coop). EROS/SAIC placements increased from one during 2003-04 to 26 during 2005-07. Additional internships include the Air Force Research Lab (Kirtland AFB, NM). Similarly, SDSGC has increased efforts to place fellowship awardees in industry internships. Industry placements increased from 0 during 2003-04 to 3 during 2005-07 (not including EROS contractor SAIC), including Hamilton Sundstrand, Spirit Aerosystems, and ATI Allvac.

#### Impact/Results

Since adopting new strategic objectives and completely restructuring its Fellowship/Scholarship program in 2004, SDSGC has demonstrated steady improvement in this program; the percentage of fellowship outcome targets that have been achieved increased from 71% in 2005 to 92% in 2007, and two fellowship strategies have been permanently retired. The following milestones highlight the results and impact of the program:

- Participating institutions increased from 3 to 8; number of applicants increased from 34 to 56 and selections are more competitive
- First applications and awards to three Tribal Colleges; 33 Native American student awards

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<sup>5</sup> CMIS Table IV-B, “Distribution of Fellowship Awards and Funds across Affiliates,” shows the vast majority of awards at SDSM&T. This is due to the fact that since 2004, SDSGC has conducted a centralized Fellowship/Scholarship program and awards to students from affiliate institutions are reported under the lead institution. Exceptions are two institutions that have formal subawards with SDSGC and have the Fellowship/Scholarship funds for awardees at those institutions added to the annual subaward.



- Increase from three NASA student interns in 2003-04 to 16 in 2005-07 and an increase from one EROS student intern in 2003-04 to 26 in 2005-07, through a combination of funding and administrative assistance
- Three aerospace industry interns
- Tracking data for 2006-07 demonstrate that 100% of Fellowship/Scholarship awardees who completed their degree are either employed in the STEM workforce or pursuing advanced STEM degrees (see Longitudinal Tracking)
- 2003-04 female Space Grant fellow conducted internship at KSC and now works for NASA

## Research Infrastructure

### Description

The goal of the SDSGC Research Infrastructure Program is **“To promote the improvement of research programs and capabilities of institutional and affiliate members with an emphasis on the fields of aerospace, earth science, and supporting STEM disciplines.”** The *2007-08 Strategic Plan* identifies seven specific objectives for achieving this goal (box at right); associated with each objective are operational strategies and outcome indicators that the Consortium uses to measure the success of the program.

#### Research Infrastructure Objectives

- B.2.1: Research proposals
- B.2.2: Research support
- B.2.3: Collaborations
- B.2.4: Facilities
- B.2.5: Integrate research & education
- B.2.6: Diversity
- B.2.7: Evaluation

*Characteristics* – SDSGC Research Infrastructure programs include: 1) faculty development to enhance research facilities and opportunities, 2) faculty and graduate student research fellowships at EROS, 3) research capability enhancement through Program Initiation Grants and travel support, 4) collaborative efforts with the Upper Midwest Aerospace Consortium, and 5) collaboration with NSF Research Experiences for Undergraduates projects. Additionally, SDSGC oversees critical Research Infrastructure initiatives through close coordination with the SD NASA EPSCoR program. As compiled in CMIS Table V, “Participants,” 282 college and university students and faculty were impacted by the Consortium’s Research Infrastructure programs over the five-year period. In response to increased emphasis on the Research Infrastructure program, the annual number of participants increased from 24 in 2003 to an average of 65 during 2005-2007.

*Percentage of budget* – As depicted in Figure 3, from 2003-2007 the Consortium allotted an average of 12.5% of its annual NASA funding (12.8% NASA plus match) to Research Infrastructure programs.

*Assessment and evaluation* – See *Self-assessment and evaluation* (p. 8).

*Recruitment and participation of targeted groups* – (See also Diversity section, p 22.) CMIS Table V, “Research Participants,” shows that between 2003-2007 participants in Research Infrastructure programs were 34% female and 18% from underrepresented groups. Specifically, SDSGC promotes research collaborations and shared use of facilities to link faculty at universities with established research capabilities with faculty at Tribal Colleges. Test sites to promote collaboration in remote sensing research have been developed on the Pine Ridge Reservation (Oglala Lakota College) and the Rosebud Reservation (Sinte Gleska University). The SDSGC Director collaborated with Oglala Lakota College on a \$2.5 million NSF grant (2001-2007) to share research facilities with SDSGC’s lead institution and to develop environmental analytical laboratories at OLC. Both the remote sensing research and the analytical laboratories are critical components of the \$177,000 Consortium Development

Competition grant awarded to SDSGC in 2007; a major goal of that program is to recruit at least two Native American students into graduate science and engineering programs.

### **Analysis of Core Criteria**

#### *Interdisciplinary*

Students and faculty supported through the Research Infrastructure, Higher Education, and Fellowship/Scholarship programs represent more than 35 disciplines. The Consortium prioritizes support of interdisciplinary projects, including engineering design teams (Aero Design Team, Unmanned Aerial Vehicle Team, and IEEE Robotics Team). Since its inception, SDSGC has promoted research in support of NASA's Earth Observing System, especially through cooperative programs with the Land Processes DAAC at EROS. EROS is staffed by approximately 600 USGS and private sector employees, some of whom are deployed at NASA Goddard. Research collaborations with EROS are inherently interdisciplinary in nature, bringing together specialists in geography, geology, hydrology, atmospheric science, physics, plant science, agronomy, computer science and engineering, and electrical engineering. The \$177,000 Consortium Development Grant awarded to SDSGC in 2007 is an interdisciplinary project that will be carried out on the Pine Ridge Reservation; the project integrates remote sensing and GPS, a "Badlands Rover" robot, electrical and mechanical engineering challenges, computer programming, in situ analysis and sampling, and lab analysis. SDSGC supports interdisciplinary research at the Deep Underground Science and Engineering Laboratory discussed below under "Consortium Specific."

