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Chapter 1:
Institutional Context

SOUTH DAKOTA
M
SCHOOL OF MINES & TECHNOLOGY
Chapter 1: Institutional Context

This chapter provides a broad orientation to the South Dakota School of Mines and Technology (referred to hereafter as SDSM&T); details on the topics introduced here are given later in this text and in the Resource Room.

Items in the Resource Room are referenced with an “RR,” followed by a number. All “RR” items are available electronically via the in-text hyperlinks that can be activated by holding down the “control” key while clicking the underlined RR number. Online, these same items are found in alphabetic order at http://www.hpcnet.org/ResourceRoom. Appendix F lists all items alphabetically and numerically. During the team visit, all RR items will be available in hard copy format in the Resource Room.

The State Context

South Dakota is a rural state with a relatively low per capita income ($17,562) and a total population of 754,844, which is 46th in the nation. Half of all state residents live in rural areas, and the overall population distribution is 9.9 people per square mile. We have the nation's poorest county, Buffalo County, and with 9.3% of South Dakota's total population living in poverty, we have the 2nd highest state poverty level.

Given the low per capita income, many South Dakota residents need assistance with the cost of college. This is especially true for our Native American population, which is 8.3% of the population. High school degrees are earned by 84.6% of state residents and 21.5% hold a bachelor's or other advanced degree. In academic year 2004-05, 522 or 25.96% of SDSM&T's total domestic undergraduate population was eligible for Pell Grants.

SDSM&T is one of six regents’ universities in the state and is located in the 2nd largest population center, Rapid City, which is nestled on the eastern side of the Black Hills. The University is governed externally by the South Dakota Board of Regents and internally by the President, Dr. Charles Ruch.

The Institutional Context

SDSM&T is a regional university specializing in undergraduate and graduate education in science and engineering. It was established in 1885 to provide instruction in mining engineering. The University diversified as a science and engineering school following World War I, and in 1943 the state legislature changed the name of the institution to the South Dakota School of Mines and Technology, in recognition of the school’s expanded role. Since then, the University has expanded its curriculum to include 16 Bachelor of Science programs in science and engineering, 10 Masters of Science programs, and four Doctor of Philosophy degree programs in science and engineering (RR219). NOTE: Hold “control” key down while you click on the RR link in order to bring up linked Resource Room file.

In December 2003, the Board of Regents reconfirmed SDSM&T’s mission as a technological university and the only institution in the western half of the state to grant engineering degrees. The mission of the South Dakota School of Mines and Technology is as follows:
The South Dakota School of Mines and Technology serves the People of South Dakota as their technological university. Its mission is to provide a well-rounded education that prepares students for leadership roles in engineering and science; to advance the state of knowledge and application of this knowledge through research and scholarship; and to benefit the state, region, and nation through collaborative efforts in education and economic development.

South Dakota Tech (School of Mines) is dedicated to being a leader in twenty-first century education that reflects a belief in the role of engineers and scientists as crucial to the advancement of society. Our vision is to be recognized as a premiere technological university in the United States.

Most immediately, our goal is to be recognized as the University of Choice for engineering and science within South Dakota and among our peer group of specialized engineering and science universities.

Our Statement of Purpose (created in 2003) reflects our commitment to positive change through our mission:

SDSM&T is dedicated to being a leader in twenty-first century education that reflects a belief in the role of engineers and scientists as crucial to the advancement of society. Responding to the unprecedented challenges facing today’s world, SDSM&T will seek opportunities to benefit the educational, civic, and economic activities of the community, state, and region. SDSM&T will maintain and expand its role in research, scholarship, and creative endeavors that advance knowledge, solve problems, develop individual potential, and explore the human condition. Through its rigorous academic programs and co-curricular activities, SDSM&T is committed to developing informed and responsible scientists and engineers who behave ethically, value a global perspective, and accept the duties and responsibilities of citizenship.

In 1983 SDSM&T reached a peak enrollment of 2,908 students. Current total enrollment as of the census date in fall 2005 is 2313, of which 256 are graduate students. Females comprise 30.7% of the student population; 83.8% is Caucasian; 69% of all students fall between the age of 18 and 23; and 75% of all students attend the institution full time.

The cost of an education at SDSM&T is not high. Based on a weighted average cost and rank of public higher education institutions in the eight-state region, SDSM&T (and the other regents’ schools) are the least expensive for undergraduates, graduates, residents, and non-residents (RR106).

The Student Context

- The average ACT composite score of new incoming freshman in fall 2005 is 24.3. In spring 2005, the regents approved a proposal to raise admission standards.
- The typical SDSM&T freshman is a white male between 18 and 24 years of age who resides on campus. Looking at undergraduates overall, the profile is similar except that 70% of undergraduates overall live off campus.
Examination of National Survey of Student Engagement (NSSE) and Student Satisfaction Inventory (SSI) results tell us that our students, overall, are highly goal and task-oriented, technologically skilled, yet relatively homogeneous in their Western cultural views. They place high importance on values and ethics but have relatively few interactions with people from diverse and differing cultural and religious orientations.

South Dakota is one of two states nationwide that uses ACT and Collegiate Assessment of Academic Proficiency (CAAP) scores as bookend assessments of the General Education program and requires a passing score for degree progression beyond the sophomore year. All regents’ institutions have conducted proficiency testing since 1998. Compared to national norms, South Dakota students test higher than the national norms in all four testing areas (writing, mathematics, reading and science reasoning), and SDSM&T students consistently score highest in the state.

Students are encouraged to engage in the development of life skills through the division of student affairs. Alcohol education and prevention, career planning and placement, counseling and ADA services, external scholarship coaching, campus ministries, child care, health services, Ivanhoe International Center, multicultural development, residence life, student activities and leadership, student center, and student conduct services are provided.

Most students participate in at least one of the 80 co-/extra-curricular activities that encompass academic, recreational, community service, Greek life, honor society, leadership development, multicultural, religious, special interest group, government and media opportunities and experiences.

540 students live on-campus in one of three residence halls. Typically half of these students are in their first year; more than 80% are traditional age males. Student staffing provides most of day-to-day supervision at a 1 to 23 ratio. For the past four years, applications for student positions have been double or triple the number of positions available. Residence Life is charged with ensuring resident students are proficient in five major outcome areas: academic skills; personal skills; leadership skills; community and civic responsibility; and understanding and appreciating human differences.

Ten percent of the undergraduate degree-seeking students participate in Intercollegiate Athletics. Teams are competitive in the NAIA Dakota Athletic Conference (DAC). Athletes often are recognized as DAC “player of the week.” The Lady Hardrocker basketball team has a strong record of success, with 10 NAIA national tournament appearances since 1994. SDSM&T is the recipient of the Dakota Athletic Conference Scholars Award presented to the school with the highest percentage of athletes honored as DAC Scholars. The Hardrockers placed 38% of their athletes on the academic honors list. Student-athletes must earn a grade point average of 3.25 or better to earn the conference academic recognition.

Students are proud of “traditions” which include each “frosh” receiving a “beanie” at orientation. Seniors have miner’s hats that are branded with their major and signed by classmates. The homecoming activities (M Week) encompass a week of events that feature coronation, a parade, an all-school picnic, and the “M-Hill climb” to white wash the school’s initials. M Week concludes with the “frosh” wearing their beanies and running around the track during half time of the football game. Once the run is completed, they transition from “frosh” to “freshmen” and beanies are retired to memorabilia. Other traditions include Honors Convocation and the Senior Design Fair held each spring. Traditional December and May commencements highlight outstanding...
alumni in an effort to motivate graduating students to aspire to successes that equal or surpass those who have previously graduated.

- Student ambition, drive, and focus can be seen in the success of the approximately 150 juniors and seniors involved yearly in our Center for Applied Manufacturing and Production (CAMP) program and the enterprise teams that compete and excel in national competitions. Our student teams in the Concrete Canoe, West Regional Mini Baja, IEEE Robotics, Human Powered Vehicle, SAE Aero Design, and International Aerial Robotics competitions have triumphed over teams from significantly larger and more prestigious universities. For example, the SDSM&T team placed first in the 2005 SAE Aero Design international competition and received two honorable mentions in the 2005 International Aerial Robotics Competition.

- Our six-year graduation rate as of 2004 was roughly 38% and far lower than our newly established goal of 65%. We received approval to raise admission standards in March 2005 and anticipate that this will lower the percentage of applicants we admit (currently at 94%).

- SDSM&T students fare well in the job market. During the 2004-2005 academic year, approximately 100 companies recruited SDSM&T students. Companies that have hired SDSM&T graduates this year include Boeing, Cargill, Caterpillar, Dow Corning, Dow Chemical, DuPont, Gateway, Microsoft, and Raytheon—to name a few.

- The placement rate for students who graduated in 2003 was 92% for engineering graduates and 88% for science graduates. The average initial offer for 2003 graduates overall was $47,061.

- We rely on alumni reports to estimate the percentage of students who undertake graduate studies. Of our 11,381 living alums in August 2004, over 1/4 (or 3,325) had earned the Master of Science and 432 had earned a Doctorate.

**The Faculty Context**

- As of fall 2005, we had 142 faculty members. These 142 faculty members can be further classified as follows:
  - 107 are full-time instructional faculty members
  - 25 are part-time instructional faculty members, or “adjuncts”
  - 10 are “full-time but have a mix of roles, including “researcher,” and “research / administrative,” with limited or no teaching duties

- As of AY 2004-05, terminal degrees are held by 86.5% (90 out of 104) of full-time tenure-track faculty members. We note that 4.4% of these 90 full-time terminal degrees are from SDSM&T.

- Tenure is held by 63 of 107 full-time faculty members, or 58.9%. This figure is for fall of 2005.

- All faculty members are represented by the Council on Higher Education (COHE), which is the legally recognized bargaining agent for faculty in negotiating terms of employment with the Board of Regents. Faculty members are represented by COHE whether or not they formally become dues-paying members. Very few SDSM&T faculty members have chosen to join COHE, and SDSM&T sends no representatives to the Council.
• SDSM&T faculty switched to a Faculty Senate form of shared governance in 2003. Initially, the Senate had 10 elected senators, but in spring 2006, the general faculty will voted whether or not to modify the senate membership to include one representative from each department. This change will increase the number of senators from 10 to 16. Overall, the Senate has been extremely active since its inception. Minutes of Senate meetings can be found at http://www.mcs.sdsmt.edu/fac senate.

• Workload is perceived as high by all faculty members, and SDSM&T is more thinly staffed than most comparable institutions elsewhere. In the absence of release time or time allocated for research, the average teaching load is approximately 9 credit hours per semester. Overall, the SDSM&T faculty is very hard working.

The Curricular Context

• The curriculum at all regents’ institutions governed by the Board of Regents is unified to a much greater degree than in most state systems. Since 2003 the 6 institutions share a single common student database. Course numbering and academic policies are uniform throughout the system. For incentive-funding purposes, student retention is measured as retention within the system.

• We have a common General Education Program within the South Dakota system; however, individual schools may add learning outcomes and/or institutional graduation requirements. SDSM&T follows the common program with no additional, institution-specific, requirements.

• We have a common freshman course (Professionalism in Science and Engineering, GES115) for engineering and science majors and are working on creating a more fully integrated first-year experience to improve the way freshman students are advised, mentored, and integrated into the life of the campus.

• A distinctive feature of our curriculum is our CAMP (Center of Excellence for Advanced Manufacturing and Production) program and the enterprise teams it supports. Students from all majors and all class levels may elect to join a team and work on an engineering design project. Many of our CAMP teams travel nationwide to participate in competitions. (See http://camp.sdsmt.edu.) Students are generally well prepared technically from the formal engineering curriculum; however, projects falter and fall short of their potential due to non-technical issues. Most students major in engineering because they are interested in designing, building, and testing. They do not enjoy documentation, developing (and sticking with) schedules, and being required to coordinate with other groups; however, these are the skills that graduates need. The goal of CAMP is to aid students in learning goal setting, scheduling, fulfilling commitments, establishing priorities, problem solving, and conflict resolution in an environment that works to develop open communication, trust, commitment, cooperation, and responsibility to others.

• In 2000, the CAMP program beat Purdue University and Brigham Young University to win the Boeing Outstanding Educator Award. The award recognizes faculty members who have made outstanding contributions to undergraduate engineering education.

• Also of note is the curricular watershed SDSM&T experienced in 2003 when we decided to close the mining engineering program, which had been integral to the identity of the school since its founding. A program in mining engineering and management was created in its stead and is flourishing.
The Research Context

• Our steadily building research productivity seems to have achieved the beginning of critical mass. Since 1996, external funding for research has quadrupled, from $3,210,173 to $11,922,155 in FY 2004. More important was the doubling of external funding that occurred between FYs 2000 and 2001, which suggests we are building the critical mass needed to sustain a high level of research funding. We are confident in our ability to sustain and grow this level of increased external funding. The recent dramatic increase in research at SDSM&T is seen in the recent additions of research centers and institutes. Historically the Engineering Mining and Experiment Station was established, in 1903, to provide analytical services for local industry. In 1959 the first research institute, The Institute of Atmospheric Sciences (IAS), was created. In 2001 and 2004 two important centers were added.

  o In 2001, the Advanced Materials Processing center was established and in 2004 was reorganized into the Advanced Materials Processing and Joining Laboratory (AMP-J) and the Additive Manufacture Laboratory (AML). (See http://ampcenter.sdsmt.edu for details.) AMP-J conducts leading-edge research on friction stir processing which led to the creation, in 2004, of the National Science Foundation’s Industry/University Cooperative Research Center for Friction Stir Processing with SDSM&T as the lead institution. A recent addition to AML, which focuses on laser deposition technologies, is the maskless mesoscale materials deposition technology which allows placement of electronics on materials that are one-thousandth of an inch wide. An example application of this new technology involves the advanced antenna research for national defense uses.

  o In July 2004, the Center for Accelerated Applications at the Nanoscale (CAAN) was established by a competitive state grant process (see http://www.hpcnet.org/caan.) A permanent center director was hired in 2004. CAAN-related work focuses on nanotechnology research in the areas of nanoparticles and associated nanosensors, with particular emphasis on South Dakota mineral development.

• Research in physics is closely aligned with the CAAN through expertise in condensed matter physics, such as experimental characterization and theoretical analysis of electronic materials. Physics faculty members will play a major role in the new nanoscience and nanoengineering Ph.D. program.

• In October 2004, SDSM&T, Brigham Young University, the University of South Carolina, the University of Missouri- Rolla and more than 18 industry partners announced the National Science Foundation Friction Stir Processing Industry/University Cooperative Research Center (I/UCRC). The Center will address the needs of the aerospace, aeronautic, energy, military and commercial industries in developing the rapidly growing friction stir processing technology. Currently, this center is housed in the Civil / Mechanical Building, but more appropriate facilities are being sought.

• In October 2004, SDSM&T dedicated its Tech Development Laboratory (TDL). This is a limited liability corporation established near campus for researchers working in the areas of composites, laser deposition, super lightweight materials, and polymers. The TDL houses cutting-edge research activities and projects designed to solve the problems of industry, the military and government and to create economic development opportunities for South Dakota.
In 2005 a Computational Mechanics Laboratory was added to the Civil/Mechanical Engineering Building. The laboratory provides much needed space for a variety of high-end computing activities and provides students access to the computational mechanics hardware and software currently used by industry. As its uses are developed, it will greatly benefit faculty and researchers involved in externally-funded projects. We anticipate that the facility will be open by the time of the team visit in March 2006.

Research in computer science includes significant efforts in database design, including data warehousing and data mining, image processing and signal processing, pattern recognition, with applications to remote sensing, neural networks, distributed and parallel computing, and artificial intelligence.

SDSM&T has been an Experimental Program to Stimulate Competitive Research (EPSCoR) state since 1989, and has received approximately $3.5M in EPSCoR funding since 1996. Two notable ongoing EPSCoR-funded projects involve the investigation of thermoplastic matrix composites and the development of new optically clear polycarbonate plastics for use in protective armor and new explosive materials using nano-particles.

Two new Ph.D. programs were created in 2004, one in atmospheric and environmental science and one in nanoscience and nanoengineering.

Two significant research awards have been recently earned by faculty members: In 2003 Dr. Andre Petukhov (Physics) received the Alan Berman Award recognizing the most important publication in 2003 originating from the U. S. Naval Research Laboratory. Dr. Paul Smith (Institute of Atmospheric Sciences) was appointed an associate member of the National Academy of Sciences in January 2005, based on an outstanding career in atmospheric science at SDSM&T.

Since 2001, SDSM&T has been near the center of a statewide effort to have the former Homestake gold mine in Lead, SD converted to a Deep Underground Science and Engineering Laboratory (H-DUSEL) supported by the National Science Foundation and the Department of Energy. Creation of the lab is a goal of the Governor’s 2010 initiative. The successful creation of such a lab would have tremendous implications for science and engineering initiatives at SDSM&T.

The Administrative Context

Administrative changes have occurred in the last three years. In 2002, Dr. Richard Gowen retired after 14 years as president. In June 2003, Dr. Charles Ruch became the school’s 17th president, and in fall 2003 launched the school’s first major strategic planning process since 1989.

In 2003, the faculty switched to a Faculty Senate form of shared governance.

The position of Vice President for Research was created in 2004.

In spring 2004, the institutional self-study was begun, and, in the fall of 2004, the campus began a year-long reconsideration of its organizational structure.

In June 2005, we reorganized from a four-college structure to a two-college structure. A search is underway for a dean of the College of Engineering and a dean of the College of Science and Letters. The position of Associate Vice President for Academic Affairs was also created.
The self-study working groups and our tri-annual 5-hour long all-campus meetings have been our primary means of holding campus “discussions” during this time of rapid change.

The Community / Economic Development Context

- SDSM&T has the reputation of being an academically challenging school. Our sister institution, Black Hills State University (BHSU), is universally regarded as the university attended by most local high school graduates.

- With notable exceptions, we had less-than-close relationships with the community during the 1990s; however, dramatic changes in SDSM&T’s community links and role in economic development have occurred in the last two years.

- In spring 2005, ground was broken for a 60,000 square-foot business incubator on the SDSM&T campus. The Governor’s Office of Economic Development in concert with the Rapid City Economic Development Foundation has funded the creation of center to be called the Black Hills Business Development Center (RR141). As a University / community venture, the incubator is a vivid and tangible symbol of the school’s increased involvement in technology transfer and economic development.

- SDSM&T has assumed a leadership role in the State’s bid to locate a national underground laboratory in the former Homestake gold mine in nearby Lead, South Dakota. The principle investigators for this project, one from Lawrence Berkeley National Laboratory and one from SDSM&T, are funded through the National Science Foundation (NSF) to create a conceptual design report for the proposed Homestake Deep Underground Science and Engineering Laboratory (H-DUSEL). The conceptual design will be submitted to the NSF in June, 2006. Later in 2006, an award of $1.5 million will be awarded to the group selected to produce a Technical Design Report.

- Since 1991, we have participated in the Small Business Innovation Research (SBIR) and the Small Business Technology Transfer (STTR) grants from the Small Business Administration. Seventeen SBIR/STTR grants have involved Tech faculty and graduates as contractors or consultants performing specific research for one of 11 government agencies. As of 2004, the West River Coordinator for the SBIR/STTR program is located on the SDSM&T campus and will occupy space in a new business incubator facility currently under construction on campus. In addition, SBIR/STTR proposal submission will be increased due to the construction of the new business incubator facility on campus, the creation of Tech Ventures for the creation of formal entrepreneurial business entities, and the development of the entrepreneurial minor.

- SDSM&T has been involved since 2004 with the Governor and the greater Black Hills community in the “Black Hills Vision” project. This project includes the Black Hills Technology Corridor Project which seeks to make the region home to more than 1,000 technology-based businesses and organizations.

- A significant research / economic-development event involving Black Hills Vision funding occurred in October 2005 when the campus hosted the 2005 Powder River Basin Coalbed Methane Education Conference for 110 representatives of industry, federal and state government, consulting firms, advocacy groups, as well as faculty and students. Topics included production operations, future technology, and gas supply and marketing. The 2006 conference is currently being planned.
Chapter 2:
Significant Developments Since the 1996 Team Report
Chapter 2: Significant Developments Since the 1996 Team Report

This chapter reports on major developments since 1996 and is organized according to the “old” criteria, with subject headings derived from the content of the 1996 team report, pages 10 through 82 (RR1).

Topics mentioned under Criterion 1 (pages 10-12 of the 1996 team report)

Mining Programs

In fall 2001, the mining engineering program had 20 students, 15 of whom were to graduate that year. After examining ways to preserve our mining heritage and our civil and geological engineering focus of mining, we developed the Mining Engineering and Management program to replace the former mining program in fall 2004.

Center of Excellence

In 1997, the Center for Advanced Manufacturing and Production (CAMP) program was established as our institutional “Center for Excellence.” It has flourished. Currently, there are 10 multidisciplinary teams involving approximately 200 students in design and performance competitions on a local, regional, and national basis. All teams work on engineering projects in areas such as robotics, aircraft, concrete canoes, helicopters, racecars, off-road vehicles, and industrial design projects. The role of engineers has changed in recent years from solitary designers in the laboratory to members of teams that have to sell their ideas and work with customers. CAMP was formed to develop students’ abilities to excel on multidisciplinary teams and the program uses these projects as a means to grow these skills.