#### *Alignment with NASA*

SDSGC has always maintained close research ties with NASA earth science priorities through its affiliate EROS, which is part of NASA's Earth Observing System. However, since 2005 the Consortium has placed increased emphasis on developing 1) research capabilities outside of the Science Mission Directorate that are more closely aligned with the *Vision for Space Exploration*, and 2) direct linkages with researchers at NASA Centers. In 2006-07 alone, 48 "targeted announcements of opportunity" that involved NASA-related research were distributed to SDSGC affiliates. Although technically a NASA EPSCoR function, 62 seed grant proposals or concept papers were generated during the three year period from 2005-2007 in response to SDSGC's effort to refocus and identify new areas of collaboration with NASA. Similar refocusing has impacted SDSGC travel support. Whereas in 2003, SDSGC reported support for 23 trips, none of these was to a NASA Center. In contrast, from 2004-2007, 21 trips were supported, but every trip was to a NASA Center or Headquarters. Through these efforts, SDSGC, in coordination with its EPSCoR program, has successfully promoted collaboration between state researchers and NASA scientists and engineers at NASA Headquarters and eight Field Centers (ARC, GRC, GSFC, JPL, JSC, KSC, LaRC, and SSC) as well as other universities, industries, and federal research facilities.

#### *Consortium Specific*

*Collaborations* – A prime example of research collaboration is the Deep Underground Science and Engineering Laboratory (DUSEL) at the site of the former Homestake mine in Lead, SD. The Consortium is proud of the fact that the DUSEL concept initially started as a SDSGC initiative in 2001 through collaboration with the University of Pennsylvania. Today, DUSEL is unquestionably the state's number one research and development priority. In 2007, the National Science Foundation selected the site from among seven sites as the preferred location for a national and international deep science facility, and more than 50 scientists from across the U.S.

and abroad are actively involved in the project. State, private and federal funds of \$85 million are now committed to the project to develop an interim lab at the 4,850-foot level, near the site of measurements of solar neutrino flux by Ray Davis that led to the 2002 Nobel Prize in Physics. Currently, a faculty member from the lead institution, along with a physicist from UC-Berkeley/Lawrence Berkeley National Laboratory, is a Principal Investigator on a \$15 million NSF grant to develop the final science and engineering plans for a deeper laboratory at the 7,400-foot level. The project will next be submitted as an NSF Major Research Equipment expenditure, which would pave the way for \$300 million in federal FY2010-2011 funds to develop the infrastructure down to the 7,400-foot level. Once fully operational, DUSEL will be a multi-disciplinary facility with research in neutrino physics, particle physics, dark matter, nuclear astrophysics, nucleosynthesis, microgravity, geomicrobiology, hydrology, and geology, as well as the site of a comprehensive Education and Outreach center that will be managed by an SDSGC affiliate. Science and engineering experiments will be funded primarily by DOE and NSF, but research in astrophysics and dark matter may also attract NASA funding. Faculty from all eight of the Consortium's four-year universities (including two Tribal Colleges) are involved in research, education, or outreach components of the DUSEL project, and SDSGC provides financial support through a Program Initiation Grant to develop a 3-D, internet-accessible database of geological and engineering information.

### Impact/Results

*Impact on research capability* – From 2003-2007, SDSGC made significant progress toward its overall goal of strengthening the research capacity of its affiliate organizations and the state of South Dakota. While continuing strong support for earth science research activities focused on NASA's Science Mission Directorate and EROS, SDSGC has greatly expanded its support of engineering projects aligned with the Exploration Systems Mission Directorate. The Consortium has expanded its efforts to involve Tribal Colleges in its research programs, and continues to contribute to the state's top research priority, which is the development of the national/international DUSEL facility. In order to assess the research needs and capabilities of state industries in areas of interest to SDSGC and NASA, the Consortium sponsored a market research project in 2004-05 targeting 95 state businesses with ties to aviation, aerospace, and related industries. One respondent, Aerostar International, Inc., is the chief supplier of high-altitude research balloons for NASA, DoD, and NOAA. This contact sparked an on-going research relationship through SD NASA EPSCoR, for which Aerostar donated a \$20,000 balloon launch that carried experiments to 76,000 feet.

*External metrics* – Since adopting the Evaluation Logic Model approach in 2005, SDSGC increased the percentage of achieving its Research Infrastructure outcome targets from 75% in 2005 to 81% in 2007. Four strategies have been permanently retired. Evidence of leveraging as a result of SDSGC support is the fact that proposals were funded from the following agencies: NASA, NSF, USGS, USDA, DoD, US DOT, and SD Department of Education.