Increase of “Resources Available to the Institution”

Since 1996, our external (non-state) funding through grants and contracts has increased from $3 million/year to more than $12 million/year. A summary breakdown of all external funding (state, federal, and other) for the years 1996 to 2005 can be found in the Resource Room as RR182.

Giving has increased since 1995 when we began our first ever capital campaign. Our goal was to raise $16 million, and the campaign ended in July 2000 with over $20 million raised. In 2004 we began planning for a second, $50 million capital campaign by examining institutional priorities. We have begun taking our case statement to potential donors.

Partnerships with business and industry have yielded significant support for specific programs. Caterpillar Inc. funded the creation of a specialized lab for the Center for Advanced Manufacturing and Production (CAMP) program, Cargill funded development of a bioengineering specialization, Dow Chemical supported our Chemistry program, and Steven J. Miller and Agilent provided significant support to our Electrical Engineering program. Since 2001, SDSM&T has worked with the Genesis of Innovation for South Dakota, a non-profit group that advocates for entrepreneurial-minded individuals, businesses, and
agricultural producers who are pursuing innovative research and development for the purpose of incubating and fostering South Dakota owned businesses. In 2003, Realtronics Corp. of Rapid City, partnered with an SDSMT faculty member in a Small Business Innovation Research Phase I grant from the National Science Foundation to develop a through-wall electromagnetic imaging system. Recently, in 2005, SDSM&T signed a formal Memorandum of Understanding (MOU) with RESPEC, Inc., a Rapid City-based business founded (by SDSM&T graduates) almost 40 years ago from entrepreneurial activities associated with SDSM&T. The MOU allows SDSM&T and RE/SPEC to work collaboratively on research projects in broad technical areas such as environmental engineering, waste treatment, and national defense.

Government / Military Partnerships

Since 2001 federal appropriations to SDSM&T have totaled nearly $60 million through partnerships with the Army Research Laboratory (ARL) and the Air Force Research Laboratory (AFRL). $15.2 million are included in the federal FY 2005 defense budget and include continued funding through ARL and AFRL and funding through the U.S. Army’s Armament Research, Development and Engineering Center (ARDEC). The appropriations have been used primarily to enhance infrastructure for materials-related research and development and include laboratory construction, acquisition, and renovation. State-of-the-art equipment for friction stir welding and laser additive manufacturing and support for faculty and student research were also funded.

Our government partnerships include partnerships with other universities and industry and are focused on the transition and commercialization of new technologies. One such partner is RPM & Associates of Rapid City which employs laser additive manufacturing. Partnerships have also been established with the Edison Welding Institute of Columbus, Ohio and Florida A&M University for the advancement and development of joining and polymer technologies, respectively. An advisory board comprised of defense contractors has been engaged in identifying applications for the capabilities available through SDSM&T. Members represent companies such as Sikorsky, Boeing, United Technologies, and United Defense. Upon occasion, student engineering teams form government partnerships. For instance, a Center for Advanced Manufacturing and Production (CAMP) team collaborated with the NASA Glenn Research Center for the data acquisition and transmission control of the Advanced Power Technologies experiment on the Starshine III satellite launched in 2001.

Topics mentioned under Criterion 2 (pages 12 – 38 of the 1996 team report)

Relationship of the Board and the Institution

The regents have continued to increase their emphasis on collaboration between and among the six universities in the regents’ system. Unifying initiatives and policies include a common general education program, common course numbering, the Electronic University Consortium, the implementation of a unified student database, the creation of statewide discipline councils, and statewide human resources / finance system currently being implemented. The 1997 policy that established the statewide discipline councils was based on the premise that the “regental system shall continue to work as a Unified System of Public Higher Education.” The South Dakota public higher education system continues to be one of the most unified state systems in the country. This said, some faculty and staff members do
not regard this as a positive philosophy or direction and regard the Board of Regents as too controlling and intrusive in campus affairs.

**State Funding**

State funding of SDSM&T in 1996 was not generous but has not been subject to the rise (and subsequent fall) of state funding for higher education seen in most of the country; in fact, state funding has increased slightly every year since 1996. In 1998 the legislature allowed the university system to retain state funding due to be lost as result of decreased enrollments and to use these funds to fund a Salary Enhancement Program.

**Institutional Governance Structures**

The Executive Council consists of the following people:
- President
- Provost and Vice President for Academic Affairs
- Vice President for Business and Administration
- Vice President for Student Affairs and Dean of Students
- Vice President for University Relations
- Vice President for Research
- President of the SDSM&T Foundation
- Director of the SDSM&T Alumni Association
- Chair of the Faculty
- Assistant to the President

The Council meets at the call of the President (usually weekly) and provides direction for the administration of the University.

The University Cabinet consists of the following people:
- President
- Provost and Vice President for Academic Affairs
- Vice President for Business and Administration
- Vice President for Student Affairs and Dean of Students
- Vice President for University Relations
- Vice President for Research
- President of the SDSM&T Foundation
- Director of the SDSM&T Alumni Association
- Chair of the Faculty
- Assistant to the President
- College Deans
- Dean of Graduate Education
- Director of Facilities
- Chair of Career Service Council
- Chair of Exempt Employees
- President of the Student Association

The Cabinet meets monthly (or at the call of the President) to advise the President concerning the development of policy, the governance of the university, strategic planning, and the fiscal operation of the University.

A small expansion was made to the Executive Council in 2003 when the Chair of the Faculty and the Director of the Alumni Association were added. In 2004, a Vice President for Research was hired and added. No changes have been made in either the Career Service Advisory Council or the Exempt Employees’ Advisory Council. However, in 2002-03, the Town Hall form of governance embodied in the Faculty Advisory Council (FAC) was
reexamined and, in 2004, the faculty opted to adopt a Faculty Senate on a trial basis. The bylaws were revised and the Senate form of faculty governance was piloted during AY 2004-05.

**Four-College Structure**

In 1996, our four-college structure (with one dean of interdisciplinary sciences and three deans of science and engineering) was still relatively new. The structure offered an equitable distribution of faculty and programs and a means of fostering interdisciplinary collaboration. This structure has been mixed in its success, and a wide range of opinions are held as to its effectiveness. Under the four-college structure, the deans divided their time between administrative (40%) and faculty (60%) duties. The College of Interdisciplinary Sciences clearly succeeded under this structure in creating an identity for itself and building a strong degree program; in fact, four “specializations” (Atmospheric Sciences; Business Applications in Science and Technology; Pre-Professional Health Sciences; and Science, Technology, and Society) were defined within the interdisciplinary sciences program, effective fall 2005.

During AY 2004-05 the organizational structure was reconsidered by the faculty and staff as part of one of our strategic initiatives. The Co-chairs for Criterion 1 of the self-study led this campus-wide effort. In July 2005, the University changed to a two-college structure (RR223).

**Graduate Education**

In AY 1998-99 the masters programs in chemistry, physics, and metallurgy were combined into a Masters of Science in the materials engineering and science program. In 2003, a half-time position of Associate Dean for Graduate Education was created to alleviate the workload of the Dean for Research and Graduate Education. In July 2004, a Vice President for Research was hired, and in 2005 the Associate Dean of Graduate Education’s position was elevated to that of Dean.

**Changes in Faculty**

In the period from fall 1996 to fall 2004, the number of full-time state funded faculty members increased 3.7% from 108 to 112 while student headcount increased 4.33% from 2218 to 2314. However, student full time equivalents (FTE) fell by 2.94% 1942 FTE to 1885 FTE during the same period. The percentage of doctoral-prepared faculty members increased from 83.33% to 87.5%, of tenured faculty members from 47.22% to 55.36%, and of faculty members over the age of 45 from 59.26% to 72.32%. While the percentage of female faculty increased only slightly from 17.59% to 18.75%, the number of female faculty members in science and engineering departments increased from 10 to 14 and women were hired for the first time into tenure-track positions in civil engineering, electrical engineering and industrial engineering. The only areas where part-time instructors are used on a regular basis are those areas, such as foreign language, where demand does not justify a full time position. This practice has not changed since the last visit.

Faculty work loads remain generally heavy, and faculty members are increasingly concerned about balancing research and teaching obligations. The Colleague database provides some information about workload but does not offer the entire picture, and precise, uniform data on workload is difficult to collect because of differences among programs. While current policy grants programs (specifically, the program chair) flexibility in distributing teaching loads in
order to achieve the most effective use of human capital, exercising this flexibility is rarely as easy as it seems to be on paper.

**COHE (Council of Higher Education)**

COHE is the legally recognized bargaining agent for all faculty members with 50% or more teaching duties and no administrative duties. Faculty members at SDSM&T are covered by COHE; however, few faculty members are dues-paying members. In 2004, SDSM&T members numbered just two, and we did not send a representative to the council.

**Faculty Salaries**

Efforts have been made to enhance faculty salaries and to narrow the gap between the salaries of the humanities and social sciences faculty members and their colleagues in science and engineering. Program Improvement Fee (PIF) funds raised through a student fee approved in 1984 were applied, and salary enhancement funds continue to be distributed on a yearly basis to raise and, when needed, equalize salaries. For a time, the additional monies were allocated to support faculty summer projects or as salary bonuses; currently salary enhancement funds are part of base salary. In 1998, a Salary Enhancement Program commenced which resulted in average salary increases of 7% per year for three years. Salary increases were tied to performance and the COHE-Board of Regents Agreement specified precisely how this was to be done. In each year subsequent to this program the Board of Regents has authorized an additional 1% over and above the salary package approved by the legislature. Typically, increases have averaged 4% per year with the exception of the 3.25% increase for 2005-06. These actions by the Board of Regents have narrowed the gap between South Dakota salaries and those of surrounding states. Nevertheless, most faculty salaries remain below the average by discipline and rank as published annually by Oklahoma State University.

**Research**

In 1994 the Office of Graduate Education and Sponsored Programs set the goal of facilitating collaborative research across disciplines. The late 1990s was when EPSCoR programs including NSF, DOE and NASA became significant funding sources for our state institutions. The Dean of Graduate Education and Sponsored Programs was actively involved in these programs and worked successfully to encourage collaborative research. Multidisciplinary centers on materials research were established among SDSM&T, the University of South Dakota, and South Dakota State University and in other areas such as Atmospheric, Environmental, and Water Resources (AEWR).

SDSM&T introduced four multidisciplinary post-graduate programs. Examples include the Atmospheric, Environmental, and Water Resources (AEWR) Ph.D. program, the Materials Engineering and Science (MES) M.S. and Ph.D. programs, a nanoscience and nanoengineering Ph.D. program, and our recently approved biomedical engineering Ph.D. program. Under the Governor’s 2010 initiative the Accelerated Applications at the Nanoscale Center (CAAN) was established in 2004 as a multidisciplinary and multi-institution research center.

Creation of the position of Vice President for Research in 2004 illustrates the university’s commitment to research programs. The Office of Research Affairs provides administrative oversight, leadership and mentorship in the development and implementation of campus-wide
research and graduate studies. The Office of Sponsored Programs, which oversees and coordinates all pre- and post-award functions and compliance actions for externally funded programs, is housed in the Office of Research Affairs. All intellectual property, licensing, and patenting activity, along with technology transfer, economic development, and federal relations activities are also coordinated by the Office of Research Affairs. Since his arrival in 2004, the Vice President for Research has met individually with every faculty member on campus to discuss research plans and possible interdisciplinary collaborations. SDSM&T faculty members have become so successful recently in securing external funding that some of the nearly $60 million dollars in Department of Defense funding that has been directed to SDSM&T through the South Dakota congressional delegation since 2001 has been used to create the Tech Development Laboratory and provide needed space.

The four-college structure was put into place in 1994 with the explicit aim of fostering interdisciplinary research. Work on reducing administrative barriers to multidisciplinary research has been underway since then. With the creation of the Vice President for Research position, initiatives to better support research projects and collaborations have been renewed and redoubled. We envision a time in the near future when administrative barriers are minimal for all faculty members interested in seeking research funding or conducting funded projects. The Vice President for Research’s current priorities are to expand and improve the sponsored programs office, to expand the number of graduate degrees, and to enhance the technology-transfer process.

**Research Support from the State**

Since the election of Governor Mike Rounds in 2003, state initiatives and funding to support economic development through university research have increased dramatically. In July 2004, a system-level Vice President of Research position was created for the Board of Regents, with responsibility for working with the six state universities, state and federal agencies and the private sector to stimulate and build research capacity and performance within the state. Also in 2004, a Director of Commercialization in the Office of Tourism and State Development was appointed with responsibility for facilitating commercialization of innovations and inventions resulting from university research and coordinating entrepreneurship activities in South Dakota. For the regents’ university system a Research Affairs Council was established to provide leadership and coordination for the System’s research agenda and for maximizing the System’s investment in infrastructure.

The 2004 legislature appropriated $3,715,861 for the Governor’s 2010 Research Initiative. Approximately $2.7 million of this was awarded to state universities to develop four highly focused, highly competitive research centers. The Center for Accelerated Applications at the Nanoscale or CAAN was created at SDSM&T for research on nanoparticles and associated nanosensors, with particular emphasis on South Dakota mineral development. The governor also established the South Dakota 2010 Research and Commercialization Council. This council oversees the 2010 Research Initiative and makes recommendations for funding of 2010 Research Centers. It also aids in the commercialization process for technology transfer and innovation. In summer 2005, the governor awarded nearly $445,000 to 19 faculty members statewide as “seed grants” to spur their research work. Targeted research at the public universities and its commercialization potential are part of Governor Rounds’ 2010 Initiative, which calls for the state to “become a recognized leader in research and technology development by 2010.” Of the 19 grants awarded, 14 came from just 2 schools, and SDSM&T faculty members secured 5 of the awards (RR302).
EPSCoR Funding

South Dakota has been an Experimental Program to Stimulate Competitive Research (EPSCoR) state since 1989. From 1996 to the present, SDSM&T has received approximately $3.5 Million in NSF EPSCoR funding.

Centers and Research Institutes Already Established in 1996

The Engineering and Mining Experiment Station (EMES) was established by the state legislature in 1903 to provide analytical services to the public and to serve the institution’s academic and research programs. Since 1996, EMES has received over $1 million in federal funds to upgrade instrumentation for electron microscopy, X-ray diffraction, and elemental analysis.

The Institute of Atmospheric Sciences (IAS) was founded in 1959 to study the physical, chemical, and biological processes that affect the composition and dynamics of the atmosphere. Until 1996, the focus of the IAS was on meteorology; since 1996, the IAS has built upon its strong foundation in physical meteorology to evolve into a research group that focuses on scientific issues that are regionally relevant, nationally important and of global concern. Key scientists, instrumentation and observational facilities have been added and the curriculum for undergraduate, M.S. and Ph.D. students greatly strengthened. The IAS is currently trying to replace their T28 storm-penetrating aircraft with a new A10 aircraft. This would elevate them to a center of research and experimentation.

The Institute for Minerals and Materials (IMM) was closed in 2002-2003 because of a lack of activity. In 2004, the creation of an Institute for Multiphase / Multiscale Materials was proposed and a search for a director begun; however, the search was cancelled with the hiring of a Vice President for Research in September 2004 as the position seemed unnecessary.

In 2005, the structure of the Museum of Geology was reorganized to better integrate the M.S. program in paleontology into the academic structure of the university. The Museum personnel who support the program are now faculty members of the Department of Geology and Geological Engineering, which has a paleontology track at the undergraduate level and whose faculty also supports the M.S. program. The Collections Manager position was restructured as Collections and Museum Manager. This position has responsibility for the operation and development of the public display museum and its collections.

The Geographic Information Systems Laboratory (GIS) lab was new in 1996 and just six students used the two computers the lab contained to take the one GIS class offered that year. Since 1996, the lab has expanded to 15 computers and approximately 90 students a year select among three different GIS classes offered yearly. In 2004 we began offering the Introduction to GIS both semesters and in 2005 are adding a summer Internet section. The lab is being renovated for fall 2005 with new furniture, a projection system, and a new generation of computers. The new space will be a boon both to classes and to the three to four GIS workshops taught every year.

New Centers, Research Institutes, and Labs

In 2001, the Advanced Materials Processing (AMP) center was created under a contract with the Army Research Laboratory with a focus on two leading edge technologies. The latest
state-of-the-art equipment in friction stir welding was designed, procured and installed at SDSM&T with the assistance of our industrial partner, MTS Systems Corporation of Eden Prairie, MN. A laser deposition system was similarly acquired. In 2004, AMP was reorganized into two separately administered laboratories: the Advanced Materials Processing and Joining (AMP-J) Laboratory and the Additive Manufacturing Laboratory (AML).

The friction stir welding equipment provided the SDSM&T with the most versatile, fully instrumented friction stir welding and processing research and development tools found anywhere in the world. Since 2001, the Advanced Materials Processing and Joining Laboratory has developed internal research programs at SDSM&T and has provided support for over 40 graduate and undergraduate students and release time or summer support for six faculty members.

In 2004, SDSM&T announced, as the lead institution, the creation of the National Science Foundation’s Friction Stir Processing Industry/University Cooperative Research Center (I/UCRC). SDSM&T joined with three university and 18 industry partners to create the first NSF I/UCRC and national research center to focus on friction stir processing. The Center addresses the need of the aerospace, aeronautic, energy, military and commercial industries for the development of the rapidly growing friction stir processing technology. Also in 2004, the Center for Accelerated Applications at the Nanoscale (CAAN) was created at via a special legislative appropriation to focus on research on nanoparticles and associated nanosensors, with particular emphasis on South Dakota mineral development. The doors were opened on the Tech Development Laboratory (TDL) in October 2004. The SDSM&T Foundation purchased a building near the campus’ southern border and renovated it to provide 14,600 square feet of state-of-the-art research laboratory space. The TDL also contains office, classroom, laboratory and processing areas for several funded projects.

The Additive Manufacturing Laboratory performs applied research in the area of Direct Write (DW) and Laser Powder Deposition (LPD). With the addition of Direct Write Laboratory (DWL) in the summer of 2004, the AML became a unique organization focused on additive manufacturing techniques covering six orders of magnitude from microns to meters.

The Earth Resources Observation Systems (EROS) Data Center is a unit of the U.S. Geological Survey (USGS) and has offices at SDSM&T and at the South Dakota State University. It is a data management, systems development, and research field center where researchers work to increase the accuracy and resolution of remotely-sensed data of the type obtained at the EROS Data Center. The data is used to develop models that link weather patterns, precipitation levels, and ground cover which are used to provide vital information in water resource management and flood forecasting.

The South Dakota Space Grant Consortium (SDSGC), based at SDSM&T, enhances faculty development through summer faculty fellowships at the EROS Center. The South Dakota Center for Biocomplexity Studies builds upon previous EPSCoR support for scientific clusters in Biological Response to Stress and Geophysical Processes of the Northern Plains. The center is a virtual center utilizing the intellectual and physical resources at South Dakota State University, the University of South Dakota, SDSM&T, and the EROS Data Center. Construction of a computational mechanics laboratory will be completed by the time of the team visit. The laboratory will provide much needed space for a variety of high-end computing activities, as well as classrooms, office space and meeting rooms. The laboratory will provide our students access to the computational mechanics hardware and software
currently used by industry and will benefit faculty and researchers involved in externally-funded projects.

The West River Foundation, in concert with the Rapid City Area Economic Development Partnership, is building a regional incubator/accelerator facility on campus. The new building will be completed by summer 2006 and house new and expanding businesses with significant growth potential. The incubator will have the specific task of starting and growing innovative high growth companies; facilitating the networking between researchers, entrepreneurs, public entities and private professionals; and developing ideas into commercial applications.

**The Graduate Education Research Council (GERC)**

The Graduate Education and Research Council (GERC) plays an advisory role on items related to graduate education and research to the administration and campus community. The committee consists of the Vice President for Research (Ex-Officio), Associate Dean of Graduate Education (Ex-Officio), four College Deans, four representatives from four colleges and one representative from the University Senate. Since 1996, the major issues addressed by the GERC are as follows:
- development of policies for graduate education and research
- effective implementation of various policies for graduate education and research
- development of various programs to recruit graduate students
- assistance to the faculty in identifying financial support to graduate students
- assistance in allocating teaching assistants to various programs and departments
- assistance in prioritizing various research activities on campus
- assistance in the development and strategy in acquiring state-of-the-art equipment

In 2005, the GERC will be reformed to reflect the 2-college structure and the hiring of a Vice President for Research. The GERC will be renamed the Graduate Education Council (GEC).