## Higher Education

### Description

The goal of the SDSGC Higher Education program is **“To build interdisciplinary programs related to NASA’s mission and goals at the state’s institutions of higher education and to support related programs that serve to strengthen STEM education in South Dakota.”** The *2007-08 Strategic Plan* identifies six specific objectives for achieving this goal (box at right); associated with each objective are operational strategies and outcome indicators that the Consortium uses to measure the success of the program.

### Higher Education Objectives

- B.3.1: Curriculum and NASA content
- B.3.2: NASA and EROS ties
- B.3.3: State government
- B.3.4: Industry involvement
- B.3.5: Diversity
- B.3.6: Evaluation

*Characteristics* – SDSGC Higher Education funding supports: 1) student and faculty travel support to present technical papers, 2) American Indian Science and Engineering Society (AISES) student chapter, 3) Project Initiation Grants for higher education, 4) a Tribal College Relations Program with Consortium Tribal College affiliates, 5) a college-preparatory program for Native American students called South Dakota GEAR UP, 6) Flandreau Indian School “Success Academy” at SD State University, 7) university Robotics Teams on several campuses, and 8) a multi-consortium Space Grant Internet Telescope Network program. As compiled in the CMIS Table VI, “Participants,” an average of 662 college and university students and faculty are impacted by the Consortium’s Higher Education programs each year.

*Percentage of budget* – As depicted in Figure 3, the consortium allotted an average of 18.6% of its annual NASA funding (29.9% NASA plus match) to Higher Education programs from 2003 through 2007. As noted previously (p. 12), the 2003 values are anomalous because of an infusion of Workforce Development funds that year which were used almost exclusively for Higher Education programs. Ignoring the 2003 anomaly, the percentage of NASA funds allocated to Higher Education increased steadily from 12.8% in 2004 to 19.8% in 2007, with a comparable increase in non-federal match.

*Assessment and evaluation* – See *Self-assessment and evaluation* (p. 8).

*Recruitment and participation of targeted groups* – The data in CMIS Table VI, “Participants,” indicates that over the five-year period, 41.0% of the Higher Education participants were female and 31.2% were from underrepresented groups (almost exclusively Native American), in both cases exceeding the Consortium’s diversity targets. The Consortium enhances recruitment and retention of underrepresented groups through its support of the following Higher Education and college bridge programs:

- *American Indian Science and Engineering Society (AISES)*—In 2003 and 2005, SDSGC staff and student fellows organized and hosted the American Indian Science and Engineering Society (AISES) Region Five Conference in Rapid City with about 150 Native American students and staff attending each year.
- *Flandreau Indian School Success Academy*—Through SDSU’s Flandreau Indian School Success Academy, 52 Native American students have taken university courses as concurrent high school students, and in the 2006-07 school year, five of these students enrolled as college freshmen (compared with only one student prior to the start of the Success Academy).
- *South Dakota GEAR UP*—SDSGC supports the SD GEAR UP Program, a six-week residential, college-preparatory program that each year serves about 200 Native American

students interested in engineering and science. Of the students who graduate from the program, virtually 100% also graduate from high school, and 85% attend college.

- Space Grant Consortium Development Competition award—To further enhance its recruitment of women and minorities, SDSGC submitted a Consortium Development Competition grant proposal in 2007, which was one of five selected by NASA for funding. Through this \$177,000 award, 10 female undergraduates and 10 Tribal College students will receive mentoring and participate in a hands-on “Badlands Rover” robotics and remote sensing mission. The overall goal is to enroll at least two of the participants into M.S. science and engineering degree programs by the end of the project.

### Analysis of Core Criteria

#### *Interdisciplinary*

As emphasized above in the Higher Education program goal, SDSGC focuses on interdisciplinary experiences for individual students or design teams. From 2003-2007, SDSGC supported the following student-centered, hands-on, engineering programs that integrate a wide variety of STEM fields: 1) Aero Design Team, 2) Unmanned Aerial Vehicle Team, and 3) IEEE Robotics Team. These activities are focused around challenging engineering design problems, but also incorporate real-world, systems-engineering aspects, such as logistics, planning, resource development, and deadlines, that prepare students for the STEM workforce. Likewise, SDSGC has sponsored three student teams to participate in NASA’s Reduced Gravity Student Flight Opportunity Program where students from several different engineering disciplines came together to design thin-membrane/solar sail structures and test them in various applications under microgravity conditions. Consistent with the Consortium’s increasing emphasis on robotics training, in 2006 and 2007 SDSGC awarded special Program Initiation Grants to two affiliates in order to integrate robotics and mechanical and electrical engineering principles into the computer science curriculum.

#### *Consortium Specific*

*Space Grant Internet Telescope Network* – The multi-consortium Space Grant Internet Telescope Network program began operations in North and South Dakota in August 2007. Discussions are underway to add observatories in Utah and Alabama to the network, as well as potential observers in Connecticut and Puerto Rico. The primary goal is to provide undergraduate and graduate students and faculty with greater access to research quality astronomical observatories for research and educational projects. SDSGC affiliate Badlands Observatory is a principal link in the network, with its research-grade 26-inch f/4.8 Newtonian telescope. Five graduate student and faculty projects have already used the observatory.