**Research and Teaching Balance**

In 1996, the team noted some tensions between faculty members regarding commitment to research versus teaching. Considerable efforts have been made to address the support for undergraduate teaching needed on campus; however, SDSM&T’s reconfirmation in 2004 of its focus on science and engineering and its goal of developing a national student base have heightened, rather than lessened, this tension. Since 1998, funding for faculty development has been very strong, particularly in the areas of pedagogy and assessment. In fall 2002, SDSM&T’s promotion and tenure guidelines were revised to include “curriculum development,” including “innovations in curriculum” and “improving pedagogy” as evidence of “scholarly activity.” Our strategic planning work and college restructuring are creating opportunities for discussing and possibly resolving the conflict of demands seen by some faculty. At least part of the tension felt relates to workloads as research involvement has increased without a corresponding increase in state-funded faculty positions. To address the need for more faculty members, the creation of more endowed faculty positions has been identified as a goal for SDSM&T’s second capital campaign, for which a feasibility study is underway. The feasibility study involves taking our case statement to potential donors nationwide.
Staff and Student Changes

No significant changes to have been made to the career service staff (i.e., hourly workers) component of the University. In Student Affairs, numerous programs have been created and the Dean of Students position was elevated to Vice President for Student Affairs and Dean of Students. The student profile has become slightly more female and diverse. Attracting women and minority students to science and engineering is particularly challenging for a small, specialized, and relatively isolated Midwestern school. We have, however, led the nation in the past two years in graduating American Indian students with B.S. degrees in engineering. This is a significant accomplishment considering we graduated approximately 40 Native American students between 1970 and 2000. Between 2002 and 2004, SDSM&T has graduated 16 Native Americans; in 2004 SDSM&T recruited 18 first-time freshman Native Americans and now ranks third in the nation behind the University of Oklahoma and Oklahoma State in its fostering of Native American students in STEM (i.e., science, technology, engineering, and math) areas. In 2005, SDSM&T awarded its first Ph.D. to a Native American.

Enrollment Management Plan

A reorganization of service areas in summer 2005 has placed us in a new situation regarding the development of a comprehensive Strategic Enrollment Management (SEM) plan. Admissions, recruitment, and financial aid functions were moved from the Academic and Enrollment Services (AES) area (under Academic Affairs) to the University and Public Relations (UPR) area. At the same time, the Vice President for Academic Affairs assumed the title and role of Provost. One of the VPAA/Provost’s priorities for AY 2005-06 is to oversee the development of a comprehensive Strategic Enrollment Management plan (SEM) that reflects the dramatic changes made in the system to unify student data and the new division of key services between AES and UPR. A draft plan was completed in October 2005 and will be further refined by the time of the team visit (RR289).

Progress on Creating a “Wellness” Program

The Wellness Center went through a major remodel in 2002; state of the art equipment (treadmills, weight machines, etc.) was purchased and the Student Association has committed $.50 per credit hour for continual equipment upgrades and replacements. An innovative intramural sports program was developed that provides students as well as faculty/staff members and their spouses with the opportunity to participate in a variety of team and individual sports. Currently offered sports include co-ed soccer, co-ed water polo, 1-on-1 basketball (men’s and women’s), 3-on-3 basketball (men’s and women’s), 5-on-5 basketball (men’s and women’s), 6-on-6 volleyball (men’s, women’s, and co-ed), co-ed dodgeball, flag football (men’s and women’s), co-ed kickball, and a racquetball tournament. Almost 100 teams have participated in these various sports in the previous calendar year. In addition, a full-size swimming pool supervised by certified student lifeguards is open between 30 and 40 hours a week. Our two-credit PE requirement for all four-year degree programs underscores our commitment to student wellness.

To address high risk behaviors, a Campus Community Prevention Coalition was formed in 2004 to improve and coordinate substance abuse prevention activities among young adults. Two important grants have been recently funded for Student Affairs in this area are: a two year HEC high risk alcohol prevention program which includes a positive norming campaign
and bystander training and a three year SAMHSA campus suicide prevention grant to include wellness education for students, intervention training for staff and assessment and treatment for depressed students.

**Financial Resources**

Unsurprisingly, the cost of instruction per student FTE has risen since 1996. Budgeted amounts for instruction (NACUBO program 1) per FTE student were $3492 in FY 1996 and $5490 in FY 2005, an increase of 57% over 10 years. Resident undergraduate tuition and fees increased from $2789 to $4836 from FY 2006 to FY 2005, an increase of 73%. Resident graduate tuition and fees increased from $2805 to $4548 or 62% over the same period. Undergraduate non resident rates increased from $5621 to $10003 (78%) and graduate non resident rates increased from $5649 to $9805 (74%). An important development occurred in October 2005 when the regents approved the creation of a uniform out-of-state tuition of 150% of in-state tuition. The move seeks to make a South Dakota public university education more attractive to regional and international students. This reduction in fees for non-residents further enhances our “Best Buy” status, a distinction the School of Mines has achieved for eight consecutive years (RR290).

**Physical Facilities**

Our most recent campus-wide space utilization audit was presented to the campus at an all-campus planning session in May 2005. The campus has been able to keep pace with expanding/changing space needs, but just barely. With the increased emphasis on research comes an increased need for research space. Only three sources of funding are available for buildings: 1) federal research funding, 2) state (Board of Regents) funding through the Higher Education Facilities Funds (HEFF) which comes from student-paid tuition fees, and 3) private donations.

The 2005 space audit affirmed that SDSM&T is a typical college campus. Classrooms are heavily utilized on certain days and times, but capacity exists for expansion if classes are offered at non-traditional times. Classroom space was determined to be adequate at the present time. Based on square footage, 70% of the classroom and lab area on campus is in excellent or good condition, and only 6% was judged inadequate or unsuitable.

Board of Regents’ policy prohibits significant increases to square footage for academic purposes. Therefore, as old buildings become obsolete or decrepit, the space can be replaced only by razing the building. To finance the replacement of facilities the Board of Regents places 20% of tuition paid by students in the Higher Education Facilities Fund (HEFF). HEFF are allocated via a statewide project priority list. Since 1996, SDSM&T has received HEFF funding for the renovation of the Civil/Mechanical building ($3,750,000) and the Devereaux Library ($881,000), and for electrical upgrades ($767,795) and a central chiller project ($2,131,000). Replacement of the Chemistry Building is currently SDSM&T’s highest priority on the list.

Since the last visit, the following major improvements to the physical plant have been made:

- **2005:** Construction of a computational mechanics addition to the Civil/Mechanical Building to be operational by spring 2006; $1,821,000 funded through a contract with
the Army Research Laboratory. Once complete, the addition will house 9,550 square feet of teaching laboratories, faculty and grad student offices, and research labs.

- **2005:** Training Room was renovated to improve use and better support the Title IX objectives of the University. The renovation removed a room divider, enlarged the space, moved the laundry facilities, replaced the ceiling and lighting, and improved the use of the room by both male and female athletes (as well as male or female trainers). The total cost of the project was $25,000.

- **2004:** Renovation of the Devereaux Library; $881,000 funded through the HEFF fund. This renovation opened the fourth floor (12,000 square feet) of the Library that had not been finished when the building was originally completed. The main floor was also remodeled to increase the ADA access, add restrooms to all floors, improve exiting (fire code issues), and add study space for students.

- **2003-2004:** Acquisition and remodeling of the Tech Development Laboratory (TDL), a building adjacent to campus that houses research activity; $500,000 funded through a contract with the Army Research Laboratory. The TDL was a former printing building purchased by the Foundation and renovated into 14,000 square feet of state-of-the-art laboratory space. The TDL currently houses an Army Research Laboratory and a Nanotechnology laboratory.

- **2003-2004:** Addition of the Hardrock Hall of Fame room to the King Center; $525,000 funded through alumni donations. The Hall of Fame was developed as a 4,000 square foot place to bring new athletes / recruits to show them the history of the University and to demonstrate the commitment the University has to current athletes. It was financed by alumni and now it is also used as a University meeting room with state-of-the-art projection and sound systems.

- **2003-2004:** Construction of a new residence hall, Howard Peterson Hall; $4,300,000 funded through a bond issuance. Howard Peterson Hall is a 53,000 square foot, 297 bed addition to the Surbeck Student Center. The building was designed and funded with student fees and input. As a result, Howard Peterson Hall has a variety of room types (from suites to dorm style rooms) that meet the needs of new students. Each room has its own temperature controls for heat and air conditioning served by the central plant. The entire facility aids in the recruitment of new students and allows for summer conferences that help fund future student improvements.

- **2003-2004:** Renovation of the Surbeck Student Center; $1,200,000 funded through student fees. The renovation occurred at the same time as the construction of the new residence hall, and the two structures are joined in order to increase the use of the student center and promote more interaction between students and peers. Impromptu meetings and study groups are the result of this shared space and the students have more of a sense of "home" than in older residence halls. A new student organization area was constructed over the former bowling alley which also adds to the atmosphere of the building as a complete student center.

- **2003:** Construction of a Wellness Center within the King Center; $460,000 funded through student fees. The wellness center was constructed at the same time as the new residence hall. The students themselves voted for a better facility for daily life on campus. Three rooms were made into a state-of-the-art workout facility that incorporates $100,000 worth of new weight lifting and aerobic equipment, and two new locker rooms that allow for Title IX compliance in the athletic department.
• 2003: Renovation of the Varsity Weight Room (located in a former rifle range) removed the steel trap wall, renovated the ventilation, installed a new floor, replaced the ceiling and lighting, repainted the room, and repaired the ceiling. The total cost of the project was $40,000.

• 2002: O’Harra Track Renovation was a cooperative project between Rapid City School District, City of Rapid City and SDSM&T. The project replaced (at a cost of $1,000,000) the existing urethane track that had failed and was no longer suitable for track meets. The cost of the project was shared with $400,000 for the Rapid City School District, $400,000 for the City of Rapid City, and $200,000 for SDSM&T. The new track required a new asphalt base and drainage system before the rolled Mondo Surface was installed. The new Mondo surface is an all weather track that can be used for practices as well as meets.

• 1999-00: Renovation of the Civil/Mechanical Building; $3,750,000 funded through the HEFF fund, and $500,000 through a grant from the Kresge Foundation. The renovation of the 43,542 square foot Civil/Mechanical building involved a complete gutting of the building and rebuilding from the inside out. The new space was designed with student interaction and team building in mind. Student teams can now share tools, ideas, and personnel. This new design was a factor in the selection of SDSM&T as the winner of the Boeing Engineering Excellence Award.

• 1999-00: addition of the Caterpillar Student Laboratory to the Civil/Mechanical Building; $150,000 funded through a grant from the Caterpillar Foundation. This laboratory added 4,600 square feet of specialized lab space for the student teams involved in the CAMP program. The Mini-Indy, human powered vehicle, Mini-Baja, Aero, concrete canoe, and other competition teams all utilize this space.

• 1999-00: addition of a civil engineering laboratory wing to the Civil/Mechanical Building; $150,000 funded through alumni donations. This expansion added 4,600 square feet of new lab and test space to house the concrete lab. The concrete canoe team also utilizes this space for testing and building. Many hours of research into new concrete formulas have been done in this lab in the last six years.

Library

Longstanding plans to renovate the Devereaux Library moved ahead in 2004 when the legislature authorized funding to complete the unfinished 4th floor. Carpeting, paint, drop ceilings and lights were put on to the barren floor, along with a secure, climate controlled vault for special collections and archives. The 2nd floor of the library also received some attention, getting new tile, flooring, paint and a new Circulation Desk. Both floors also had restrooms installed. The Library was also included in the central chiller project resulting in a new air handling system being installed while renovation of the 4th floor was underway. Some progress has been made since 1996 in securing funding for the general collection and for research. The library was allocated 3% of Facilities and Administration (F&A) charges to research grants. These funds allocated to the Library are to be focused on research areas.
Topics mentioned under Criterion 3 (pages 38-70 of the 1996 team report)

General Education

Since 1996, the two most significant developments in our general education program have been 1) the system-wide adoption of the CAAP (Collegiate Assessment of Academic Proficiency) test as our the general education assessment and 2) the creation of general education objectives and outcomes that are common to all of the regents’ institutions.

All “rising junior” students, i.e., students who have completed their general education courses, must be assessed via the CAAP; moreover, they are not able to progress in their degree programs unless they meet “cut scores” set by the regents. The CAAP scores are used in conjunction with the ACT scores of incoming students in order to produce a campus “gains” report that indicates (by cohort) the gains made by students via the general education program. The common general education objectives and outcomes were defined in 1998 and then reviewed and revised effective fall 2005. Much more detail is given about this in subsequent chapters.

The newly designed computer-based Individual Educational Program (IEP) in development at the time of the last visit was replaced in 1998 by the Colleague student information system. In 1998, the Board of Regents began the process of centralizing student information through the implementation of Datatel’s Colleague software. SDSM&T resources were refocused on the new student information system and the IEP project was discontinued. A freshmen mentoring program was developed and is still in place. Between 2002 and 2005, the centralization of student information was completed, and a centralized HR / finance system project was begun in 2005.

Tremendous gains have been made in the area of assessment since 1996; in fact, it is fair to assert that the campus has developed a culture of assessment. A ½-time administrative position to oversee academic assessment was created in fall 2001. And in 2004 nine of our ABET-accredited programs underwent ABET review under the new EC2000 criteria which require program curricula to address and assess 11 specific learning outcomes. A General Education Assessment Committee (GEAC) and an Engineering Assessment Committee (EAC) were functioning by spring 2002, and by spring 2004, the General Education Assessment Plan was created and beginning to “close the loop” on key outcomes, such as effective written and oral communication. Progress made on creating a culture of assessment was reinforced by the rising expectations of the National Science Foundation and other granting agencies for thorough and authentic assessment of grant-funded projects. The campus as a whole shares a vocabulary of “objectives” and “outcomes” when planning any initiative and takes assessment for granted as a natural and desired dimension of what we, as faculty and staff members, do. Under the 2005 reorganization of the colleges, assessment oversight has become part of the deans’ description of duties.

Collaboration with Black Hills State University (BHSU)

Black Hills State University (BHSU) is our “sister” institution in the region and is located 50 miles away in Spearfish. In collaboration with BHSU and the nearby Western Dakota Tech (WDT), we are able to serve the region’s higher education needs by serving different constituents. BHSU, for instance, is known for its high quality teacher education program and serves the teacher training and staffing needs of the region. WDT serves those in the
region who seek a post-secondary education combined with preparation for employment in the trades. And SDSM&T is known as a science and engineering institution and a center of research and development. In 2004, our intent to collaborate on educational programming was formalized through the creation of the Higher Education Center – West River located in Rapid City.

**Developments Within the Colleges**

Within the College of Materials Science and Engineering, the chemical engineering faculty developed a biochemical engineering focus with financial assistance from Cargill and have redesigned their approach to laboratory experiences with funding from Dow Chemical. This college has seen a growth in research activity and has played a major role in the development of the Ph.D. in nanoscience and nanoengineering. Enrollments in chemical engineering declined by approximately 50% but show signs of turning around. Chemistry has shown an increase while physics enrollments have declined.

In 2002 the decision was made by the College of Earth Systems to phase out the mining engineering program and to develop a mining engineering and management program as a replacement. This transformation was achieved with a $300,000 investment from the mining industry raised by our alumni. Enrollments in civil engineering have declined significantly, while interest in the paleontology masters program has increased. In 2004, the AEWR Ph.D. program, shared with SDSU, was replaced by a Ph.D. in atmospheric and environmental science. A baccalaureate program in environmental engineering was authorized by the Board of Regents for implementation in fall 2000 and is seeking accreditation.

With our recommitment in 2004 to our traditional focus on science and engineering, the College of Interdisciplinary Studies undertook to redesign their interdisciplinary science program and to create four “specializations” clearly focused on science. These four specializations are as follows: Atmospheric Sciences; Business Applications in Science and Technology; Pre-Professional Health Sciences; and Science, Technology and Society. The Business Applications in Science and Technology specialization requires a minor in business or entrepreneurship from Black Hills State University (BHSU). This specialization is part of the cooperative efforts being made with (BHSU).

Within the College of Systems Engineering, Mechanical Engineering and Industrial Engineering both experienced significant growth in enrollments (about 50% in mechanical engineering and 100% in industrial engineering). Within this college, 5.25 new faculty members have been added, 2.25 in industrial engineering and 3 in mechanical. Following a high in fall 2001, enrollments in both computer engineering and computer science have declined significantly following national trends. The faculty of this college has played a major role in the development of the Advanced Materials Processing and Joining Laboratory. The institution’s first endowed chair, funded at 50%, was established in electrical engineering in 2001. Mechanical engineering and electrical engineering have collaborated in the development of a shared focus in mechatronics.

**2004 ABET Review**

In 1998 the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC-ABET) reviewed the engineering programs and renewed the accreditation. The new major of computer engineering received its first accreditation. In
2002, the Computing Accreditation Commission of ABET reviewed the computer science program resulting in continued accreditation for the full six-year period. The 2004 accreditation visit by EAC-ABET resulted in six-year continued accreditation for all currently accredited programs. The program in environmental engineering was deemed not yet accreditable. The chair of the Department of Civil and Environmental Engineering is working with the program’s faculty to prepare the program for an accreditation visit in fall 2007.

Graduate Programs

The quality and quantity of our graduate education programs have improved since 1996. During the last two years, we have seen a decline in international students in our graduate programs. Average enrollment in our M.S. programs increased 36%. Between 1995 and 1999 average M.S. enrollment was 195; between 2000 and 2004 average M.S. enrollment was 266. Average enrollment in our Ph.D. programs increased 44%. Between 1995 and 1999 average Ph.D. enrollment was 30; between 2000 and 2004 average Ph.D. enrollment was 43. This increase reflects the administration’s strong support for graduate education and research. The AEWR Ph.D. program was replaced by the AES Ph.D. program in fall of 2005 and we have a new Ph.D. program in nanoscience and nanoengineering which started in fall 2005.

Computing and Networking Services

The networking environment on campus is both local area network (LAN) and wireless enabled, and our personal computer infrastructure is very good. LAN speeds moved from 10mbps in 1996 to 100 mbps to the desktop in all buildings. Our network backbone has increased from 100mbps to 1gbps across campus. All student computer lab machines have been upgraded so that all lab machines can run any application on campus, and all faculty machines have been upgraded. We are piloting a tablet PC program for students and plan to fully implement it for all incoming freshman in fall 2006. Roughly 1/4th of the faculty now uses tablet PC computers. Our virtual conferencing capabilities are via five polycom units, three in classrooms and two in conference rooms. Our Internet 2 bandwidth and routes have been established to route Internet 2 traffic between the other regents’ institutions and other cooperating Internet 2 sites.

Distance Education Offerings

SDSM&T is a contributing partner in the South Dakota Electronic University Consortium (EUC), which was accredited by the Higher Learning Commission in 2004. However, we continue to play a relatively small role in the creation of online curricula and courses. We have one program, the M.S. in technology management delivered via a distance mode. The Chemistry Department has offered CHEM 106, 112, and 114 online for three years now. SDSM&T faculty members create specialty courses, such as Geographical Information Systems, for online delivery. Several of our general education faculty members have created online versions of lower-level courses, such as introductory psychology, for delivery via the EUC.

Institute of Atmospheric Sciences

(See above under “Centers and Research Institutes Already Established in 1996.”)
Engineering and Mining Experiment Station

*(See above under “Centers and Research Institutes Already Established in 1996.”)*

Technology Fellows Program

In 2000, the Technology Fellows (Tech Fellows) program was funded (primarily by the State with campus matching funds) to provide a unique opportunity for undergraduate students to develop professional level technology skills, learn to work in a team-based environment and to be remunerated while learning. The program is designed so that Tech Fellow students assist faculty members in learning new technology that can be integrated into their course curricula. The scope and type of projects are determined by the needs of the faculty. In addition to their assigned projects and tasks, Tech Fellows spend one hour per week in a seminar course. This course draws on the expertise of various faculty members, staff members and even the Tech Fellows themselves. For AY 2005-06 we have 15 Tech Fellows.

High Plains Center for Technology (HPCnet)

HPCnet is the name of the software that supports our University web presence. In December 2003 The High Plains Center was closed as a profit center and its staff was integrated into our Information Technology Services (ITS). The few external contracts existing at that time continue to be supported. In 2004, we contracted with Stamats for assistance with a web site redesign, and in fall 2005 a search for a director of communications was begun.

Museum of Geology

*(See above under “Centers and Research Institutes Already Established in 1996.”)*

Apex Gallery

Since 1996 the "New Gallery" has been officially named the Apex Gallery. A director was hired in 1999 to curate eight to ten exhibits annually, many by artists who are nationally or internationally known. Each exhibit has interpretive material or educational programming with the goal of engaging student interest and participation. In 2002, a grant from the Firestone Graham Foundation brought in the internationally known installation artist, Sandy Skogland who worked with the director’s Modern and Contemporary Art History (ARTH 321) class as well as Wilson Middle School's 4th grade class to create a complete environment in the gallery. Most recently a grant from the South Dakota Humanities Council brought in the exhibition, China: Exploring the Interior. This exhibition chronicled a Carnegie expedition into China by a man who had also helped to map the Black Hills in the late 1800s.
**Ranch A**

Ranch A is located along the banks of Sand Creek in the Wyoming part of the Black Hills and continues to be rented by the Department of Geology and Geological Engineering for ten weeks per year to conduct field camps. Currently there are two camps, the geology field camp and geological engineering field camp, each of which is five weeks long. The field camps are operated by the Black Hills Natural Sciences Field Station and are cooperative efforts between SDSMT, the University of North Dakota, the University of Mississippi, and the University of Wisconsin-Milwaukee.

**Black Hills Natural Sciences Field Station**

The character of the Black Hills Natural Sciences Field Station has evolved over a period of more than 35 years. For the past 25 years it has functioned as a summer field program for geology and geological engineering. It is now a cooperative effort among four universities that send students to joint field camps (one for geology and one for geological engineering) at Ranch A (see above). In the past two years this effort has expanded to include an international geology field camp based at the countryside town of Taskesthi in northwestern Turkey. Approximately 55 students participate in the six-credit field experiences each summer. The success of this program was demonstrated in 2005 when 12 students from non-consortium universities from across the United States participated in the geology field camp in Turkey.

**Exchange Programs and Other International Programs**

There have been no changes in our exchange program with the Bergakademie Technical University in Freiberg, Germany or with the University of Mining and Metallurgy in Krakow, Poland. Since 1996 a relationship with the Mongolian University of Science and Technology (MUST) has developed. We have updated our overall Memorandum of Understanding (MOU) and have signed a specific MOU for our technology management program. We also had one faculty member spend a one-year sabbatical at MUST and are attracting many Mongolian graduate students ([RR280](#) and [RR291](#)). We have secured agreements with two universities in Norway’s Gjøvik University College and Telemark University College. Two students spent the 2004-05 academic year at Telemark University College. In 2005, a Memorandum of Understanding was signed with Sri Ramakrishna Engineering College in Coimbatore, India, which includes faculty and student exchanges and other opportunities for collaboration. A similar MOU was signed with China Three Gorges University in October 2005.

Other exciting developments in this area have been pilot projects involving international humanitarian engineering projects. The effort was begun by a single environmental engineering professor who designed the projects (in Guatemala and Uganda) for seniors completing Senior Design. He funded the trips through on-campus grants and personal resources. His efforts have incited the interest and involvement of other faculty members, and a small group of engineers and one administrator are piloting a project to develop an international / humanitarian alternative to Senior Design under the auspices of CAMP. They await news about NSF funding and plan to field a project team to Uganda in winter 2005-2006.
The geology program sponsors biannual geology international trips that have proven extremely popular. Groups of faculty, students, staff, and community members have traveled recently to Spain, New Zealand, and Mongolia. Every three years, our choir director leads a contingent of the SDSM&T chorus on an international trip that involves performances and collaborative experiences.

**The Center for Advanced Manufacturing and Production**

(See page 9 above under Criterion 1 and “Center of Excellence.”)

**Topics mentioned under Criterion 4 (pages 70-77 of the 1996 team report)**

**The “Tech Quality Plan” and the Reinvestment Plan**

In 1995-1996 the Board of Regents approved the Tech Quality Plan. The plan focused on more efficient use of resources by restricting entry to the high-cost majors in science and engineering but was never implemented due to faculty opposition and generally declining enrollments. In 1996, the Legislature required the state university system to reduce its appropriated budget by 10% and, subsequently, allowed the universities to retain this funding as a “reinvestment” pool. Each university was required to use 1/3 of these savings to establish a center of excellence and to use the remaining funds in six specified areas: technology infrastructure, redesign of the university curriculum, protecting assets, economic development, linkages to the K-12 community, investment in change. Our Center of Excellence is our CAMP Program (Center for Advanced Manufacturing and Production) established in 1997. SDSM&T sends a reinvestment plan to the regents each year. Since 1998 reinvestment funds have been used for projects such as the development of the freshman engineering course, GES 115, and other curricular projects, laboratory improvements, outfitting all classrooms with ceiling mount projectors and computers, and membership in Internet 2.

**System-Wide Services and Centralization of Student Services**

The Colleague student information system by Datatel was installed in the regents’ system in 1997, at which time admissions paper processing became handled centrally by the Enrollment Services Center (ESC) in Vermillion, South Dakota. Web Advisor became fully operational on the SDSM&T campus soon after, and is used by students, faculty, and staff. In 2004 the centralization of student data was completed via the STUDENT project, and all academic policies of all universities in the regents’ system were aligned. Successful completion of the STUDENT project in 2004 is now making possible development of centralized online student services. In 2005 a system-wide Human Resources and Finance System project was begun, this time with SCT, Inc. software. The project is ongoing, but the goal is to create system-wide shared services and to achieve dramatic efficiencies in resources and personnel.

**Reduction of Small Sections and Programs**

In 1996 the regents implemented a policy that called for the reduction of the percentage of small sections (to 2% overall) exclusive of independent study, thesis, design courses, etc. “Small” was defined as fewer than ten students at the undergraduate level and fewer than
seven students at the graduate level. In 2001 this policy was revised to permit universities to offer up to 4% of its monitored sections as small classes. In 1998, the masters programs in chemistry, physics, and metallurgy, all of which had single-digit enrollments, were phased out and replaced by a masters program in materials science and engineering. The masters program in mining engineering was also eliminated at this time.

**Redirect of State Appropriations (Incentive Funding)**

Incentive funding (not to be confused with the reinvestment program described above under the “Tech Quality Plan and the Reinvestment Plan”) is part of the five-year funding plan presented to the legislature. The five-year plan we currently function under replaced the previous “formula funding” approach which based annual state appropriations on a three-year rolling average of enrollment, weighted by discipline and course level. The five-year plan approach was a political strategy at a time when declining enrollments would have meant a significant decrease in state appropriations for certain schools in the system. The Legislature approved the five-year plan approach with the understanding that a percentage of state funds would be given to the universities on an “incentive” basis. Each year, the regents and each school formulate incentive goals that are of interest to the state.

**Developments in Academic Advisory Council (AAB)**

In 1996, an institutional level advisory group, the Academic Advisory Board, was established to provide the university with external input on longer range trends of which it should be cognizant. Comprised of industry executives and leading researchers, this group meets twice annually. Its 2001 report, Drivers for Science and Engineering Education at SDSM&T, has provided guidance over the past several years as we have developed our vision of our future.

**K-12 Linkages**

SDSM&T continues to cultivate a wide array of linkages to area schools; however, we do not have any single office that coordinates the full range of involvements. For instance, the Children’s Science Center was established and run by the office of University and Public Relations while our yearly Engineers Week is coordinated by Academic Affairs. Half of our discussion under Criterion 5 is devoted to the many ways we serve and engage the K-12 community.

**Campus Master Plan and Facilities**

We concluded our first capital campaign in 2000 very successfully by raising $20.4 million; the target for that campaign had been set at $16 million. We are now preparing for a second capital campaign with a possible target of $50 million and are identifying industrial partners to help build needed facilities. Our academic departments have articulated five-year plans for how new capital funds could be used to build and expand existing programs.

In 1996 we had recently completed construction of our classroom building. Since then, numerous renovations and additions have been built. A 300-bed residence hall was constructed in 2004 and has been functioning at capacity ever since. Ground was broken in spring 2005 for a business incubator facility, and a three-story addition has been built to our Civil and Mechanical Engineering building to house a new computational mechanics
laboratory. In 2005, the Board of Regents authorized planning for the replacement of our chemical and chemical engineering facility.

Much of our renovation work has been directed at developing facilities to enable us to attract and host conferences and other educational or cultural programming. To this end, we have made extensive renovations to the Surbeck Student Center, reorganized our conferencing and scheduling staff, and hired a Director of Educational Programs and Professional Conferences in 2004.

Our O’Harra stadium has undergone continual upgrades to keep pace with the needs of the School of Mines and area athletes. In 2002 the track was updated to a state of the art “mondo” surface at a cost of slightly less than $1 million. Current plans are to partner with the City of Rapid City and the Rapid City School District to upgrade our grass playing surface to artificial field turf. This project is expected to be completed in the summer of 2006.

The Campus Master Plan created in 1989 included the creation of a High Plains center technology center and fine arts center. The vision involved joining the Old Gym, our administrative building (O’Harra) and the Civil and Mechanical Engineering building into one continuous structure. That approach to unifying the campus was not sustained, and a different approach was taken in the new Campus Master Plan released in spring 2005. The new plan is discussed in detail under Criterion 2.

Topics mentioned under Criterion 5 (pages 77-82 of the 1996 team report)

Representation of Women and Minorities on Campus

Campus demographics are strongly affected by location and size. The campus is geographically isolated for specialty schools of its type, and over 70% of the students are South Dakota natives. In terms of overall racial and gender diversity, the student body continues to be predominantly composed of white male students. Native Americans make up just over 8% of the state population but less than 3% of the student body. However, in 2003, seven Native American students earned B.S degrees in engineering at SDSM&T, the largest number granted by any single institution in the country. Over 50% of entering Native American freshman in 2004 were female.

In AY 2003-04, women accounted for just 13% of the freshman enrolled in science, technology, engineering, and math majors (i.e., STEM areas). In the graduating class in 2003, 15% of those who received B.S. degrees in STEM majors were female and only 9.8% of the engineering B.S. graduates were female. If we include interdisciplinary sciences students in the SDSM&T numbers, we can note that 23.5% of the fall 2005 incoming class of first-time freshman is female.

Nationally, women make up a persistently small percentage of faculty members in science, engineering, and technology fields. In 2001, less than 9% of all engineering faculty were female. In science, 31% of all faculty members were female nationally. At SDSM&T in fall 2005, the percentages of full-time female faculty members are 14% for science programs (excluding interdisciplinary sciences) and 9% for engineering programs. Women account for 17% of full-time faculty members in the social sciences and 55% of faculty in the
humanities. The gender division for all faculty campus wide as of fall 2004 was 19.7% female and 80.3% male, or 27 women and 110 men. For a breakdown of full-time faculty members by gender, program, and rank, please see RR292.

Foundation

Student scholarship funding has grown substantially in the past ten years, primarily as a result of the Vision 2000 Capital Campaign, to the point where close to $1 million is awarded annually in scholarships through the SDSM&T Foundation.

The number of named professorships and endowed chairs have increased since 1996. In 2001, the Steven J. Miller chair was established to assist the Department of Electrical Engineering in establishing a research focus. This endowment funds half of a position in that department. In addition, we have the following endowed professorships:
- The Douglas W. Fuerstenau Professorship supports faculty members from the mineral industries areas of study, with special focus on metallurgical engineering programs.
- The John C. Mickelson Professorship supports faculty members from the Geology and Geological Engineering program, with preference to individuals with expertise related to petroleum or geology/ground water.
- The William J. Hoffert Professorship supports faculty members from the Electrical and Computer Engineering Department at SDSM&T.
- The Pietz Professorship supports faculty members from the Industrial Engineering Department at SDSM&T.
- Robert L. Sandvig Professorship supports faculty members from the Chemical Engineering Department at SDSM&T.

Academic Program Enhancement

In excess of $1 million annually is made available, primarily to departments, for academic program enhancements ranging from funding for faculty travel to upgrading of laboratory and specialized computing facilities.

Capital Improvements

As can be seen from the list of building projects provided under “Physical Facilities” above, substantial upgrades to our facilities have been made since 1996 for a campus of our size and resources. In 2003-2004 we made a $767,795 capital investment in our electrical system to finish a long-term upgrade project begun in 1980. We now have fully looped 12kV service to every building on campus, and this provides increased reliability and the additional load capability we need to meet the current campus master plan. We also made a $2,131,000 investment in our central chiller in order to add 900 tons of cooling capabilities that connect to five current buildings. Our chiller capacity is now sufficient to serve the additional building projected for construction on the current master plan.

Other External Relationships

The most significant relationships we, as a campus, have developed since 1996 promise to have a tremendous impact on the institution’s future. We have formalized our relationship with Black Hills State University and Western Dakota Tech as the institutions that serve the
higher education needs of the region through the creation in 2004 of the Higher Education Center – West River (HEC-WR). The HEC-WR center facilitates the sharing of curriculum between and among the institutions. In 2004, we worked with Black Hills Vision on the establishment of Ph.D. programs in nanoscience and nanoengineering in order to ensure that these new programs would serve the economic-development interests of the region. We are currently working with them as we develop our proposed biomedical engineering Ph.D. program.

In 2004, President Ruch persuaded the economic development community to locate a regional business incubator building on the campus in lieu of a site across town. We believe that completion of this facility in 2006 will open a new expansive chapter for SDSM&T in its relations with regional business and industry.

In 2003, our former president, Dr. Richard Gowen, led a formidable effort to obtain state support for the selection of the Homestake Mine in Lead, South Dakota as the site for a new underground national laboratory (known as “H-DUSEL” for Homestake Deep Underground Science and Engineering Laboratory). An SDSM&T Professor of Geology and Geological Engineering is a member of the steering committee which prepared the NSF document entitled, “EarthLab: A Subterranean Laboratory and Observatory to Study Microbial Life, Fluid Flow, and Rock Deformation.” He is now the Co-PI on the NSF project to prepare a Conceptual Design Report for the H-DUSEL.

We continue to participate in the West River Nursing Consortium and partner with three other regents’ universities and Rapid City Regional Hospital to provide two-year, four-year and graduate nursing programs in Western South Dakota. Students in the undergraduate nursing programs take their general education and general science coursework at SDSM&T or Black Hills State University under this agreement.
Chapter 3:
Response to the Concerns and Suggestions of the 1996 Team Report
Chapter 3:  Response to the Concerns and Suggestions of the 1996 Team Report

The 1996 Team Report details the review team’s concerns and offers its advice and suggestions for moving forward (See pages 84 to 90 of RR1). This chapter summarizes how we have responded to the concerns, advice, and suggestions the 1996 team had to offer. This chapter is organized according to the topics in the 1996 report and the headers are derived from the language of the 1996 report (RR1).

Concerns

General Education fragmented in implementation and development

Considerable attention has been given to general education since the last visit, both at the system level and at the institutional level. In 1998-99 and again in 2003-04 the Board of Regents requested a review of general education requirements. Conducted by the academic officers together with faculty representatives, this review led to adoption of common requirements across the system effective in fall 2000 with modifications effective in fall 2005. Course syllabi were reviewed to ensure that the approved courses meet the general education objectives and outcomes. The Collegiate Assessment of Academic Proficiency (CAAP) exam was adopted as a rising junior exam to assess general education. Students failing to meet standards are placed on a development plan and given a year to retake the exam and meet standards.

At the institutional level, a General Education Assessment Committee (GEAC) was fully functioning by 2002. General education faculty worked with engineering faculty to develop rubrics for writing and speaking. Questions focused on general education gains and designed to be compared with similar questions on the incoming freshman survey were added to the Student Satisfaction Inventory (SS) taken by all students. The institution has participated in the National Survey of Student Engagement (NSSE) since 2002. Results have been used to identify actions items for curricular improvement reflected in the institution’s strategic plan.

Assessment not yet fully implemented and feedback loop not functioning

The efforts to fully implement effective assessment at both the institutional and programmatic level were greatly enhanced in 2001 with the creation of an administrative position with responsibility for assessment and faculty development. In addition to the GEAC, an Engineering Assessment Committee (EAC) was created to address assessment issues in common to engineering programs. For example, in 2003-04 the EAC considered Fundamentals of Engineering exam results related to mathematics and enlisted the assistance of the mathematics faculty to review the coverage and sequencing of topics in the calculus courses. A plan for modification of these courses was presented in fall 2004.

As a result of the fall 2004 accreditation review visit by the Accreditation Board for Engineering and Technology (ABET), all engineering programs were required to demonstrate a functioning assessment program and were able to provide convincing evidence that the “loop had been closed.” The focus on assessment by ABET and by funding agencies such as
the National Science Foundation have reinforced on campus the need to develop a culture of assessment that has as its goal the improvement of student learning.

**Vulnerability of graduate programs because of low enrollment, and lack of distinction, recruitment, assessment**

Enrollments in both the M.S. and Ph.D. programs have increased since the previous visit. Average enrollment in our M.S. programs increased 36% while average enrollment in the Ph.D. programs increased by 44%. Currently, however, graduate enrollments remain a concern as the number of international students continues to decline. The increase in funded research in recent years has enabled the institution to provide research assistantships to a growing number of graduate students. In fall 2005 a new Ph.D. program in nanoscience and nanoelectromechanical systems (NEMS), one of only a few in the nation, was implemented with an initial enrollment of seven students. Approval was received in December 2005 for a Ph.D. in biomedical engineering in collaboration with the School of Medicine at the University of South Dakota. While closing the loop in assessment at the graduate level lags behind that at the undergraduate level, most graduate programs have now developed and are in the process of implementing their assessment plans.

**Faculty not fully engaged in leading curriculum design and changes in instructional delivery**

The increased participation of the faculty in the development and implementation of assessment plans has provided the stimulus to look at the curriculum and its design and delivery. In each program, faculty members have instituted curricular changes based on assessment results. A freshman introduction to science and engineering course has been developed by the faculty and is now required by all but a few programs. Over the course of four summers, approximately 25% of our faculty members received full summer support to redesign courses to utilize technology to improve student learning through the governor’s Technology for Teaching and Learning program.

The desire by a growing group of faculty members to address student intellectual development, not just subject matter mastery, is reflected in the growing number of proposals to funding agencies to support curriculum improvement. Our assessment data, in particular the NSSE data, provided convincing evidence that our student engagement in the first two years was significantly less than of other engineering and science students nationally. In response, the administration provided funding for a small cohort of faculty members to spend summer 2005 in studying the research on active learning and pedagogies of engagement and in planning changes to their courses based on this research.

**Insufficient appointment of women and minorities**

Some progress has been made in recruiting women faculty members in the engineering disciplines with the addition of women faculty members in civil, electrical, and industrial engineering. The percentage of women faculty members in engineering programs is 9% which is also the national average. Women account for 14% of the full time faculty for science programs (excluding interdisciplinary sciences), for 17% in the social sciences, and for 55% in the humanities. The gender division for all faculty campus wide as of fall 2004 was 19.7% female and 80.3% male, or 27 women and 110 men.
Insufficient State funding

While the amount of state funding available in a sparsely populated state with an economy based on agriculture and tourism is limited, the state is supportive of higher education as evidenced by two significant actions since the last visit. While the rest of state government reduced its budgets by 10% in response to taxpayer actions, the legislature allowed higher education in 1997 to retain its 10% cut as a reinvestment pool. When enrollments declined in the latter half of the 1990’s and state funding should have been reduced based on the funding formula in use at that time, the legislature allowed the universities in the regents’ system to retain the funds due to be lost and use them in a salary enhancement program. More recently, the governor’s 2010 Plan places emphasis on developing a technology-based component of the economy and recognizes the role of higher education in this initiative. As a result, close to $500,000 in new base funding was added to the 2005-06 state appropriation to support the new Ph.D. in nanoscience and nanotechnology and a similar annual amount for five years was appropriated for SDSM&T’s Center for Accelerated Applications at the Nanoscale (CAAN).

Recognizing that state appropriations will likely never be sufficient for us to attain all our goals, we have actively and successfully sought additional funding through the SDSM&T Foundation’s capital campaign, from industry partners who have a vested interest in the quality of our graduates, and from federal sources.

Demographic trends, state funding, rising tuition and fees, and decreased enrollments

In the past decade we have responded to the enrollment challenge through collaboration with other institutions, further development of the interdisciplinary sciences program, and increased focus on the needs of non-traditional students. While there have been no dramatic shifts in overall enrollment, student numbers dipped in the late 1990’s, increased in the early 2000’s and have shown a decrease in each of the past two years. We recognize that we must approach recruitment differently and have engaged the services of Stamats in developing new recruitment strategies which are being implemented in the current recruiting cycle.

Low retention rate at freshman / sophomore levels

Retention at a narrowly focused institution such as ours is a particular challenge since students who change career goals must leave the institution to pursue them. The institution has undertaken a variety of initiatives to ensure that students who want to study science and engineering have the academic and social support necessary for persistence. The freshmen mentoring program, peer advising program, and advisor training are well established and provide new students with support and guidance in their adjustment to the academic demands of our programs. In spring 2003 over twenty SDSM&T faculty members participated in the Foundations of Excellence in the First College Year project. The conversation begun then has continued to this day and has led the administration to create the position of Director of Retention in 2004, to provide funding for a first year program coordinator position in 2005, and to identify the first year as a priority in the institution’s strategic plan. In fall 2004, the FIRST program, based on the learning community concept, was instituted and, while it is too early to form solid conclusions, shows promise in increasing student engagement in the life of the university.
Retention of first year students varies from year to year but has been consistently in the low 70% with the exception of fall 2004 when it fell to 66%. While this was due in part to the reclassification of pre-nursing students when the student data bases from the six regents’ institutions were merged, it has led the president to identify retention as an institutional priority. We anticipate that two recent actions will, in the long term, result in an improvement in first year retention. In March 2005, the Regents authorized increased admission standards for SDSM&T. Since inadequate preparation, particularly in mathematics, is a strong predictor of attrition, in summer 2005 a summer “bridge” program was piloted to prepare students to begin our published curricula in the fall.

**Limited integration and impact of interdisciplinary faculty**

The creation of the College of Interdisciplinary Studies has given this faculty an identity of its own. In 2004-05 members of the Departments of Humanities and of Social Sciences redesigned the baccalaureate program in interdisciplinary sciences, creating a degree program with four specializations. These four specializations, Atmospheric Sciences; Business Applications in Science and Technology; Pre-Professional Health Sciences; and Science, Technology and Society, clearly align with our mission of science and engineering. Faculty from this college are active members of the Faculty Senate, are represented on major committees, and have worked with their science and engineering colleagues on such projects as the development of rubrics for writing and speaking that can be employed in all classes.

**Advice and suggestions**

**Administrative or faculty support of faculty development**

In 2001 an administrative position, Director of Academic Initiatives, was created with responsibility for faculty development and assessment. A grant, the fourth three-year grant received, from the Bush Foundation has provided $100,000 annually for the past three years and has been supplemented by approximately $50,000 annually in institutional funds. Between 2001 and 2005 over 250 separate project proposals were funded, including teaching enhancement projects, travel, and workshops.