### Impact/Results

*External metrics* – Since adopting this Evaluation Logic Model approach in 2005, SDSGC increased the percentage of achieving the targeted outcomes for Higher Education from 67% in 2005, to 75% in 2006, to 100% in 2007. Two Higher Education strategies have been permanently retired.

*Robotics success story* – The Interdisciplinary Robotics Initiative (IRI) at SDSM&T began in 2006 through an SDSGC Project Initiation Grant and has seeded additional growth in robotics education during 2007 at both the university and precollege level. The IRI project is aimed at increasing the number of graduates in computer science and engineering and promoting careers in science and technology. 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 middle school Robotics Camps. Plans are also underway for an NSF Research Experience for Undergraduates (REU) program to train undergraduate students to teach precollege Robotics Camps. 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.

Furthermore, the SDSGC-funded activity has sparked a fundamental change in SDSM&T's Computer Science graduate program. The Computer Science department is now planning a focused interdisciplinary graduate program in autonomous intelligent systems and robotics. The new degree program will carry the thread initiated at the undergraduate level on through the graduate level and will be tightly coupled with other SDSGC-supported multidisciplinary research groups on campus such as the Unmanned Aerial Vehicle. This team-oriented project-based program aims to develop a workforce that can tackle the complex multidisciplinary engineering problems of the coming decades.

Because of the success of the SDSM&T program, a similar program at Augustana College is being supported under a 2007 Project Initiation Grant.

## **NASA Education Outcome 1: National Program Emphases**

### **Diversity of Participants**

#### Description

During the past five years, SDSGC has embraced diversity as a cross-cutting theme, with strategic objectives in all five program areas and Management that are designed to recruit and support women and underrepresented minorities. Starting in 2004, the composition of the Management Team changed from five white males to a nine-member team that has included three females and two Native Americans. This team works with the Space Grant contacts at SDSGC's 10 academic affiliates (three of which are Tribal Colleges or Minority-focused), three Informal Education affiliates, and two K-12 Tribal Partner School contacts to improve recruitment of qualified female and minority students. Recruitment strategies include support of the following precollege and college bridge programs: Women in Science Conferences, Flandreau Indian School Success Academy, St. Francis Indian School, Native American GEAR UP Honors Program, Tribal College Relations Program, NASA Explorer Schools, and South Dakota Space Days. Strategies to maintain and support participation include: targeting women and minorities in the Fellowship/Scholarship announcement, a new scholarship for a Native American Scientist or Engineer, a new Consortium Development Competition grant that targets women and Native Americans, participation in the multi-consortium "NativeConnections" workforce development program, support for remote sensing research test sites located near Tribal Colleges, and support for the American Indian Science and Engineering Society (AISES).

#### Analysis of Core Criteria

##### *Target*

*Women* – As discussed in "Fellowship/Scholarship" section (p. 15), the target for women in SDSGC's programs is 40%. Between 2003-2007 women participants in the Fellowship/Scholarship program increased from 22.0% in 2003 to an average of 38.8% during 2005-07 (counting only NASA-funded students, the three year average is 40%). Between 2003-2007 women participants in Research Infrastructure programs averaged 34.0%, and in Higher Education programs the average was 41.1%. Thus, by the end of the five-year period, SDSGC was meeting or exceeding its target for participation of women in Fellowship/Scholarship and Higher Education, but fell short of the target in Research Infrastructure.

*Underrepresented minorities* – As explained in “Fellowship/Scholarship” section (p. 15), the target for underrepresented minority participants in SDSGC’s programs is 10%. Between 2003-2007 underrepresented participants in the Fellowship/Scholarship program increased from 9.4% to 16.7%. Between 2003-2007 underrepresented participants in Research Infrastructure programs averaged 18.1%, and in Higher Education programs the average was 31.2%. By the end of the five-year period SDSGC was consistently exceeding its target for minority participation in all these programs. These participants are almost exclusively Native American.

*Persons with disabilities* – SDSGC has not established a specific target for participation of persons with disabilities. The Consortium is committed to finding better ways to engage this group and will work with NASA to establish a both a target and clear criteria for inclusion in this group. The Consortium has very recently developed a program to support the Black Hills Workshop, an organization that serves 600 disabled people, through senior design projects, Fellowships, and Program Initiation Grants that involve the engineering of assistive devices to improve the quality of life and vocational productivity of this group. These projects will provide societal benefit and introduce student design teams to NASA-relevant challenges related to human function in a limited-mobility environment.

### Impact/Results

The Consortium’s efforts to recruit and support women and underrepresented minorities have increased diversity in the STEM pipeline and STEM workforce as shown by the following specific examples:

- Participation of women and underrepresented minorities almost doubled between 2003-2007
- Fellowship awards to Native American students increased from 3 (9.4%) in 2003 to between 7 and 9 each year (16.7-17.6%) in 2005-07; awards have been made to a total of 33 Native American student at four affiliates, including three Tribal Colleges
- Space Grant fellow Josephine Santiago (2003-04) employed at NASA KSC
- Space Grant fellow Cassandra Soeffing conducted Einstein Distinguished Educator Fellowship in 2006 at NASA Headquarters
- First Native American Ph.D. graduate Dr. Bull Bennett from SDSM&T (2005) was Space Grant Fellow
- Native American student James Sanovia transferred from Tribal College affiliate to SDSM&T; he then completed two internships at NASA Goddard and is now enrolled in graduate school at SDSM&T
- Native American graduate student Connie Giroux completed an internship at NASA JPL and was offered employment after graduation; she is currently in charge of minority participation at the DUSEL project
- New Consortium Development Competition grant will support 10 female and 10 Native American undergraduates with the goal of enrolling two students into graduate school

More broadly, the Consortium has adopted permanent strategies to increase diversity in all of its programs and has embodied diversity in the composition of its Management Team and in its affiliate organizations and partners across the state. As a result of this unique structure, SDSGC is gaining a reputation as a leader in promoting STEM opportunities for Native American students from precollege through employment.