**Establishment of teaching and learning / curriculum center or campus resource**

The establishment of a true Center for Teaching and Learning remains a dream on our campus. However, funding from our Bush grant and the SDSM&T Foundation, together with fund-raising lunches put on by faculty and staff members, have enabled us to create a “reading corner” in the Faculty Lounge. Over $4,200 in grant funding plus an additional $2,200 in foundation funds have been spent to equip the reading corner and to stock it with books on teaching, learning, assessment, leadership and other topics. Faculty members are encouraged to identify books they would like to have added to the collection.

**Reduce dorm rates as compensation for poor condition**

The first phase of a plan to replace our aging residence halls was completed in August 2004 with the opening of Howard Peterson Hall, a modern, air-conditioned residence connected to the Surbeck Student Center.
Provide incentives for faculty teaching core freshman / sophomore courses, working on curricular revisions, and on assessment

Each year since 1997, significant funding has been allocated through the reinvestment program to provide support for curricular revision and assessment activities, most often in the form of summer support for these activities. Whenever possible, year-end funding has also been directed toward these areas. The development of the freshmen engineering and science course, GES 115, and development of supplementary learning materials for chemistry courses are two examples of curriculum projects supported. The institution is a member of The Collaboration for the Advancement of College Teaching and Learning and is well represented at The Collaboration’s conferences. In addition to institutional incentives, between 2001 and 2004 over 20 faculty members received full summer support from the Office of the Governor for curriculum redesign projects.

Encourage more cross-disciplinary work among faculty

The introduction of multidisciplinary graduate programs and the increase in research activity along with the focus by funding agencies on collaborative project have provided the stimulus for faculty to work together across disciplines.

Raise research requirements / standards for tenure

As our research agenda has grown, so has the attention paid to research involvements by our Tenure and Promotion Committees. In fall 2005 the institutional faculty performance standards will be reviewed to ensure that these adequately reflect the current expectations and will support our mission and goals.

Address faculty concerns about impact of student evaluations

Beginning in 2001, the COHE/Board of Regents Agreement has stipulated that a major portion of faculty pay increases be based on performance in each of the three areas of teaching, scholarship and service. Faculty members and their department chairs agree on percentages of effort for each of these areas which then feed into the salary computation. Nevertheless, many faculty members continue to feel that undue importance is given to student opinion surveys when assessing teaching performance while many students feel that little if any attention is paid to these.

Lessen anxiety among faculty about implementation of Tech Quality Plan

The Tech Quality Plan was not implemented due to faculty opposition and generally declining enrollments that made restriction of entry to the major a moot point.

Increase percentage of pay (within COHE) devoted to merit pay to more strongly reward contributions in key areas

Each year the college deans have been given authority over the discretionary portion of the performance-based section of salary policy so they could provide additional rewards to strong contributors in key areas. That being said, it remains true that the COHE/Board of Regents
agreement puts a limit on the percentage that is discretionary so that the amount of money available annually to each dean has been between $3000 and $8000 depending on the size of the college.
Chapter 4:
Design of the Self-Study and Request for Continued Accreditation

SOUTH DAKOTA
M
SCHOOL OF MINES & TECHNOLOGY

Chapter 4:
Design of the Self-Study
Chapter 4: Design of the Self-Study and Request for Continued Accreditation

Special circumstances of this self-study process

The same year we began our self-study planning (2003), Dr. Charles Ruch became the school’s 17th president. Our former president, Dr. Richard Gowen had retired after 14 years of service. In fall 2003, Dr. Ruch launched the school’s first major strategic planning process since 1989.

The special circumstance SDSM&T faced was the need to conduct strategic planning at the same time as a self-study. As a small, thinly staffed institution, we questioned our ability to do both in tandem in a thorough and meaningful manner unless we found a way to align the two tasks.

The goals of the SDSM&T self-study process

As an institution that had not experienced a fully participatory strategic-planning process since 1989, we had much to gain from a thorough, fair, and inclusive self-examination and self-evaluation. As explained below, the people entrusted with leading this effort took very seriously the chance they were given to craft a self-study approach that would genuinely help the institution during a time of considerable challenge and change. The culture of SDSM&T is very practical, hard working, and results driven. We cannot spare good people unless a project is meaningful.

The goals the self-study steering committee set for itself are reflected in the slogan it adopted: “leading accreditation and strategic change.” The leadership team aimed for a process that was genuine, inclusive, and useful to our broader efforts to move the institution forward.

Structure of the SDSM&T self-study process

We successfully aligned strategic-planning and self-study by focusing first on strategic planning. Dr. Ruch initiated the “all-campus planning session” technique to campus, and the first session held in October 2003 attracted 148 participants who remained the full six hours of the event. The purpose of the all-campus session was to give everyone associated with the University an opportunity to set institutional priorities. The small round-table discussions employed at the October 2003 and January 2004 sessions generated a phenomenal amount of written input.

Dr. Ruch created a small “think group” comprised of 12 faculty, staff, and community members who he asked to study and analyze campus input. The small group met with the president throughout spring 2004 to distill an initial set of campus-wide strategic initiatives.

Once the institutions needs and priorities were established through debate and analysis, the president published the first iteration of our Strategic Agenda (RR122). He took care to fairly and effectively address each of the priorities identified in the planning process under one of the five accreditation criteria. The alignment between our strategic priorities and the criteria are shown below in Figure 4.1.
Strategic Initiatives | Accreditation Criteria
--- | ---
Prepare for our Future as a National Player in Science and Engineering Education and Research | Mission and Integrity
Reshape the Learning and Teaching Experience | Preparing for the Future
Promote the Acquisition, Discovery, and Application of Knowledge | Student Learning and Effective Teaching
Engage and Serve the Broader Community | Acquisition, Discovery, and Application of Knowledge
Engagement and Service

Figure 4.1  Alignment of Strategic Initiatives to Accreditation Criteria

The timeline

Below is a basic chronology of our aligned self-study and strategic Planning processes. The public record and the results of specific all-campus sessions can be found at [http://www.hpcnet.org/presidentcampusplanning](http://www.hpcnet.org/presidentcampusplanning). Additional detail can be found in RR123.

**September 2003:** Planning for October 29, 2003 all-campus strategic planning event

**October 29, 2003:** All-campus strategic planning session, 148 attendees

**November and December 2003:** Small “think group” designated by the president met to analyze the transcribed input from the October 29 session and to draft preliminary statements about strategic planning areas and priorities

**January 22, 2004:** Second all-campus strategic planning session

**February 2004:** Small “think group” met to formulate a strategic planning statement to share with the Board of Regents in March 2004

**February to March 2004:** The Strategic Initiatives / Self-Study Steering Committee is formed

**March 2004:** Six Steering Committee members attend the HLC self-study planning workshop and annual conference in Chicago

**March 2004:** Strategy for aligning the self-study process with the strategic planning and implementation work is refined and set

**March 25, 2004:** Dr. Ruch meets with the regents to discuss the draft strategic plan

Design of the Self-Study 40
May 4, 2004: Steering Committee meets via conference call with HLC liaison Karen Solomon

May 11, 2004: Final AY 03-04 all-campus planning session to set priorities for strategic initiatives and to introduce the plan for aligning the self-study process with the strategic planning and implementation

Summer 2004: Steering Committee works to finalize AY 04-05 strategic initiative action items and to collect data needed for SWOT analyses in fall 2004

August 27, 2004: Steering Committee planning retreat

November 4, 2004: Self-study “Co-chairs” run the 6-hour session. Strategic initiatives under criteria 3, 5, and 1 discussed.

February 3, 2005: Strategic initiatives under Criterion 2, 1, and 4 discussed. Campus Master plan and space-utilization study presented.

April 2005: 10 Steering Committee members attend and present at the HLC annual meeting in Chicago

May 10, 2005: Briefings on critical issues were given and progress on our strategic initiatives at the close of year one were assessed.

September 9, 2005: Draft self-study distributed to all campus offices and posted online. Online forms created for submission of input between September 9 and November 13.

October 6, 2005: Year two iteration of our Strategic Agenda presented, and the draft self-study and academic advising were discussed.

This timeline lists major events or meetings. Much work went on that is not documented here, particularly the work done by each of the co-chairs in conjunction with their working groups. The Faculty Senate and the Executive Council was kept apprised of the work of the co-chairs via written reports created by the co-chairs every 5-6 weeks during the critical time period between September 2004 and May 2005.

The 2nd-year iteration of our Strategic Agenda can be found in the Resource Room as (RR293).
The leadership team

Two co-chairs were appointed in association with each self-study criteria, for a total of 10 co-chairs. Because we had merged self-study with work on our strategic initiatives, the co-chairs (and the self-study steering committee as a whole) had a hybrid charge that was not easy to explain in simple terms.

The full steering committee spent much time debating and discussing the priorities and identity of the team. At last, a title and unifying slogan emerged, and the Campus Action Team (CAT) was introduced to campus. The “CATs,” as the team became known, adopted “Leading Accreditation and Strategic Change” as its slogan. Figure 4.2 on the following page shows the CATs organizational chart. More details can be found at http://www.hpcnet.org/SelfStudy.
CAMPUS ACTION TEAM
Steering Committee
Co-coordinators

Affirm our Mission and Institutional Integrity
- Alvis Lisenbee
  - Mineral Industries 302
  - Ph: 394-2463
  - Fax: 394-6703
- Deb Sloat
  - O’Harra 112
  - Ph: 394-1203
  - Fax: 394-6131

Prepare for our Future as a National Player in Science and Engineering Education and Research
- Toni Logar
  - McLaury 206
  - Ph: 394-2471
  - Fax: 394-6078
- Brad Johnson
  - O’Harra 102
  - Ph: 394-2623
  - Fax: 394-6679

Reshape the Learning and Teaching Experience
- Sue Shirley
  - Classroom Bldg 317
  - Ph: 394-2482
  - Fax: 394-6124
- Stu Kellogg
  - Civil Mechanical 320
  - Ph: 394-1271
  - Fax: 394-2405

Promote the Acquisition, Discovery and Application of Knowledge
- Tom Fontaine
  - Civil Mechanical 315
  - Ph: 394-5173
  - Fax: 394-5171
- Maribeth Price
  - Mineral Industries 315
  - Ph: 394-1290
  - Fax: 394-6703

Engage and Serve the Broader Community
- Jim Munro
  - Chem Bldg 227
  - Phone: 394-2422
  - Fax: 394-1232
- Bill Jones
  - O’Harra 216
  - Ph: 394-2400
  - Fax: 394-1268

Karen Whitehead
- EEP 235
- Ph: 394-6952
- Fax: 394-5266

Kate Alley
- Ph: 394-2631

Karen Whitehead
- O’Harra 215
- Ph: 394-2256
- Fax: 394-2490

Kate Alley
- EEP 235
- Ph: 394-6952
- Fax: 394-5266

Figure 4.2 CATs Organizational Chart
Process

Once the CATs gained a handle on the complexities of conducting a self-study while furthering work on the strategic initiatives, they set to work with the practical determination for which our faculty and staff are known. Each co-chair created a working group while taking care to ensure the broadest representation of all constituents who had a stake in their work.

The people working on each of the accreditation criteria organized themselves in slightly different ways, as best suited their goals. The co-chairs for Criterion 1, for instance, had a single large goal: to gather campus input on the college structure and to formulate recommendations for the president to consider. The “work” conducted under Criterion 1 concerned everyone on campus, and the working group for Criterion 1 met weekly toward the conclusion of AY 2004-05. The reports submitted by the co-chairs can be seen at RR294.

Community involvement and input

Community leaders were invited to the first two all-campus planning sessions when the needs and priorities of the institution were being identified. Several community leaders were appointed to the small “think group” the president consulted on his distillation of all the input created by the all-campus sessions. The self-study co-chairs met with the Academic Advisory Board on three separate occasions to gather input on the content of the text. The largest number of community leaders involved directly in the self-study was included in the working group for Criterion 5.

Once the self-study was in draft form, it was distributed in digital and hard copy to the Alumni Board and the Academic Advisory Board (AAB). Input was sought from all board members, and a special session was held with the AAB to gather input on the text. Bruce Rampleberg, a member of the original small “think group” appointed by the President to discuss input from the all-campus sessions was also given a draft text and asked for input.

Once the self-study was in final, published form, clearly visible notices were run in January and February in the Rapid City Journal, the Lakota Times, and the Argus Leader, which is the main newspaper for the eastern half of the state. As of the printing of this document, requests have been sent to key constituent groups in the community, such as the education sub-committee of the Chamber of Commerce, asking that SDSM&T’s self-study be placed on the February agenda for discussion. A record of all input and comment received will be made available to the visiting team.

Campus input

The draft self-study was printed and distributed to all campus offices on September 9, 2005. The draft was posted online in PDF format, and an online form was created to enable everyone and anyone to submit comments and textual edits via online forms. These forms can be viewed at http://interact.sdsmt.edu/SelfStudy/input.htm. At the close of the public comment period (November 13, 2005), all comments and edits submitted online were organized into a spreadsheet which was posted on the Campus Planning website and sent to the co-chairs for consideration. The time between mid-November and early December was used for considering all input and making changes as needed. The draft was finalized and formatted by late December, then printed and sent to Commission staff in mid-January 2006.
For a record of all input received via the online form as of the printing of this document, please see [RR312].

**Request for continued accreditation**

The South Dakota School of Mines and Technology has examined itself thoroughly and presented in this document specific and unbiased evidence that the institution is meeting accreditation criteria. We therefore respectfully request that the Higher Learning Commission of the North Central Association of Colleges and Schools grant the South Dakota School of Mines and Technology continued accreditation.
Chapter 5:
Criterion One: Mission and Integrity

Core Component A.......p. 47
Core Component B.......p. 48
Core Component C.......p. 55
Core Component D.......p. 59
Core Component E.......p. 63
Chapter 5: Criterion One, Mission and Integrity

The organization operates with integrity to ensure the fulfillment of its mission through structures and processes that involve the Board, administration, faculty, staff, and students.

Core Component 1a. The organization’s mission documents are clear and articulate publicly the organization’s commitments.

Evaluative statement for all of Component 1a

SDSM&T recognizes the need to periodically review and assess its mission documents. In June 2003, the South Dakota Board of Regents released its report entitled “South Dakota Opportunities” that included recognition of SDSM&T as the state’s technological university. At that time, the University began discussions with its constituents to review and revise the University’s mission documents. The discussions resulted in a published Strategic Agenda and other documents that clearly express the University’s mission, its commitments to its constituents (RR122), and an operation of openness and integrity.

The following section illustrates the clarity of our mission statements. It, and succeeding sections, gives insights into our recent efforts to redefine these documents as well as examples showing that actions support the words.

Evidence Cited

1. 2004-05 Strategic Agenda
2. 2004-05 Undergraduate and Graduate Catalog

1st item of evidence in support of Core Component A

2004-05 Strategic Agenda

Discussion of 1st example of evidence

A series of all-campus meetings, including hundreds of faculty, staff, students, alumni, and community members, were held to discuss the University’s mission and the steps we should take to achieve the University’s goals (RR123). These meetings resulted in publication in May 2004 of a strategic agenda that included a revised university mission Statement and four strategic initiatives. The mission Statement and the four 2004 strategic initiatives read as follows:

The South Dakota School of Mines and Technology serves the People of South Dakota as their technological university. Its mission is to provide a well-rounded education that prepares students for leadership roles in engineering and science; to advance the state of knowledge and application of this knowledge through research and scholarship; and to benefit the state, region, and nation through collaborative efforts in education and economic development.
The South Dakota School of Mines and Technology is dedicated to being a leader in twenty-first century education that reflects a belief in the role of engineers and scientists as crucial to the advancement of society. Our vision is to be recognized as a premiere technological university in the United States. Most immediately, our goal is to be recognized as the University of choice for engineering and science within South Dakota and among our peer group of specialized engineering and science universities.

Strategic Initiative 1: Reshape the learning and teaching experience  
Strategic Initiative 2: Promote the acquisition, discovery, and application of knowledge  
Strategic Initiative 3: Engage and serve the broader community  
Strategic Initiative 4: Prepare for our future as a national player in science, engineering education, and research

The strategic initiatives listed above were set at a May 2004 all-campus meeting. One year later, in May 2005, the campus community gathered again to “grade” our progress and to assist the Executive Council in creating the AY 2005-06 version of our strategic plan. Our current plan was published in September 2005 (RR293).

Our mission Statement and strategic initiatives appear in various media, including: President’s Report 2004, the University website, and has been adopted for the 2005-06 Undergraduate and Graduate Catalog. This self-study contains other evidence of efforts towards achieving our mission and strategic initiatives.

2nd item of evidence in support of Core Component A

2004-05 Undergraduate and Graduate Catalog

Discussion of 2nd example of evidence

SDSM&T’s commitment to students is articulated in the undergraduate and graduate catalog. The catalog includes statements regarding University information, academic information, educational resources and outreach services, and student information.

Each academic year, this catalog is reviewed and updated as the University’s contract with incoming students. This review and update addresses changes in Board of Regents’ policies, University policies, and academic programs.

The catalog appears as a printed document published and disseminated to the community by the Office of University and Public Relations. The catalog also appears on the University’s website at www.sdsmt.edu/catalog (RR201).

Core Component 1b. In its mission documents, the organization recognizes the diversity of its learners, other constituencies, and the greater society it serves.

Evaluative statement for all of Component 1b

SDSM&T continues to do well in expressing commitment to diversity and has recently taken steps to clarify the role it plays in the region and the constituents it serves. Although our
faculty is internationally diverse and has recently added a number of women faculty members, our undergraduate student body is not diverse. Our students are representative of the South Dakota population with the exceptions of 1) women (the percent of women in the science and engineering programs reflects the low national average), and 2) Native Americans (this fastest growing portion of the South Dakota population is under represented). The language of our mission statement is matched by the significant efforts we have made to fulfill that mission. This is particularly reflected in the very significant increase in Native American student numbers, and in a new initiative to increase the number of female students in engineering.

Evidence Cited

2. Our 2002 Statement of Purposes and the progress we have made toward achieving specific strategic initiatives, e.g., increasing numbers in under-represented groups  
3. General education requirements for graduation

1st item of evidence in support of Core Component B

South Dakota Board of Regents Policy Manual System Mission Statement

Discussion of 1st example of evidence

The South Dakota Board of Regents Policy Manual System Mission Statement (RR88) specifically recognizes the diversity of its learners, other constituencies, and the greater society it serves:

The Board affirms a commitment to diverse campus communities through serving the needs of all persons including minorities, handicapped, and part-time students and by seeking racial and ethnic diversity among the faculty and staff. The diversity of the campus community embodies the basic principles of an open democratic society in which free speech and thought respectful of differing opinions is encouraged among the students, faculty and staff.

Although this is the mission statement of the Board of Regents, it sets the context for the operation of the institutions within its purview.

2nd item of evidence in support of Core Component B

Our 2002 Statement of Purposes and the progress we have made toward achieving specific strategic initiatives

Discussion of 2nd example of evidence

Campus-wide discussions resulted in the creation of a Statement of Purposes in AY 2002-03 that reads as follows (RR71):

SDSM&T is dedicated to being a leader in twenty-first century education that reflects a belief in the role of engineers and scientists as crucial to the advancement of society. Responding to the unprecedented challenges facing today’s world, SDSM&T will seek opportunities to benefit the educational, civic, and economic activities of the
community, state, and region. SDSM&T will maintain and expand its role in research, scholarship, and creative endeavors that advance knowledge, solve problems, develop individual potential, and explore the human condition. Through its rigorous academic programs and co-curricular activities, SDSM&T is committed to developing informed and responsible scientists and engineers who behave ethically, value a global perspective, and accept the duties and responsibilities of citizenship.

Our strategic planning efforts and progress made on specific strategic initiatives are strong evidence that we take the language of our Statement of Purposes seriously. During AY 2003-04, the entire campus community participated in a major effort to clarify our mission and to articulate “strategic initiatives” based on the mission. Four strategic initiatives were formulated (RR122), and under each initiative, action items were articulated. Initiatives 1 and 3 are relevant to this example of evidence.

**Strategic Initiative 1**: Reshape the learning and teaching experience includes the following Action Items:
- Introducing a campus-wide multidimensional strategy to increase minority representation on campus as initiated by the Multicultural Committee,
- Supporting collaboration on global awareness initiatives,
- Developing curricula for orientation and other sessions in career planning/job search, health issues, globalization, diversity awareness, and leadership development,
- Implementing the Women in Science and Engineering project.

**First Action Item cited**: One important thing included under the heading of serving the “region” and accepting the “responsibilities of citizenship” is to encourage and support Native Americans to pursue careers in science and engineering (as reiterated in our statement on constituents, (RR172)). In the 2003-04 academic year, a renewed effort to increase Native American representation on campus resulted in the formation of the Multicultural Committee, which set as its goals: 1) increasing Native American recruitment and retention at the undergraduate and graduate level by targeting the Rapid City district Native American population; 2) increasing K-12 representation on South Dakota’s reservations, and; 3) increasing the number of program participants and graduates (RR73 and RR97).

As evidence of the efforts to include Native American Students, in fall 2003, SDSM&T had the highest number of first-time freshmen and transfer Native Americans (22 in all) in the history of the institution. The lead institutions in the United States, Oklahoma State University and University of Oklahoma, reported 33 and 35 respectively. In the spring of 2003, SDSM&T graduated seven American Indians with degrees in engineering, the highest in school history. This was also the highest number nationwide from any one college/university. In the spring of 2005, the first Native American Ph.D. candidate was granted his degree. Recent efforts to increase Native American student representation include an articulation agreement with Ogalala Lakota College (OLC) and the He Sapa extension of that institution.

**Second action Item cited**: In 2001, our attention was brought to the need to increase global awareness among our students by a year-long study of the “drivers” for engineering and science education that was conducted by our Academic Advisory Board (RR138). To follow up on the report’s recommendations, the Vice President for Academic Affairs hosted a series
of roundtable discussions on global issues in spring 2002 (RR177). The most recent significant development in this area is an effort that is underway to expand the array of student enterprise teams that the Center for Advanced Manufacturing and Production (CAMP) program supports to include multi-year and multi-class-level team projects that solve engineering and science problems in third-world countries (RR189). This development also supports Outcome “j” of ABET Criterion 3 “the broad education necessary to understand the impact of engineering solutions in a global and societal context”. In this context, the Department of Geology and Geological Engineering has bi-annual international field trips (Italy, Turkey, New Zealand, and Spain) and a yearly geology field camp in Turkey; the Department of Civil and Environmental Engineering has initiated a program utilizing real international projects in the Senior Design component. Work is now underway to establish international projects within the Advanced Materials Processing (AMP) area.

Third action Item cited: Currently, we have some very successful “pockets” of teaming and leadership development opportunities for our students. Existing programs include course content in numerous classes, such as a psychology course entitled “Teams and Teaming.” The course has now been taught three consecutive semesters with relatively small class sizes primarily comprising engineering students. The student-led CAMP program and the Leadership Development Team are very active, but only reach 20% of the undergraduate population. In June 2005, a team of 9 faculty and staff members spent a week at a summer institute for curriculum development, June 7-11, 2005, in Northfield, Minnesota, where they analyzed existing teaming/leadership activities, identified teaming and leadership techniques and skills that graduating bachelor’s candidates will ideally possess, and mapped out the “gaps” in the undergraduate teaming and leadership development experience. The team returned and briefed campus on a draft action plan for getting a larger percentage of the campus community involved (RR221).

In fall 2005, the team published a white paper on leadership that outlined their vision: As promised in our Mission, all School of Mines students will receive “a well-rounded education that prepares [them] for leadership roles in engineering and science” (RR71). The metaphor of leadership development as a road each person must travel underlies our analysis of how the SDSM&T experience affects students. Figure 5.1 below summarizes current teaming and leadership development opportunities.
<table>
<thead>
<tr>
<th>Status</th>
<th>Classroom Experience</th>
<th>Co-Curricular Experience</th>
<th>Outcomes</th>
<th>Tools/Benchmarks</th>
<th>Recognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>GES115 and GES115M, MSC 101,111 – Intro to Org. Dev. 1st-yr initiatives MEM120 WISE, M&amp;M program, FIRST cohort courses</td>
<td>Orientation Wk. Leadership Dev. Workshop Attendance LDT-Emerging Leaders Institute Freshman Senators MWeek FIRST</td>
<td>Personal awareness Understanding Tech traditions Understanding Gender &amp; diversity issues, Safety/risk management</td>
<td>Myers-Briggs/Colors Story telling LASSI Mouton Rube Goldberg Contest</td>
<td>LDT all campus leadership recognition dinner CAMP Honors Convocation Department and student organizations celebrations/recognition Recognition in Raver, hometown newspapers, Website--</td>
</tr>
<tr>
<td>2nd year</td>
<td>EE 211/212 – Intro to Electrical Engr. CENG 244 – Intro to Digital Systems ME 262 – Product Dev. MSC 201, 211, 290, 291 Space Grant Professional Development Seminar WISE Sophomore Design—NEW</td>
<td>Sophomore Senator *See below All students participate in a co-curricular activity through the Sophomore Design Course--NEW</td>
<td>Involved – all students are in at least 1 extra-curricular activity</td>
<td>Relationship diagrams Myers-Briggs inventory Sophomores mentor freshmen in Rube Goldberg competition</td>
<td>LDT all campus leadership recognition dinner; presentation of rising star award for outstanding sophomore CAMP Honors Convocation Department and student organizations celebrations/recognition Recognition in Raver, hometown newspapers, Website--</td>
</tr>
<tr>
<td>3rd year</td>
<td>IENG 345 – Entrepreneurship PSYCH 331 – Industrial &amp; Org. Psych; IENG 366 Management; ME/EE 351 Mechatronics; MSC 201 ROTC Psych 392, Teaming</td>
<td>CAMP Member Junior Senator *See below</td>
<td>Leadership style and ideology Values – tool? Ethic-Character-Experience in co-curricular-</td>
<td></td>
<td>LDT all campus leadership recognition dinner CAMP Honors Convocation Department and student organizations celebrations/recognition Recognition in Raver, hometown newspapers, Website--</td>
</tr>
<tr>
<td>4th year</td>
<td>Senior Design MSC 331 – ROTC Cadets only New Course – 8 week Capstone leadership experience</td>
<td>CAMP Leadership Dev, Team (LDT); Emerging Leaders Institute; Leadership presentations Gender issues Globalization &amp; Diversity Ethics &amp; Integrity Alumni experiences</td>
<td>Capstone year experience Mentor underclass persons Legacy transition</td>
<td>Oath of the Engineer CAMP team successes</td>
<td>Order of the Engineer LDT all campus leadership recognition dinner—Leadership Hall of Fame Recognition CAMP Honors Convocation Department and student organizations celebrations/recognition Recognition in Raver, hometown newspapers, Website--</td>
</tr>
</tbody>
</table>

Figure 5.1 SDSM&T Teaming and Leadership Development Opportunities 2005.

Students can develop leadership skills by serving in one or more of the following roles: Peer Advisor, Resident Assistant, Student Ambassador, Orientation Leader, Athletic Team Captains, Athletics, ROTC, Leadership Development Team Leaders, CAMP Coordinating Council, CAMP Team Leaders, Student Association, Inter-fraternity Council Members, Greek organization officers, officers and members of the 80 student clubs and organizations (includes social, recreational and professional associations), co-ops and internships.
The following leadership models and opportunities contribute to students’ efforts to develop leadership skills: Faculty members commonly invite leaders in various fields of endeavor into their classrooms to speak to students. The Classroom without Walls is a series of presentations for faculty, staff and students to come together to work on teaming and leadership skills sponsored by the Division of Student Affairs. The campus as a whole also nominates “Outstanding Alumni” who have become nationally recognized leaders, and select alumni are invited three times a year to speak at fall and spring commencements and during Engineers Week.

The following student leadership development tools are available: An on-line Student Organization Handbook http://www.hpcnet.org/studorghandbook gives risk management, organizational, and team-building guidelines; co-op and internship forums; and information on business etiquette dinners.

Our current needs in the area of student leadership development include the following: Safety and risk management; awareness of diversity, gender and global issues; ethical issues.

Fourth action Item cited: The National Science Foundation has funded the creation at SDSM&T of a “Women in Science and Engineering” (WISE) program and a Director was hired in fall 2005. The Director will establish a mentoring program for women based on the successful Mentors and Mentees Program at Purdue University and secure funding for ongoing development of the program. The objective is to establish a women’s mentoring program to increase the retention and recruitment of females in the science, technology, engineering and mathematics (STEM) fields. The broader impact of this project is to increase the diversity of the engineering and science workforce through the increased retention of women STEM students. In the past two years, SDSM&T has added three women in tenure-track engineering faculty positions within the civil, electrical and industrial engineering departments.

Strategic Initiative 3: “Engage and Serve the Broader Community” includes the following Action Item:

- Seek external funding for minority student scholarships and support for under-represented, under prepared, or economically disadvantaged students

The National Science Foundation has recently funded a Research Experience for Undergraduates (REU) grant in which faculty members from multiple engineering departments will work with Native American students.

A Summer Bridge Program (RR180) seeks to improve the success rate for non-traditional students or students with moderate mathematics background not ready to enter the science and engineering curriculum. The first Summer Bridge program, immersing students in both algebra and basic chemistry, was offered for 4 weeks at the end of the summer of 2005. This group consists of students who placed into college algebra rather than calculus. This first group consisted of bright and dedicated students from small high schools (many of which offer only limited advanced math courses) and non-traditional students whose math skills were rusty.

The Bridge Program is based on the belief that such students have the potential to be productive scientists and engineers. However, since many first year engineering and science courses have mathematics prerequisites, they cannot begin the normal course sequence for their intended majors until they have completed college algebra. Thus, they spend their first
year doing little but preparatory work. Many become disenchanted and fail to return the following year. Historical data shows that this group has a less than 4 in 10 chance of graduating within six years. Program objective and outcomes are as follows:

- **OBJECTIVE**: First-time college students that face remediation often experience failure in their first semester of college. The purpose of this program is to provide the opportunity and support to prepare these students for college coursework in chemistry and mathematics.
  - **Outcome 1**: The percentage of Summer Bridge students that pass Bridge classes with a C or better will be ten percentage points higher than the baselines for Math 102 and Chemistry 106 respectively.
  - **Outcome 2**: The percentage of Summer Bridge students that pass Math 120 and Chemistry 112 with a C or better will be ten percentage points higher than the baselines for Math 102 and Chemistry 106 respectively.
  - **Outcome 3**: The percentage of Summer Bridge students that return to campus for the next academic year will be ten percentage points higher than the baselines for Math 102 and Chemistry 106 respectively.

**3rd item of evidence in support of Core Component B**

General education requirements for graduation

**Discussion of 3rd example of evidence**

Our revised general education requirements (RR186) became effective fall 2005; two of the seven broad objectives make explicit reference to diversity:

- *Students will understand the organization, potential, and diversity of the human community through study of the social sciences.* (6 credit hours)
- *Students will understand the diversity and complexity of the human experience through study of the arts and humanities.* (6 credit hours)

Also effective fall 2005 is a new Board of Regents’ globalization/global issues requirement (RR148). Our campus has decided that this requirement must be satisfied by courses at the 300 level or above. Each program has identified one or two courses within the major which meet the following guidelines:

- The syllabus clearly articulates the goals, learning outcomes, and assessments related to global issues.
- The student’s understanding of the issues addressed in the course is evaluated through graded assignments, reports, papers, tests, etc.
- Performance on such assignments contributes to the student’s grade for the course.

ABET Criteria Three for accreditation of our engineering and computer science programs explicitly requires demonstration that our students achieve the following outcomes by graduation:

(h) *the broad education necessary to understand the impact of engineering solutions in a global and societal context*

(j) *knowledge of contemporary issues*

In order to meet ABET accreditation requirements, each program currently addresses global issues in a distributed fashion throughout the curriculum. The adequacy of current efforts to
address global issues in this manner was recently confirmed by the ABET accreditation review team that visited SDSM&T in October 2004.

**Core Component 1c. Understanding of and support for the mission pervade the organization.**

**Evaluative statement for all of Component 1c**

The revised mission statement for SDSM&T successfully guides the everyday workings of the campus, especially in the planning and implementing of new programs. There is general (and growing) support for choices we have made in the investment of time, energy and resources in moving to a new mission and new structure for the University.

**Evidence Cited:**

1. Existing programs and new academic initiatives respond effectively to our mission commitment “to provide a well-rounded education that prepares students for leadership roles in engineering and science” and “to advance the state of knowledge and application of this knowledge through research and scholarship.”
2. Our strategic planning process and the administration’s commitment to shared governance is reflected clearly in funding priorities and decisions.
3. Co-curricular activities are designed to assist in providing a well-rounded education including leadership and wellness skills, as emphasized in the mission statement.

**1st item of evidence in support of Core Component C**

Existing programs and new academic initiatives respond effectively to our mission commitment “to provide a well-rounded education that prepares students for leadership roles in engineering and science” and “to advance the state of knowledge and application of this knowledge through research and scholarship.”

**Discussion of 1st example of evidence**

SDSM&T has always focused on keeping engineering and science at the core of our academic programs. This has been a dynamic process rather than a static identity. The following section cites several examples of such changes.

- In 1996, the Board of Regents designated our Center for Advanced Manufacturing and Production (CAMP) program as our institutional “Center for Excellence,” thereby recognizing that engineering is at the heart of our enterprise. CAMP is comprised of multidisciplinary student-project teams that span multiple class levels. Currently, there are 10 teams involving over 200 students in design and performance competitions on a local, regional, and national basis. All of these teams are involved in engineering challenges such as robotics, aircraft, concrete canoes, helicopters, racecars, and off-road vehicles. The array of projects has expanded over the past several years, and work is now underway to establish international CAMP projects. Donors recognize CAMP as part of SDSM&T’s identity, and Caterpillar Inc. funded the creation of a specialized lab for our student project teams; the lab opened in fall 2000. In addition, in response to an annual request, Caterpillar provides an annual $25,000 gift to fund five $2,500 scholarships for students in mechanical, electrical,
and metallurgical engineering. Each year for the past decade, in addition to these scholarships, Caterpillar has made an annual investment of $12,500 alternating between the mechanical and metallurgical engineering departments for curriculum and faculty development. We are awaiting news from Caterpillar on our request for an additional $10,000 per year for five $2,000 recruiting scholarships for Native American and/or female students.

- Investments in campus infrastructure and equipment also reflect clear support of our research and scholarship mission in science and engineering. To provide a facility to support enhanced engineering education, SDSM&T received legislative approval in 1998 to expend $3.75 million in HEFF funds (Higher Education Facilities Fund, a fund into which 20% of all state support tuition revenue is placed) to renovate the Civil/Mechanical Building. Funds from Title III, the Great Plains Foundation, and the SDSM&T Foundation provided an additional $500,000 for student project and laboratory space dedicated to undergraduate instruction and equipment. Outdated experimental equipment was replaced with commercially available, turnkey, self-contained modular experiments, using state-of-the-art controls and sensors. The Civil/Mechanical building houses departments with total enrollments approaching one-third of the student population on campus. The renovation was completed in 2000, and, in 2005, installation of a Super Sonic Wind Tunnel (SSWT) in front of the building was completed. The SSWT is used for instructional demonstrations and student projects at the junior and senior level and for the mechanical engineering Capstone Design course. It will also be used as a demonstration facility for the mechanical engineering fluid mechanics, Thermo II, gas dynamics courses. Lastly, in April 2005, the Regents approved plans for construction of a new chemistry building. The impact of this investment is discussed below under Criterion 2.

- Programmatic initiatives show our commitment to keeping abreast of advances in knowledge. For example, a new major in environmental engineering has been established (http://www.hpcnet.org/EnvE_selfstudy_04). The traditional mining engineering major has closed and a new degree program in mining engineering and Management established in fall 2004 (RR236). In the institution’s striving to stay abreast of industrial needs and in keeping with our mission, the industrial engineering program has grown from two faculty members to five and the number of students majoring in this discipline is now well over ninety. There has been a realignment of the interdisciplinary sciences program so that the four new specializations it offers, atmospheric sciences; business applications in science and technology; pre-professional health sciences; and science, technology and society, are now in much closer alignment to our mission and reflect the institution’s ongoing commitment to keeping abreast of current educational needs within the scope of our mission (RR66).

- In order to assure that entering freshmen are better prepared to succeed in rigorous engineering and science curricula, the Board of Regents approved higher admission standards for SDSM&T in March 2005. System-wide admissions standards grant automatic admission for students who have an ACT composite score of 18 or better or who have a high school GPA of at least 2.6 or who are in the top 60% of their high school class. Under the new standards approved for SDSM&T only, applicants will be considered for admission if they have an ACT composite score of at least 21 or an ACT math subscore of at least 21 or a high school GPA of at least 2.75. Students whose ACT scores are at least 25 or who have taken four years of high school math and have a high school GPA of 3.5 will be automatically admitted. Other applications will be reviewed by an admissions committee. It is expected that these
higher standards will be phased in and fully operational by fall 2006, and that these changes will result in a student population that is even better prepared to forge successful careers in science and engineering (RR206).

2\textsuperscript{nd} item of evidence in support of Core Component C

Funding priorities and decisions

Discussion of 2\textsuperscript{nd} example of evidence

Over the past two years, frequent campus-wide planning sessions have been held to translate our mission into a shared vision accompanied by goals and specific strategic initiatives. We have also worked collectively to develop action plans to achieve these strategic initiatives. Faculty members, researchers, staff, administration and students have actively participated in these events (RR122 and RR123). Results of the campus-wide planning sessions have been consistently communicated to the campus community through convocations, a campus planning web site, and e-mails (See \url{http://www.hpcnet.org/PresidentCampusPlanning}). As a result, the focus of most campus activities and funding priorities is in support of the strategic initiatives and mission. A few recent examples include the following:

- The SDSM&T Budget Advisory Committee weights 80\% of their funding decisions toward the support and achievement of the institution’s strategic initiatives.
- Consultants were recently retained to develop a campus facilities master plan to help ensure we have the necessary facilities to enable us to provide excellence in engineering and science education and to conduct nationally recognized research.
- In order to prepare for our future as a national player in science and engineering research, a Vice President of Research position was created and filled in June 2004.
- In order to support faculty and student research efforts, reference search engines were purchased with initial $79,000 one-time FY 2005 funding. Examples of these search engines include Engineering Village 2 (Compendex), GeoRef/GeoBase, and Kluwer/Springer.
- A campus-wide retention strategy is being implemented to support the “reshaping the learning and teaching experience” strategic initiative. A Director of Retention and Testing was hired to coordinate these efforts (RR226). Early successes of this program include an enhanced early alert system for at-risk students and the Freshman Introduction to Real Success at Tech (FIRST) program. FIRST was implemented for approximately 100 first time freshman living in the dorms in FY05 and integrates academics and residence hall neighborhoods. Plans are underway to expand the program to include first-year students who do not live on campus. Nationally, these types of programs have shown great success (RR215 and RR216). A new faculty position responsible for first-year experience coordination has been funded and a search is in progress.

3\textsuperscript{rd} item of evidence in support of Core Component C

Co-curricular activities are designed to assist in providing a well-rounded education including leadership and wellness skills, as emphasized in the mission statement.
The SDSM&T co-curricular structure supports the mission of the institution. Leadership and citizenship skills among students are taught and reinforced with a number of campus programs. Student Activities and Leadership involves SDSM&T students in participating and leading in 80 student organizations, including professional societies, six Greek organizations, the Student Association governing body and the Leadership Development Team which offers workshops and speakers on leadership (RR221). The Center for Advanced Manufacturing and Production (CAMP) also is extremely active in promoting teaming, leadership and interdisciplinary collaboration through competitions, training and speakers.

Residence Life offers an on-campus living experience with the Living/Learning/Leading model and sponsors the FIRST program which is a freshman experiential program in which a cohort of students live together in the residence halls, take classes, study, and have orientation programs together in an effort to integrate academic and co-curricular activities (RR215 and RR216). Students also learn leadership through serving on the Residence Hall Council.

The Multicultural Affairs Office, as well as the Multicultural Committee and the Ivanhoe International Center, work to promote domestic diversity and global awareness by recruiting and working to retain international and under-represented American populations with activities and projects that include all students such as bulletin board displays, speakers for Martin Luther King Day, Cultural Expo and the Diwali Celebration (RR212).

Counseling and Student ADA Services, the Dean of Students Office, Career Planning, Campus Ministries and Student Health Services work together to focus on the wellness of students in body, mind and spirit through education, risk management and early intervention with students who have problems. In June of 2005 the institution was granted $284,000 from the Department of Education for two years to address high risk drinking behaviors of 18 to 24 year olds. The grant focuses on: increasing the number, awareness, and participation of alcohol free social and recreational options including late night and weekend programs; developing a comprehensive community alcohol abuse prevention program; developing and implementing an information and education program regarding impact of high risk drinking on future career options; and developing skills of bystanders to recognize and intervene with problem behaviors. The Dean of Students and Student Affairs staff work with great determination to forge educational partnerships with academics to advance student learning and development.

The objectives for the Mentors & Mentees Program (under the Women in Science and Engineering program) for are to share effective strategies that lead women students to successful completion of their engineering education and prepare them for future careers as engineers; to enhance personal support of students through contact with peers, female role models and mentors on a regular basis; and to build confidence in students through affirmation of their skills and values.
Core Component 1d. The organization’s governance and administrative structures promote effective leadership and support collaborative processes that enable the organization to fulfill its mission.