## **Workforce Development**

### Description

Workforce development efforts in the Consortium's Fellowship/Scholarship, Higher Education, and Research Infrastructure are designed to provide students with a solid STEM education that is augmented by hands-on interdisciplinary research experiences, exposure to NASA-relevant projects (e.g., senior design and engineering team competitions), and internship experiences at NASA Centers, aerospace industry, and EROS. The *Strategic Plan* outlines specific objectives and strategies for recruitment, fellowship support, and NASA and industry placement and establishes outcome indicators that the Consortium uses to measure the success of the program. SDSGC's annual Fellowship/Scholarship Program announcement specifically states that "strong consideration will be given to student applicants interested in internships at NASA Centers, EROS, or other federal or industry internships." Numerous NASA and other internship programs are listed in the application materials along with corresponding web links. SDSGC also provides significant support to design teams for participation in national competitions, including Augustana College's Robotics Team and SDSM&T's IEEE Robotics Team, Aero Design Team, and Unmanned Aerial Vehicle Team (see p. 21). Additionally, during 2004-05, the Consortium employed a Native American woman as full-time Manager for Workforce Development using funding from a Workforce augmentation.

### Evidence of Success

In 2004-05 SDSGC established annual targets of three students in NASA internships and five students in EROS-SAIC or other industry internships. In the three year period from 2005 to 2007, SDSGC placed 16 NASA interns, 26 EROS-SAIC interns, three aerospace industry interns and two U.S. Air Force Research Laboratory interns (see p. 16-17). These placements leverage the Consortium's close partnership with its affiliate EROS-SAIC as well as partnerships with five NASA Centers (GSFC, JPL, JSC, KSC, and MSFC) and three aerospace industries (Hamilton Sundstrand, Spirit Aerosystems, and ATI Allvac).

Evidence of the success of the workforce development initiatives includes Space Grant student Josephine Santiago who conducted a NASA internship at KSC in 2003 and has been employed there since graduation. Similarly, Space Grant student Connie Giroux conducted a NASA internship at JPL in 2007 and was offered employment after graduation. As discussed below under "Longitudinal Tracking," 100% of the students supported by SDSGC in 2006-2007 who have responded to surveys and obtained their degrees are either pursuing advanced STEM degrees or are employed in the STEM workforce.

More broadly, the Consortium has adopted a permanent focus on preparing students for the STEM workforce with the highest priority given to NASA employment and related aerospace careers. This focus is now a common thread from Precollege programs through STEM Higher Education programs and employment. In turn, SDSGC benefits from this emphasis on workforce development in its programs by increased collaborations with NASA Centers and STEM industries.

## **Longitudinal Tracking**

### Description

During 2005, SDSGC entered into a formal arrangement with the National Space Grant Foundation such that all students provided with "significant support" from Space Grant are tracked in accordance with NASA's longitudinal tracking requirements. Students funded during 2005 and beyond are tracked at least through first employment through a web-based, automated



system that allows self-reporting of post award educational history, employment history, anecdotal, and other information.

As shown in CMIS Table IV-A, “Award Levels and Amount,” SDSGC’s average award amounts are \$2,880 for undergraduates and \$3,385 for graduate students. However, for purposes of student tracking, the Management Team has defined “significant support” as a single award of \$1,000 or more. There are several reasons for adopting this relatively low threshold:

1. SDSGC has 10 academic affiliates and a five-year average of \$108,021 in fellowship funds. In an effort to spread the fellowship funds as broadly as possible, and also to bring talented freshmen into the “NASA pipeline,” approximately 20 awards were made at the \$1,000 level during the five years. These include awards to students at Tribal Colleges with limited STEM capabilities.
2. The “standard” semester award of \$2,500, and even a \$1,000 award, constitutes significant financial assistance in terms of the relatively low expenses (on a national scale) at institutions of higher education in South Dakota.
3. Most importantly, by obtaining longitudinal data on students receiving both large and small awards, the Consortium will be able to make a quantitative assessment of the impact of award size on students. Given a longer baseline of tracking data, SDSGC will likely refine its definition of “significant support” and, if necessary, make adjustments to its standard award sizes.

Evidence of Success

Since the longitudinal tracking system was implemented in 2005, 118 students have been entered into the system. The response rate of those who have completed their degrees and taken the “next step” is currently 45%. However, 100% of the responders who were supported by Space Grant during 2006-07 are either pursuing advanced STEM degrees or are employed in STEM industry or academia (see table at right).