Evaluative statement for all of Component 1d

SDSM&T has three major areas of governance: the SDSM&T administration; the South Dakota Board of Regents; and the Faculty Senate. Within this governance, the institutional governance consists of the Executive Council, the University Cabinet, and the Faculty Senate. The constituencies of the latter three groups are as follows:

**Executive Council**
- President
- Vice Presidents
- Alumni Director
- Foundation Director
- Faculty Senate Chair
- Assistant to the President

**University Cabinet**
- President
- Vice Presidents
- Alumni Director
- Foundation Director
- Faculty Senate Chair
- Assistant to the President
- Deans
- NFE Employee Chair
- CSA Employee Chair
- Student Association President
- Facilities Services Director

**Faculty Senate**
- Chair of the Faculty
- *Engineering Division
- *Science Division
- *Arts Division
- Ex-Officio Members:
  - VPAA/Provost
  - Dean of Graduate Education
  - *(3) Senators elected from each division; a bylaws change is under review which would elect one senator from each academic department

SDSM&T’s administrative structure consists of the president, vice presidents, deans, directors and department chairs:

Many positive outcomes have been realized since July 2003 with the change of presidential leadership. Some of these changes include presidential encouragement to involve all members of the campus in assessing our institutional needs, mission, identity, strategic initiatives, and to support, collaborate and implement the necessary changes identified by the process. Although the members of the Board of Regents have been quite supportive of the new directions at SDSM&T, they continue to be viewed by some as micro-managing and obstructionist. The Faculty Senate was created as a governing body in December of 2003 and is gaining ground in building the trust and confidence of the faculty body.
Evidence Cited:

1. The change in administrative leadership style of the president has been empowering for the campus community and has led to substantial collaboration in assessing the state of the institution.
2. The institutional “system” functions well in encouraging individual efforts and collaboration, especially within our limited resources, relative to the campus, the community, the region, the State, and the nation.
3. There is participatory and shared governance on the campus.

1st item of evidence in support of Core Component D

Change in administrative leadership style of the president

Discussion of 1st example of evidence

Under the guidance of a new president, in the fall of 2003, discussions and planning regarding strategic initiatives, refinement of mission and goals, and a general review of our campus identity, was begun. This effort is coordinated with the ongoing self-study effort and involves numerous committees working on various aspects of the campus organization. A continuing series of all-campus meetings was implemented to provide the campus a means to study, discuss, and make decisions relevant to the campus’ needs. To date, many of the suggested changes identified through this effort have been implemented and supported by the campus and the Board of Regents.

Because the academic structure of the last 15 years was only partially viewed as successful by the four deans, the department chairs, and the faculty at large, the president assigned the HLC Criterion 1 committee, as an additional project, to review the academic structure and to provide him with recommendations representative of the study. As a result of the year-long study by the Criterion 1 committee, the Faculty Senate, and all members of the campus community who elected to become informed and involved, a restructuring plan was announced June 16, 2005 and implementation began on July 1, 2005 (RR223). Under this new plan, two dean searches are underway; the Vice President for Academic Affairs’ duties and responsibilities are now as a Provost; and an Associate Vice President for Academic Affairs position has been added. The guiding goals of this restructuring effort are to improve the leadership and success of the academic mission; this is nearly a cost-neutral event. In August 2005, the Faculty Senate approved the position descriptions for the chairs and deans (RR281).

We consider the following as three very significant achievements under the new style of leadership. In refining “who we are,” SDSM&T has reaffirmed its mission and articulated strategic objectives and institutional goals. We have gained South Dakota Board of Regents’ approval for implementing new admissions standards and have re-defined our nickname, which will be used in advertising and in our public presence, as the “School of Mines.” We are focusing heavily on enrolling and retaining the students who will best reflect our mission.

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2nd item of evidence in support of Core Component D

The institutional “system” functions well in encouraging individual efforts and collaboration, especially within our limited resources, relative to the campus, the community, the region, the State, and the nation.

Discussion of 2nd example of evidence

Members of SDSM&T are involved in numerous collaborative efforts, both internally and externally. Internal collaborative efforts are evidenced by the presence of research centers, the increasing amount and variety of research activity, and job and project sharing between departments. Our internal research centers include the following:

- The Additive Manufacturing Laboratory
- The Engineering and Mining Experiment Station
- The Advanced Materials Processing and Joining Laboratory
- The Center for Accelerated Applications at the Nanoscale
- The Institute of Atmospheric Sciences
- The Computational Mechanics Laboratory
- The Polymer Technology, Processing and Composites Laboratory
- The Ultra-Lightweight Systems Laboratory
- The National Science Foundation Industry/University Cooperative Research Center (NSF I/UCRC) for Friction Stir Processing (SDSM&T is the lead institution in this regional center)

Researchers in industry and from other universities partner with SDSM&T to perform research sponsored by the Army Research Laboratory and the Air Force Research Laboratory. The Center for Advanced Manufacturing and Production (CAMP) is a multidisciplinary educational approach to promote learning and hands-on production in a team-building environment. The paragraphs that follow highlight illustrative collaborative efforts.

In March 2005, the world's leading supplier of molecular nanotechnology tools, Zyvex Corp., selected SDSM&T as the exclusive provider of integrated circuit (IC) failure analysis services to the semi-conductor industry. Zyvex will outsource its testing services to the Center for Accelerated Applications at the Nanoscale (CAAN), located on campus. The Governor presented $250,000 of State funding to the school under his 2010 economic development initiative to make possible the acquisition of the specialized equipment needed to perform research at the nanoscale.

Externally, SDSM&T is working closely with the City of Rapid City’s 2012 Project to: 1) build a connector road to St. Patrick Street which will provide ease in traveling to and from the campus to our Tech Development Lab and enable constituents better access to the economic development business incubator; 2) install artificial turf on the O’Harra Stadium football field, a complex that is shared with the City and the Rapid City School District; and 3) acquire portable bleachers.

Our strong participation in and our hosting of the economic development business incubator is certainly evidence of our local collaborative efforts. In June 2005 ground was broken on campus for an economic development incubator building, a prime example of current town-gown collaboration. The facility, which is funded and will be operated by area economic

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development entities, was originally to be built across town in an industrial park. Discussions between Dr. Ruch and community leaders led to the recognition of the advantages of physical proximity to research activity and an offer by SDSM&T to provide the land for the building.

The Multicultural Committee spent the 2004-05 academic year defining the role of multicultural concerns on this campus, particularly concerning Native Americans. Central to the committee’s work was this issue: how best to recruit, retain, and graduate Native American students in engineering and science. The committee’s complete work, including agendas, committee minutes, and meeting videos, can be found at this web location: http://www.mcs.sdsmt.edu/mcc. Beginning in the 2005-06 academic year, and based upon the initial committee’s work, the Multicultural Committee was subdivided into the following working teams:

- Coordination Team—providing institutional, committee, and team direction
- Student Rights and Responsibilities—providing a safe campus
- Campus Climate—providing a welcoming environment
- Funding—providing necessary financial resources
- Recruiting and Retention—providing student base
- Campus Connection—providing a critical mass for minority/international students

In response to the original charge to the Multicultural Committee, the working teams are in the final planning stages of developing pilot programs to be implemented in 2006-07 academic year.

The Higher Education Center – West River was created in 2004 and located in Rapid City to assist western South Dakota residents pursuing higher education goals. The Center is a collaborative effort of five universities and the local technical institute (each of which has a representative on staff) and is run jointly by SDSM&T and Black Hills State University. The concept is to offer a one-stop shop for all students in the region and to offer the six institutions a clearinghouse to avoid duplicate coursework and facilitate the sharing of professors and curricula. At the center, students can access information about financial aid and application procedures, meet with school representatives, and even take classes. Class offerings support bachelors, masters, and doctoral degrees in a wide range of disciplines.

The alumni of SDSM&T continue to be active partners in furthering the University’s mission and strategic objectives both on a local, regional, and national level.

3rd item of evidence in support of Core Component D

There is participatory and shared governance on the campus.

Discussion of 3rd example of evidence

As previously stated, SDSM&T implemented a Faculty Senate, the governing body that represents the faculty to the administration, under the reign of the new president. This body involves electing three representatives from 3 divisions: engineering, science, and arts/humanities. In addition to its previous membership on the University Cabinet, the chairman of the Faculty Senate was installed by the president as an active governing member of the Executive Council.
The Career Service Act (CSA) employees and the non-faculty exempt (NFE) employees have employee associations and councils that are elected from within their memberships. The associations provide their members information, assistance, and camaraderie. The chairs of each association represent the members’ views on the University Cabinet. The student association is the governing body for the student population and it also holds elections for its senator positions, and its president also serves on the University Cabinet.

In addition to these University Cabinet members, the president, vice presidents, deans, directors of the Alumni, Foundation, Facilities Services and Campus Dining Services, all share in the campus governance. Specifically, the University Cabinet is designed to be all-encompassing and its role is to make decisions on various issues related to the campus and to approve policy.

The Executive Council, comprising the president, the vice presidents, the directors of the Alumni Association and the Foundation, the Faculty Senate chairman, and the assistant to the president, provides executive decisions affecting the campus.

External governance is provided by the South Dakota Board of Regents, which is a governing branch of the State of South Dakota.

The collective bargaining unit for faculty representation within the South Dakota Board of Regents’ system is the Council of Higher Education (COHE).

**Core Component 1e. The organization upholds and protects its integrity.**

**Evaluative statement for all of Component 1e**

*Tech continues to do a good job of expressing, maintaining, and supporting its identity and role in the region, and has taken recent steps to further clarify its role, the constituents it serves, and the image of the institution in the region.*

**Evidence Cited:**

1. Our recently formulated Statement of Purposes, Strategic Initiatives, and reaffirmed Mission
2. Our campus- and Board-level administrative and grievance structures
3. Our clear statements about the external constituents and interests we serve

**1st item of evidence in support of Core Component E**

Our recently formulated Statement of Purposes, Strategic Initiatives, and Reaffirmed Mission

**Discussion of 1st example of evidence**

The entire campus community has participated in two major efforts aimed at clarifying and communicating our Mission.

During 2002-03, the Vice for President Academic Affairs chaired a faculty group charged by the President to formulate a “Statement of Purposes” to lend greater detail and specificity to
our institutional mission. The Statement of Purposes that was developed and approved by the faculty is short but clear and appears above under the discussion of Core Component B. This self-study contains many references to the multiple efforts we are making to uphold this statement, in particular through economic development and research initiatives and efforts to integrate ethics and global perspectives into the curriculum.

Beginning in fall 2003, the entire campus spent a year collaborating on the formulation of our strategic initiatives. These were presented to campus in May 2004 and are being revisited each year thereafter in a continuous quality-control and planning process (RR122 and RR293). Publication of our strategic initiatives coincided with a reaffirmation by the Board of Regents of the mission of the institution. While our mission was not altered, the campus and the community were publicly reminded that we are clearly focused on engineering and science programs and their constituents.

2nd item of evidence in support of Core Component E

Our campus- and Board-level administrative and grievance structures

Discussion of 2nd example of evidence

SDSM&T is governed by a system-level Board of Regents, and the executive staff includes legal counsel for the system; we also use the services of Lynn, Jackson, Shultz, and LeBrun for legal consultations. The Board staff offers system-wide administrative oversight for academic, business, and student affairs; human resources; information systems; research; and the Electronic University Consortium. The personnel who administer these areas hold advisory councils comprised of representatives from all regents’ institutions. The president of the Student Senate also serves on a system-level council and meets regularly with the regents. These dual-level administrative oversight structures and array of peer councils provide an extra layer of accountability.

All laws, rules, regulations, policies and procedures related to governance and personnel are published and/or linked to the SDSM&T Human Resources web site http://www.hpcnet.org/sdsmt/policies, including the Board of Regents, SDSM&T, Administrative Rules of South Dakota, South Dakota Codified Law, and Council for Higher Education (COHE). The institution has clear and separate grievance processes for students, unit faculty, non-unit faculty, exempt employees, and, career service act employees. Since our last institutional review we have had numerous formal and informal grievances that all were resolved at the institutional and/or the Board of Regents level, and in no instance was the University cited for a breach of ethics or policy. The University also received two Equal Employment Opportunity (EEO) charges which were found to have no merit by the EEO.

3rd item of evidence in support of Core Component E

Our clear statements about the external constituents and interests we serve.

Discussion of 3rd example of evidence

Work on our strategic initiatives led to considerable discussion of who, precisely, our external constituents are. A clarification of who SDSM&T serves and how we work in conjunction
with other regents’ institutions in the Black Hills to ensure that the entire region is well served was created and approved in March 2004 (RR181).

In fall 2004 and spring 2005 we retained marketing consulting firms (Noel Levitz and Stamats, respectively) to conduct a marketing and recruitment study and to provide consulting on enrollment management, including recruiting strategy and the redesign of our institutional web site. Their reports were developed during spring 2005 and marketing and recruitment (RR196), and web redesign (RR197) plans were all put into final form by May 2005. Since 2002 we have reinforced our image and our focus through the advertising slogan “preparing tomorrow’s scientists and engineers.” We believe these words fairly represent to the public our activities and commitments.

Questions that arose from the self-study process relative to Criterion 1

1. Early in the self-study process, the committee working on Criterion 1 discovered at least three differing published mission statements. This lack of standardization had resulted from failure to update various publications as the mission evolved or was supplemented with our Statement of Purposes. Currently, a variation of the mission statement published in Board of Regents’ policy appears in the president’s annual report and in our strategic agenda documents. The creation of a Statement of Purposes in 2003 may have added to the confusion some people feel about the mission’s precise wording. Even though mission wording has now been standardized, effort is still needed to make the mission more accessible on the web site, standard in all publications, and better understood across campus and in the community.

2. How well are the new (May 2004 and September 2005) mission and strategic agendas understood by the campus community? Does everyone fully appreciate that significant changes are taking place?

Most significant actions taken relative to Criterion 1

1. The establishment of the all-campus session as central to our strategic planning and self-study process has altered the culture of the campus. Three years after their inception, these five-hour sessions (held three times a year) continue to be very well attended and continue to serve as a vital input from faculty, staff, students, alumni, and community members. Participants even report that they are fun.

2. A reorganization of the campus administrative structure, guided by the goals of our strategic agenda, was accomplished in July 2005. The previous four-college model was changed to a two-college model (College of Engineering and College of Science and Letters). National searches for deans are underway (January 2006) and these individuals should assume their roles in late spring or early summer of 2006.

3. The Chair of the (new) Faculty Senate was made an active member of the President’s Cabinet. Additionally, the Director of the Alumni Association also was made an active member of the President’s Cabinet.

4. The management style of President Ruch has established an inclusive campus atmosphere. There is a feeling of “rebirth” across the campus under his leadership.
5. As a result of much contemplation, and with the assistance of an outside consulting company, the campus “brand” has now been defined as the “School of Mines.” Subsequently the campus logo also has been defined and now has replaced our former usage of the school seal.

**Recommendations for moving forward**

1. Continue to ensure that the most current Mission and strategic agenda statements be presented on our web site, in the SDSM&T Catalog, in the Student and Faculty/Staff Handbooks, and in all campus publications and marketing materials.

2. Revise the SDSM&T web site.

3. Ensure that the new deans and the department chairs function with a thorough understanding of their roles, responsibilities, and authority within the new organizational structure.

4. Keep our eyes, hearts, and minds on our mission and strategic agenda.
Chapter 6:
Criterion Two: Preparing for the Future
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Chapter 6: Criterion Two, Preparing for the Future

The organization’s allocation of resources and its processes for evaluation and planning demonstrate its capacity to fulfill its mission, improve the quality of its education, and respond to future challenges and opportunities.

Brief Overview

The 1996 team evaluation report cited two trends as having potential to negatively impact the institution: demographic shifts and decreasing availability of state funding.

State funding has remained relatively stable, if insufficient; however, the institution has slowly increased external non-state support. In 2005, funding from state appropriations was 28% of actual revenues whereas funding from grants and contracts represented 38% of overall funding. This is the second year that grants and contracts revenue exceeded the state appropriations. Increases in state funding are not expected in the next decade, which means our external funding activities will continue to be critical. We believe SDSM&T has evolved to a new funding model to facilitate growth and development.

The demographic shift has proven more difficult to address. Population models for the state continue to predict a decreasing pipeline of high school graduates, particularly in the western half of the state. The figure of a 12% decline in high school graduates by 2010 is most often cited. We have responded in the past decade by forming collaborations with other institutions, creating an interdisciplinary sciences program to attract a wider audience of students, providing increased support for non-traditional students, and, most recently by raising our admissions standards. These efforts have been effective in keeping enrollments relatively stable, but we predict that these initiatives will not be sufficient. The section below on future trends details our reformulated response to the continuing issue of a diminishing regional student base.

Core Component 2a. The organization realistically prepares for a future shaped by multiple societal and economic trends.

The 10-year accreditation cycle is longer than the relevance of most institutional planning efforts, including ours. Since our last accreditation review, SDSM&T has had to identify and respond to several socioeconomic trends. This section discusses our ability to study trends and to prepare for the future.

Examples of Evidence:

For convenience, the Examples of Evidence for this Core Component address the past and, secondly, the future as follows:

1. **The past decade**, and how we have responded to changes
2. **The next decade**, and our process for identifying and planning for changes we foresee
Background

In spring 2001, our Academic Advisory Board (AAB), completed a year-long effort led by the Vice President for Academic Affairs (VPAA) to identify the top four “drivers” of the future for engineering and science education. The AAB produced a report and set of recommendations which was shared with the faculty, staff, students, and alumni (RR138). This report became the cornerstone for a number of changes and activities.

Part of our multi-year self-study process involved looking back at the trends that had the greatest impact on campus overall. Following the lead set by the AAB report in 2001, the campus engaged the question “what trends have had the greatest impact on campus over the last 10 years” via our all-campus strategic planning sessions. The top four trends that influenced the institution over the past decade are as follows:

1. The drive to increase collaborations
2. The drive toward more experiential learning
3. The drive toward increased accountability
4. The changing needs of industry

The co-chairs overseeing elements of our Strategic Agenda (RR122) and self-study work on Criterion 2 engaged their “working group members” and participants in an all-campus session to assess how we have done at responding to these trends over the last decade. The following are brief summaries of their findings.

1st item of evidence in support of component 2a (our last decade)

In the past ten years, SDSM&T has demonstrated its ability to respond to the changing educational environment by 1) increasing collaborations, 2) increasing experiential learning, 3) increasing assessment activities, and 4) responding to the changing needs of industry.

Evaluative statement for 1st item of evidence

SDSM&T has remained ahead of the curve in some respects relative to increasing collaborations. Technical research collaborations occurred naturally as a result of the progression of cutting-edge research in various fields. The interactions with industry were a natural outgrowth of a committed, and highly successful, alumni base. On the other hand, collaboration between institutions (such as SDSM&T and nearby Black Hills State University) developed much more slowly, and on-campus barriers continued to exist for the development of a common freshman year experience. Faculty development activities were the driving force for investigating pedagogical improvements, and significant changes have occurred in the diversity of teaching techniques used on campus. Increased emphasis on team projects is particularly evident. Although most classes now contain a non-lecture component and team projects have increased, lecture remains the predominant delivery method. Assessment activities, always a part of the institutional culture, have become more organized in response to accreditation requirements and a sharpened focus on learning outcomes. The changing needs of industry have also prompted increased efforts to assess specific learning outcomes (such as teaming skills) that employers expect our graduates to have achieved. The increase in team projects and the success of student teams in various competitions indicate collaborative efforts have been successful. Evaluations of other “soft skills” are still developing.
Discussion of 1st example of evidence

1. Collaboration
Collaborations between departments for teaching as well as research became more common as the cutting-edge of research blurred traditional boundaries. For example, the new Ph.D. in nanoscience and nanoengineering draws upon expertise from a number of departments across campus. In addition, biology teamed with chemistry/chemical engineering to produce a biochemical engineering emphasis within chemical engineering. Following that, a new multidisciplinary Ph.D. program in biomedical engineering was developed and received regents’ approval in December 2005. It now awaits legislative funding.

Collaborations between institutions within the state increased as it became clear that expertise could not efficiently or effectively be replicated at all universities in the system, and actions were taken at the regents’ level to have public higher education in the state function more tightly as a unified system. For example, The Higher Education Center - West River, was created in Rapid City to support collaborative curricular efforts between and among state higher education providers. Additional distance education offerings were developed and available at institutions across the state including courses in physics, geology, and technology management. A number of course redesigns were funded by the governor that encouraged collaboration between faculty members on different campus teaching similar topics.

Collaborations with institutions outside of the state, and outside of the country, have also increased. Development of formal MOUs with the Mongolian University of Science and Technology, China Three Gorges University, and the Indian Institute of Technology regarding the exchange of faculty, students, distance education, and museum specimens are in place and are influencing graduate programs and research activities.

Student collaboration, in the form of an increased emphasis on teaming was developed by SDSM&T in response to the needs of employers. The Center for Advanced Manufacturing and Production (CAMP) program was developed as an interdisciplinary, project-oriented program designed to give students hands-on experience working on teams to solve industrial problems. In addition to the technical expertise gained by participating in CAMP, students have the opportunity to take Psychology 392, Teams and Teaming, taught by a psychology professor, while participating in the engineering projects. The projects within CAMP are described elsewhere, but the program has been highly successful in achieving its goals.

Collaborations with industry were also formed and strengthened in order to keep the curriculum relevant and as a means of increasing non-state funding of research. Notable industrial partnerships include Zyvex, RESPEC, MAPS, and EROS Data Center. Federal research and development partnerships, in particular with the Army Research Lab, have also grown in recent years.

Our collaborations with the local community also increased in the past decade. One such example is the creation of the Rapid City Campuses Community Prevention Coalition (CCPC) in 2004 by SDSM&T, two other postsecondary institutions, and local community leaders. This organization was tasked with addressing high risk alcohol behavior among 18-24 year olds and successfully secured $284,000 in external funding for that effort in 2005 (RR252). The impact of high risk alcohol behavior became particularly clear to the institution and the community with the tragic death of an SDSM&T student in December
2004 from alcohol poisoning. The above collaborative effort seeks to provide education and to prevent additional tragedies.