<b>Next Step Longitudinal Data 2006-07</b>	
Non-NASA STEM contractor	64%
STEM academic employment	9%
Pursuing advanced STEM degree	27%

Student feedback is another measure of success. When asked how participating in the Space Grant program impacted her education and career, Megan Burke, a 2005 Space Grant Fellow responded, *“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 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.”*

Despite the fact that SDSGC has only two full years of data at this point, it is clear that the addition of a formal longitudinal tracking system is helping to meet its goal of “assessing the impact of the student support on the individuals’ education, career, and professional development.” At the same time, there is clearly a need to improve the response rate and to determine what has happened to the other 55% of the former recipients. As this baseline of student data is extended and becomes more complete, the Consortium will use the information to make necessary adjustments in award sizes, award distribution, and other strategies to ensure that its Fellowship/Scholarship program makes an effective contribution to the STEM workforce.

## **Minority Serving Institutions**

### Description

SDSGC's goal for engaging minority-serving institutions is **“To ensure that Minority-Serving Institutions in South Dakota, which are exclusively Tribal Colleges and Universities, are represented in the planning and implementation of all Consortium programs.”** In 2003 seven Tribal Colleges (one actually a “Minority-Focused Organization”) were SDSGC affiliates. Based on an assessment of Consortium resources and the level of STEM activity at these institutions, four of these affiliations were discontinued. SDSGC now focuses primarily on developing meaningful collaborations with two Tribal College affiliates that have significant STEM emphases, Oglala Lakota College (OLC) and Sinte Gleska University (SGU). The lead institution has articulation agreements in place with each of these, which allow Tribal College students in STEM programs to complete a four-year degree at SDSM&T. Since 2004, SDSGC's Management Team has included a Tribal College representative, consistent with the goal above. Since adopting this more focused approach to engaging Tribal College affiliates:

- A Native American Tribal College transfer student to SDSM&T from OLC completed two summer internships at NASA Goddard and is enrolled in a graduate STEM program
- A Native American Tribal College student at SGU received a SDSGC summer 2005 fellowship and completed an internship at NOAA
- With funding from SDSGC's multi-state “NativeConnections” Workforce Development grant, a student fellow helped develop a series of workshops in conjunction with EROS and SGU. Basic concepts of GIS, GPS and remote sensing were presented to precollege and university teachers and tribal representatives in 2004-05 at two Tribal Colleges in South Dakota, one in North Dakota, and one Native American Center in New Mexico
- The lead institution, SGU, and OLC collaborated to win a three-year, \$250,000 grant in 2005 from the National Science Foundation's program titled Opportunities for Enhancing Diversity in the Geosciences
- In 2007 OLC became the principle collaborator on a new \$177,000 Consortium Development Competition grant titled “Increasing Minority Participation in Higher Education in STEM Disciplines Responsive to NASA Needs”
- Also, the SDSGC Director has collaborated with OLC on a \$2.5 million NSF grant to develop environmental analytical laboratories on the OLC campus

### Evidence of Success

In 2004 SDSGC established a target that at least one fellowship would be awarded annually to a student at a Tribal College or to a Tribal College student seeking to transfer to another SDSGC university. Since then the number of Tribal Colleges whose students received awards increased from none in 2003-04 to three during 2005-07, with 12 individual students receiving awards (6.5% of the Consortium's total awards). Some of these students have already advanced to STEM graduate degree programs. Under the new Consortium Development Competition grant, 10 OLC students will participate on an interdisciplinary “Badlands Rover” robotics team and, the goal of the project is to have at least two of the participants enroll in graduate STEM programs upon graduation. Since 2004 SDSGC has established meaningful collaborations with its Tribal College affiliates in Management and in its Fellowship/Scholarship, Research Infrastructure, and Higher Education programs. These affiliates also participate in many initiatives in the Precollege and Public Service areas that serve to inspire and engage Native American students and build up the STEM pipeline.

## NASA Education Outcome 2

### Precollege Education Programs

#### Description

The goal of the SDSGC Precollege Education Program is **“To increase student awareness and access to education and career opportunities in aerospace, earth science, and supporting STEM disciplines.”** The *2007-08 Strategic Plan* identifies seven specific objectives for achieving this goal (box at right); associated with each objective are

#### **Precollege Objectives**

- D.1.1: NASA dissemination
- D.1.2: Partnerships
- D.1.3: In-service teacher training
- D.1.4: Science & education events
- D.1.5: State standards
- D.1.6: Diversity
- D.1.7: Evaluation

operational strategies and outcome indicators that the Consortium uses to measure the success of the program.

*Characteristics* – CMIS Table VII, “Activities and Products,” shows that SDSGC supports an average of about 11 precollege programs per year. In compliance with NASA’s guidance, after 2004, we reported only those “student” participants who met NASA’s definition of “direct” participants, which explains the dramatic drop in CMIS Table VII, “Participants.” From 2005 forward, an average of about 7,000 K-12 students and teachers are impacted each year through these programs.

*Percentage of consortium budget* – As depicted in Figures 1B and 3, the consortium allotted an annual average of 13.4% of its NASA funding (15.8% NASA plus match) to Precollege Education programs from 2003 through 2007. The spike in precollege funding in 2006 is due to the onset of subawards with SD Discovery Center and St. Francis Indian School, plus a large Precollege Project Initiation Grant for 39 precollege student scholarships to attend summer Space Camps. SDSGC has been reducing precollege expenditures since then.

*Assessment and evaluation* – See *Self-assessment and evaluation* (p. 8).

*Recruitment of targeted groups* – Objective D.1.6 of the *Strategic Plan* includes strategies to engage and educate students from underrepresented groups and encourage them to pursue STEM careers. Starting in 2005, SDSGC formally partnered with its affiliate at the SD Discovery Center to support five annual Women in Science (WIS) conferences designed to help young women succeed in STEM education and enter the STEM workforce; approximately 1,300 young women participate each year. Through SDSGC-funded programs at Flandreau Indian School and St. Francis Indian School, approximately 710 Native American students each year participate in specialized aerospace disciplines, earth science programs, and college-preparatory STEM courses. In 2005, SDSGC initiated a program to provide field-based scientific and cultural experiences for Native American youth, which was funded through a three-year, \$250,000 grant from the NSF program Opportunities for Enhancing Diversity in the Geosciences. Engagement of Native American students is also addressed through support of Space Day at the Black Hills Pow Wow, Youth Day at the Pow Wow, and support of three NASA Explorer Schools located on the Pine Ridge and Rosebud Indian Reservations. In 2006, SDSGC funded a “Light and Color” exhibit at the SD School for the Deaf, through which 70 students participated in 15 hands-on science activities. Two transitional higher education/ precollege programs (Flandreau Indian School Success Academy and South Dakota GEAR UP) are described in more detail under Higher Education because they are college preparatory programs for Native American students which are conducted on university campuses.

## Analysis of Core Criteria

### *Emphasis on Teacher Preparation/Development*

SDSGC supports teacher-training curriculum that is linked with state and national STEM education standards, and is executed largely through partnerships with SDSGC's three Informal Education affiliates across the state. CMIS Table VII, "Participants," shows that the number of teachers in SDSGC-supported workshops and professional development programs more than doubled over the five-year period, increasing from 290 to 670. Two important training programs supported by SDSGC are linked with NASA through the University of California–Berkeley Space Science Laboratory: 1) "Great Explorations in Math & Science," which is funded by a NASA Parent Science Research Award grant, is a standards-based, teacher-training program that focuses on space science curricula. 2) "Advancing Teacher Learning in Space Science" is a NASA-funded project for continually upgrading teacher knowledge of current space science and methodologies for teaching the concepts of space science.

### *Consortium Specific*

*Robotics emphasis* – Since 2005, SDSGC has focused on robotics curriculum as a theme for teacher-training academies and as a means for successfully promoting STEM education in the classroom. SDSGC partners with a NASA AESP robotics trainer to offer five training opportunities across the state annually, and these provide state-approved continuing education credits and/or college credit. In 2007, all (20+) of the County Extension 4-H educators in South Dakota received NASA Space Grant teacher-training in robotics and have incorporated robotics into their 4-H curriculum. 4-H also recently began holding a Robotics Challenge for students at the South Dakota State Fair with SDSGC as a co-sponsor. From 2005-2007, SDSGC supported approximately 205 middle and high school robotics team students through the purchase of robotics materials and supplies, travel to regional/national robotics competitions, robotics competition registration, and robotics camps.

*Aerospace Career and Education (ACE) Camp* – SDSGC is a major supporter of ACE Camp at SDSU, which introduces approximately 20 high school students per year to the importance of aviation and aeronautics at the federal, state, and local level, and includes flying time, hot air ballooning, tours of scientific facilities, and discussions on careers in STEM.

### Impact/Results

*Strengths and weaknesses* – Fundamental improvements over the five-year period include: 1) building strategic partnerships with the three major science centers in South Dakota, all of which now serve on the Consortium Management Team; 2) extensive partnership with NASA AESP staff and science centers to address standards-based teacher training (especially in 2006-07); and 3) engagement statewide of more than 20 County Extension 4-H educators to implement robotics programs throughout the state including rural areas. Since 2005, direct and indirect student participation has been de-emphasized and direct teacher participation has doubled.

*External metrics* – Since adopting the Evaluation Logic Model approach in 2005, the percentage of the Precollege outcome targets that have been achieved increased from 70% in 2005 to 90% in both 2006 and 2007. One Precollege strategy has been permanently retired. From 2003 through 2007, the SDSGC K-12 Informal Education Program conducted 117 separate informal education programs on space-related subjects and NASA missions to K-12 audiences

*"Dear Mr. Durkin, Thank you for giving the speech about Mars. I learned a lot more than I wanted to." — 4th grade student ☺*

and reached 8,900 students and teachers. These figures do not include the annual SD Space Days event that attracts thousands each year and is reported under “Public Service.” Science Day at Augustana College reached approximately 1,400 students (10% Native American, 49% women) and 125 teachers over the five-year period in an annual, daylong experience of hands-on science exploration and discovery. The 2004 through 2007 Women in Science (WIS) conferences reached 3,270 middle/high school girls, their parents and teachers. Through the Flandreau Indian School (FIS) Success Academy, about 1,000 Native American high school students experienced a combination of hands-on SDSGC workshops and NASA events; 52 of them took science courses for college credit at SDSU through SDSGC funding.

### NASA Education Outcome 3

#### Public Service: General Public & External Relations

##### Description

The goal of the SDSGC Precollege Education Program is **“To enhance public scientific literacy in aerospace and earth science; to complement community efforts in STEM education; and to inspire citizens of diverse backgrounds through the excitement of scientific exploration and discovery.”** The *2007-2008 Strategic Plan* identifies four specific objectives for achieving this goal (box at right); associated with each objective are operational strategies and outcome indicators that the Consortium uses to measure the success of the program.

Public Service Objectives
E.1.1: NASA dissemination
E.1.2: Science and education events
E.1.3: Diversity
E.1.4: Evaluation

*Characteristics* – SDSGC’s Public Service program strives to inspire and engage the general public through broad dissemination of NASA materials and content, up-to-date news of NASA’s missions, and staffing of science and education events. Starting in 2006, implementation of the Public Service strategies has increasingly involved partnerships and linkages with the Consortium’s three Informal Education affiliates. After the consortium began distinguishing “direct” participants from 2005 forward, an average of about 1,840 direct participants are impacted each year through these programs.<sup>6</sup>

*Percentage of consortium budget* – As depicted in Figures 1B and 3, Public Service is by far the smallest program supported by the Consortium. From 2003 to 2007, SDSGC allotted an annual average of only 3.9% of its NASA funding (3.6% NASA plus match) to Public Service. Since 2006, affiliate match has grown significantly, surpassing the NASA contribution, as the Consortium focused more NASA funds on Outcome 1 programs and informal science education affiliates stepped in to administer many of the Public Service programs through matching funds.

*Assessment and evaluation* – See *Self-assessment and evaluation* (p. 8).

*Participation of underrepresented groups* – The SDSGC *Strategic Plan* contains specific diversity strategies and targets for the Public Service program and the Consortium uses major science and education events to target the state’s Native American population. Space Days 2005 was held in conjunction with the Black Hills Pow Wow (see below), and SDSGC has continued this association in subsequent years by directing the Youth Day portion of the Pow Wow. Space Day 2006 included a special presentation by a NASA astronaut at the Pierre Indian School.

##### Analysis of Core Criteria

##### *Alignment with NASA Informal Education Definition*

<sup>6</sup> The large number of indirect participants in 2005 and 2007 reflect estimates of *StarDate* radio audience.

In 2007, SDSGC discontinued its participation in three science fairs across the state because the activities did not meet the new guidelines for Informal Education and because the impact of these activities was not considered significant. Also in 2007, the Management Team carefully examined its annual Space Days event in the context of the new guidelines and determined that it was in alignment: Space Days features standards-based education materials from NASA, EROS, USGS, and others organizations; SDSGC staff and qualified STEM educators provide hands-on activities that enhance understanding; and educational standards and learning objectives are incorporated in the content of activities. However, the Management Team decided to limit the use of NASA funds on Space Days in the future and to increase the amount of matching funds by targeting industry affiliates and other state businesses. In 2007, the Consortium was able to obtain \$15,000 in industry match for the Space Days event.

During 2007, SDSGC also reassessed its support of SD Public Radio's broadcast of *StarDate*. The Management Team determined that support of *StarDate* is an inexpensive and effective strategy to implement Public Service Objective E.1.1, which is to "increase public awareness of the Space Grant program and its activities and engage the public in the excitement of NASA missions." The program airs twice daily at peak listening times, reaching a statewide audience estimated at 96,500 daily. Sponsorship by NASA and SDSGC are acknowledged and the SDSGC website is provided. With respect to Informal Education guidelines, *StarDate* does provide extensive NASA content and STEM education material to engage and inspire a broad audience. However, it does not meet the Informal Education guidelines for staffing or specific education standards. Despite this, the Management Team is unanimous in the opinion that *StarDate* is important to the Consortium and to their respective organizations, and decided to continue support of the program with NASA funds in 2008. After 2008, the Consortium will obtain external match from industry affiliates and other state businesses.

#### *Consortium Specific*

SDSGC's Public Service program includes specific objectives and strategies to support science and education events; beginning in 2005, specific strategies were adopted to ensure participation of Native Americans. The largest program in this category is the annual SD Space Days event, which is held in different communities each year and designed to promote STEM literacy and awareness of NASA's mission to the general public. This popular annual event has become an institution in South Dakota. Thousands of students, teachers, and members of the general public from throughout the state participate in hands-on educational activities and visit with experts in aerospace, aeronautics, earth science, engineering, computer science, physics, and other disciplines about their field. Guest speakers such as NASA astronauts, scientists, and managers present programs and meet with the public. In a special effort to engage a higher percentage of Native American students in STEM, SDSGC sponsored "South Dakota Space Day at the Pow Wow: Merging Technology and Tradition" at the 2005 Black Hills Pow Wow.

#### Impact/Results

SDSGC impacted an annual average of 55,452 members of the general public via direct participation through programs such as SD Space Days and indirect participation through SD Public Radio broadcasts of *StarDate*. During the five annual SD Space Days events from 2003 to 2007, about 8,530 students and members of the general public were exposed to the excitement and opportunities of various STEM careers and they became better aware of the impact that NASA has on their lives. This is a significant impact in a state with a population of 781,000.

*External metrics* – Since adopting the Evaluation Logic Model in 2005, SDSGC increased the percentage of achieving Public Service targeted outcomes from 57% in 2005 to 83% in 2007.