2. Experiential Learning
Students entering college in the last decade have become less likely to respond to a traditional lecture format as their only means of acquiring knowledge. In response, the theme, of “Improving Pedagogy and the Curriculum,” was selected for a three-year $300,000 Faculty Development Grant (2002-05). Through this and other efforts, project courses, team experiences, internships, co-ops, structured labs that make use of technology, active learning within traditional lecture courses, and other types of group work have increasingly found their way into the curriculum. The first SDSM&T faculty member to use class time for group activity was viewed with skepticism, but now it is common to find in-class activities blended with the lecture format. For example, GES 115, the Professionalism in Engineering and Science course, has been transformed, based on assessment data, to incorporate technology-enabled learning components as the primary means of instruction. Teamed student projects which benefit local industry are now available in senior design courses in all engineering majors. In the last decade SDSM&T has become heavily invested in the co-op experience and strongly encourages students to participate. In 2004, 75% of students graduated with industry experience. As mentioned above, our CAMP program has also provided numerous opportunities for team projects, including opportunities to participate in competitive team activities such as the solar car competition, the mini-indy competition, and the unmanned aerial vehicle team.

3. Increased Accountability
The national trend toward increasing accountability in higher education was identified and acted upon several years ago. The institution had always had a strong, though unorganized, assessment orientation. Exit surveys and exit exams for students, alumni and employer surveys, and industrial advisory boards have been a part of SDSM&T’s culture for decades. However, the lack of a central coordinator prevented the dissemination of best practices within the University, and insufficient research was devoted to evaluating methodologies used externally. Another weakness was the lack of analysis of institutional data. A $1.6 million Title III grant funded in 2000 had a significant impact on our ability to collect and analyze institutional data. Previously, a great deal of data was being collected but the feedback loop was not in place until the last five years. Hiring an assessment officer in 2001 has helped to coordinate assessment efforts and to encourage the use of institutional data. The assessment officer was instrumental in guiding the recent ABET accreditation review visits (EAC and CAC), particularly in defining, gathering, analyzing, and documenting assessment activities relative to criteria a-k. Not all programs are under the auspices of ABET accreditation, but the assessment activities and instruments developed for the ABET programs are used by the non-ABET programs in their state-mandated five-year program reviews.

4. Responding to Changing Needs of Industry
A great strength of SDSM&T is its high placement rate. Close ties with industry and the institution’s ability to develop and change curricula to meet emerging needs are key to this strong point. The institution is small and has a specific focus, so the changes that are made must be compatible with our mission. The significant changes of the past 10 years have been made with the input and support of our constituents – students, faculty, alumni and employers. The Academic Advisory Board (AAB) and the department-level Industrial Advisory Boards are the primary groups that identify potential curricular changes to meet the needs of industry. One example of responding to the needs of industry is the redesign of the
mining engineering program into a B.S. in mining engineering and management. This change was directly motivated and partially funded by alumni and industrial partners. Similarly, the development of a B.S. in environmental engineering and the refocusing of the mathematics degree into applied and computational mathematics were prompted by industry input.

2\textsuperscript{nd} item of evidence in support of component 2a (the decade ahead)

SDSM&T is heading into the future with a solid culture of seeking input from its constituents, reaching consensus on which issues are important, and formulating responses. Our assessments of the future have come from the 2001 AAB report referenced above, a 2002 report by our Alumni Association, the strategic-planning process begun in 2003, five-year plans created by all but a few units in 2004 (RR249 and RR250). Most recently, the AAB took a retrospective look at the report it produced in 2001 and offered its input to the Criterion 2 co-chairs. Our current top four list of trends that guide our planning is as follows:

1. Demographic shifts
2. Funding shifts
3. Technological drivers and emerging disciplines
4. Globalization

Responses have been or are being formulated and are described below.

Evaluative statement for 2\textsuperscript{nd} item of evidence

The strategic planning process has allowed the campus to reach consensus on the likely trends for which we must prepare. The process of identifying key challenges and developing action plans has occurred over a two-year period and has involved input from alumni, employers, advisory boards, students, faculty, staff, and community members. Not all plans have been implemented; for instance, a common freshman experience is still being worked on. And some plans that have been implemented still need to be fine-tuned or even abandoned as we make adjustments in this dynamic environment. The process for acquiring input from all constituents as we formulate responses is definitely in place, well-understood, and well-received by the participants. Not all plans receive universal approval, but a solid mechanism for input which will be heard is firmly established.

Discussion of 2\textsuperscript{nd} example of evidence

1. Demographic shifts
The region and the western half of the state, in particular, are aging. The traditional student base of high school graduates in South Dakota will decease by as much as 25% by 2012. The impact of this trend is amplified for us since a majority of our students currently live within a 100-mile radius. The campus community examined the data in a variety of forums, discussed options, and decided in AY 2004-2005 to address the trend in two major ways:

1. To refocus on our traditional strengths of science and engineering
2. To become the institution of choice for science and engineering regionally

This first decision means concentrating our limited resources on our traditional programs; the second choice involves revamping our approach to recruiting. As of fall 2005, we have moved beyond identifying and discussing these two trends to evaluating and selecting solutions. Universal accord and contentment with the consequences of our decision to refocus on science and engineering does not exist, but all voices were heard prior decisions...
being made. For example, the interdisciplinary science programs have had to increase their emphasis on “hard” science and math. These changes were done with an eye toward the needs of industry, but a significant driver was also renewed emphasis on science and engineering.

Our decision to become the institution of choice regionally for science and engineering has reopened the debate about the relative importance and roles of teaching versus research on campus. In addition, raising entrance requirements and focusing on the best and brightest, while an important step toward becoming the regional institution of choice, poses risks if recruiting is unsuccessful. The decrease in interest in science and engineering careers among high school students may exacerbate the situation. A Summer Bridge program, a Women in Science and Engineering program, and an emphasis on the freshman experience are designed to counter this trend. We believe we will be successful, but we are mindful of the potential pitfalls.

Demographic shifts and declining interest in science and engineering among high school students remain our most daunting challenges. We have responded with structural changes. For instance, we combined admissions with University and Public Relations; we created an Associate Vice-President for Academic Affairs position in order to better enable the Vice President for Academic Affairs to take on provost-level responsibilities; we hired a Women in Science and Engineering (WISE) director; and we are searching for a 1st-year coordinator.

Our academic departments have participated in efforts to ensure that incoming students are prepared and supported. Examples of efforts to prepare and support freshman include the Summer Bridge program, cohort classes, linked classes, and the FIRST program to create freshman living communities in our new dorm. A continuing concern is finding ways to increase the amount of involvement the institution and the faculty have with K-14 students and teachers, particularly math and science teachers. These activities are described in Criterion 5, but they also form an important part of our response to declining interest in science and engineering education.

2. Funding shifts
While there have been no cuts in state funding, increases have been limited generally to modest annual salary increases. Our two sources of increased funding are 1) grants and contracts and 2) alumni and corporate giving. We have been successful in increasing our research funding over the past four years from 18% to 29% of our operating budget, and we successfully concluded our first-ever capital campaign in 2000 by raising $20.4 million (which surpassed the target by over $4 million). Trends that are likely to impact these revenue sources are the changes in priorities in federal grant programs and the rising cost of doing research. We are planning for these inevitable impacts by examining research priorities on campus, preparing for a (tentative) $50 million capital campaign, and finding industrial partners to help build needed facilities.

Significant increases in externally funded research have occurred in the past five years. Major initiatives include the friction stir welding project, under the direction of the Advanced Materials Processing and Joining group (AMP-J); the Center for Accelerated Applications at the Nanoscale (CAAN); and laser deposition research in the Additive Manufacturing Laboratory group (AML). The friction stir welding project (a collaboration of universities, industries, and the NSF) has provided SDSM&T research instrumentation available in just one other location in the world. The Computational Mechanics Lab currently being built was made possible by Army Research Lab funding and will provide students and researchers with
sophisticated modeling capability. Although these and similar efforts have significantly increased the percentage of the operating budget funded from external sources, continued external funding is not assured. Most of the funding for these research activities comes from congressional markups and not from competitive grants. The continuing availability of these funds is tied to political factors beyond our control.

The change in state leadership that occurred in 2002 presaged the recognition by decision makers that the state must broaden its traditional economic base of agriculture and tourism. In 2004, the South Dakota legislature appropriated funding for four new research centers, including $500,000 per year for five years for the Center for Accelerated Applications at the Nanoscale (CAAN). In 2005, the legislature appropriated $423,000 in base funding to the School of Mines for the development of the Ph.D. in nanoscience and nanoengineering. Both the CAAN and the new Ph.D. program were funded as part of a statewide initiative to grow the economy by investing in research.

Industrial partnerships have grown in size, number, and importance in recent years and are expected to form a key element of our growth plans. For example, in 2005 SDSM&T and Zyvex Corp. of Richardson, Texas announced the formation of a partnership in nanotechnology. Industrial partnerships with Caterpillar Inc. resulted in the Caterpillar Student Excellence Center addition to the Mechanical Engineering building in 2000, and a grant from Dow Corning enabled the development of the Corning “design-build-test” M.A.P.S. Laboratory (Materials, Application, Processing, Simulation) dedicated in 2003. A community-funded business incubator is currently being built on campus to provide a framework for research and development plus commercialization of new discoveries, many of which are expected to originate on campus.

The support of our alumni will continue to be an important piece of our financial future. As described in section 2b, the next capital campaign is currently in the planning stages with a tentative goal to raise $50 million. Departments have produced five-year plans which will form the basis for the portion of the capital campaign focused on departmental needs. An exploratory phase of the campaign is now underway, and the President and Foundation representatives are meeting with alumni and potential donors to communicate institutional needs and identify areas most likely to be supported.

3. Technological drivers
As an institution dedicated to science and engineering, technology is an integral part of our ability to deliver a quality education. Discipline-specific needs for computers, instrumentation, bandwidth etc. continue to be evaluated through the departmental five-year strategic plans. The institution as a whole, however, is concentrating on the use of technology to improve pedagogy. We anticipate implementing a campus-wide tablet PC laptop program in fall 2006 and are piloting it now. The challenge remains to find ways to teach faculty how to use new tools effectively in the classroom. The greatest faculty fears are for the loss of content learning and the inability to control how students are using the wireless devices during class. Considerable faculty development funding has been directed toward assisting faculty as they identify effective uses for the tablets in their courses. Technological solutions (network blockers etc.) are being investigated to address the issue of in-class control. A second concern is the development of the appropriate infrastructure that will allow faculty and students to obtain the hardware and user support they need to effectively use the technology. The pilot program will provide the opportunity to determine what infrastructure will be needed.
Two related issues are the pace at which new information is being generated and the rapid development of new areas of science. The increasing pace of change will challenge our ability to maintain complete and current information and retrieval mechanisms, particularly the ability to optimize library holdings, subscriptions, and services. Faculty groups, in particular the Group of Researchers Ready for Real Research Resources (GRRRRRR), are providing input on this important issue, as described under Criterion 4.

As noted above, the institution has a strong record of implementing new programs to produce graduates in emerging disciplines. The redesign of the mining program into a B.S. in mining engineering and management, the B.S. in environmental engineering, the redesigned mathematics curriculum in applied and computational mathematics, the new specialization areas within interdisciplinary sciences, and the development of new Ph.D.s in nanoscience and engineering and in biomedical engineering are examples of the institution’s responsiveness to the need for producing graduates in emerging disciplines. The on-campus process for introducing new courses and new programs is well-defined and well-understood by the faculty. The uncertainty about new programs often stems from systemic concerns raised at the level of the Board of Regents as well as requirements placed on common courses.

4. Globalization

Both the Academic Advisory Board (AAB) and the participants in the campus planning sessions identified globalization as a major trend to which we must respond. The AAB was the first group to describe the problem. In 2001, they outlined the institutional changes they believe are necessary for graduates to successfully compete in a global economy:  

*The key gap that Tech grads have is global perspective, whether it be in coursework, capstone courses, diversity/societal understanding, and appreciation for the total environment they will be working in during their careers. It is imperative that these aspects of their future world are incorporated into liberal arts courses; that formalizes rigorous study of history, world affairs, politics, sociology and other related subjects. In addition coursework must incorporate material on marketing and distribution, environmental law, engineering codes/regulations, global economics and the diversity of teamwork. Technical courses must expand their content to deal with problem-solving options and constraints based on these types of factors. The term PE ("political engineering") may be in everyone’s future.*

The institution has considered how to address this need and has initiated or enabled a number of efforts. In 2005, the Board of Regents introduced a requirement that globalization must be part of every program curriculum. Departments have developed plans for implementing this requirement, primarily through additional topic coverage in senior design courses. In addition, an effort to develop teamed international senior design projects based on the Engineers Without Borders model has begun. Social implications of engineering with a global perspective is being stressed via a speaker series. The first two years of this speaker series were funded internally through faculty development funds. Recently, enterprising faculty members in civil engineering have secured an external funding source for continuing the series ([RR318](#)).

Both student and faculty international experiences have increased. Faculty members frequently travel to institutions in other countries with the aim of developing international collaborations, particularly in Mongolia, India, China, and Africa. A task force has been formed to streamline the process for students studying abroad, and efforts are underway to increase these opportunities for our students. For students who cannot travel abroad, the
International Expo and other activities directed through the Ivanhoe International Center continue to provide a showcase for cultural activities presented by the international students on campus.

**Core Component 2b. The organization’s resource base supports its educational programs and its plans for maintaining and strengthening their quality in the future**

**Background**

SDSM&T resembles many public institutions in that we are facing extraordinary challenges posed by rising costs, value-shopping by consumers, increasing sophistication by every competitor, and limited financial flexibility. Our CFO (the Vice President of Business and Administration) is adapting and adopting new methods of understanding our current and projected financial health.

In 2002, the Governmental Accounting Standards Board (GASB) changed the detailed manner in which universities and related public entities present their annual financial information.

In particular, a significant source of annual revenue for a variety of functions is the SDSM&T Foundation. The Foundation manages and reports financial activity separately from the University’s business office. However, the Foundation financials were included in the comparative ratios for this chapter even though we do not produce combined financial statements. By adding the Foundation information, the metrics present a more complete picture and comply with recent Governmental Accounting Standards Board (GASB) guidelines. This complete picture shows that our financial ratios are within “healthy” range, as suggested by the consulting firm KPMG in their 2002 publication, *Ratio Analysis in Higher Education: New Insights For Leaders In Public Higher Education*.

Beginning in 2002, increases in research activity through federal Department of Defense and competitive state funding sources have provided significant capital and human resource additions to campus. This funding, however welcomed, has been the result of congressional markups and is therefore an uncertain means of sustaining the programs it starts. We have responded to the contingent nature of funding via congressional markup by using the funding we do receive to build capacity. Our faculty is writing more proposals focused toward competitively awarded peer-reviewed research grants. We are investing in leading-edge research and facilities in order to prepare for shifts in funding.

For instance, in 2002 Army Research Laboratory (ARL) funds were used to create an Advanced Materials Laboratory beginning with the acquisition of unique, state-of-the-art material-joining and material-deposition equipment. This investment has increased industrial partnerships, which have, in turn, further increased funding for equipment, personnel, travel, and student scholarships. A second example is seen in our acquisition of a commercial building adjacent to campus and the creation of the Tech Development Lab. With the help of the SDSM&T Foundation and its for-profit branch incorporated in 2004 called Tech Ventures (RR310), the building has been transformed from a 14,000 square-foot vacant shell into the most comprehensive polymer and composite design, manufacture, test, and commercialization facility in the nation. Additionally, ARL funding has enabled construction of the Computational Mechanics Laboratory addition to the Civil/Mechanical building.
Evidence Cited:

1. Financial Ratio Analysis provides a high level assessment of the overall financial health of the institution.
2. Management’s Discussion and Analysis of our finances finds us well positioned for the future.
3. The SDSM&T Foundation has entered into the initial phase of a second major capital campaign.

1st item of evidence in support of component B

Financial ratio analysis provides a high level assessment of the overall financial health of the institution.

Evaluative statement for 1st item of evidence

The Financial Ratio Analysis given below indicates the University is in good financial health. The analysis compares the institution's operating commitments and outstanding long-term obligations to its expendable financial resources over time. These ratios measure the University’s ability to generate overall return against all net resources and, on a short-term basis, to live within its means. The financial details of our affiliated foundation, South Dakota School of Mines and Technology Foundation, are included in these ratio analyses in order to give a fuller, more accurate overall picture of the institution’s financial state.

Discussion of 1st example of evidence

Primary Reserve Ratio: The primary reserve ratio measures the financial strength of the institution by comparing expendable net assets to total yearly expenses. Expendable net assets represent those assets that can be accessed and spent quickly to satisfy obligations. SDSM&T’s primary reserve ratio over the past four years is as follows:

<table>
<thead>
<tr>
<th></th>
<th>FY'05</th>
<th>FY'04</th>
<th>FY'03</th>
<th>FY'02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio</td>
<td>84.9%</td>
<td>80.3%</td>
<td>75.7%</td>
<td>72.0%</td>
</tr>
<tr>
<td>Months</td>
<td>10.19</td>
<td>9.64</td>
<td>9.08</td>
<td>8.64</td>
</tr>
</tbody>
</table>

Expendable net assets have increased by 11% and 14% the past three years primarily due to capital additions and improvements, including King Center Hall of Fame addition, President’s house, Tech Development Lab, Peterson residence hall, central chiller system and track replacement. Total expenses have steadily increased between 5% to 8% each year over the past three years due to increased research and to cover annual salary increases. This ratio indicates SDSM&T has good financial strength and flexibility by showing that the institution could continue to function for over ten months using expendable reserves and without relying on additional net assets generated by operations. The trend indicates the institution’s financial condition has strengthened over time and is above the general industry guidelines for the primary reserve ratio of 61% or 7.3 months.
**Return on Net Assets Ratio:** The return on net assets ratio determines whether the institution is financially better off than in previous years by measuring total economic return. SDSM&T’s return on net assets ratio over the past four years is as follows:

<table>
<thead>
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<th></th>
<th>FY'05</th>
<th>FY'04</th>
<th>FY'03</th>
<th>FY'02</th>
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</thead>
<tbody>
<tr>
<td>Ratio</td>
<td>11.6%</td>
<td>12.9%</td>
<td>13.0%</td>
<td>3.8%</td>
</tr>
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</table>

This ratio indicates a stable rate of return of between ~12% to 13% over the past three years. The Foundation’s investment returns have had the most impact on change in net assets over the past four years. A 6.2% investment loss ($1.5M) in FY 2002 and a 16.2% investment gain ($4.0M) in FY 2004 were significant and out of the ordinary. School of Mines is operating above the return on net assets general guidelines of greater than 5%.

**Net Operating Revenues Ratio:** The net operating revenues ratio indicates whether total operating activities resulted in a surplus or deficit and if the institution is living within available resources. SDSM&T’s net operating revenues ratio over the past four years is as follows:

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<th></th>
<th>FY'05</th>
<th>FY'04</th>
<th>FY'03</th>
<th>FY'02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio</td>
<td>4.3%</td>
<td>3.4%</td>
<td>2.6%</td>
<td>-2.9%</td>
</tr>
</tbody>
</table>

This ratio indicates a positive trend over the past four years with a 4.3% operating surplus for FY 2005. This positive trend is primarily due to the effective management of expenses, increased appropriated revenues due to prior years’ positive enrollment trends, and investment performance. This ratio is currently within the acceptable range of 3% to 5% and has allowed the University to focus financial resources on strategic initiatives in recent years based on prior-year performance.

**Viability Ratio:** The viability ratio measures the availability of expendable net assets to cover debt should the institution need to settle its obligations as of the balance sheet date. The viability ratio is a clear determinant of financial health. SDSM&T’s viability ratio over the past four years is as follows:

<table>
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<tr>
<th></th>
<th>FY'05</th>
<th>FY'04</th>
<th>FY'03</th>
<th>FY'02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio</td>
<td>2.54</td>
<td>2.27</td>
<td>2.34</td>
<td>5.70</td>
</tr>
</tbody>
</table>

This ratio indicates that SDSM&T, as of the balance sheet date, has sufficient expendable net assets to satisfy debt obligations. The institution’s ability to use internal resources to respond to adverse conditions is enhanced with this strong financial indicator, as is its ability to attract capital from external sources and its flexibility to fund new objectives. The reduction from FY 2002 to FY 2003 is attributed to the revenue bond for the new residence hall and student union renovation. SDSM&T has incurred more long-term debt in recent years but still maintains a strong viability ratio, operating with in the general guidelines of greater than 1.28%.

**Debt-Burden Ratio:** The debt-burden ratio examines the institution’s dependence on borrowed funds as a source of financing and the cost of borrowing relative to overall expenditures. It compares the level of current debt service with the institution’s total expenditures. SDSM&T’s debt burden ratio over the past four years is as follows:

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<th>FY'05</th>
<th>FY'04</th>
<th>FY'03</th>
<th>FY'02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio</td>
<td>2.9%</td>
<td>4.2%</td>
<td>1.1%</td>
<td>0.4%</td>
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</tbody>
</table>
This ratio shows there is overall flexibility for the institution to make budgetary tradeoffs in order to finance additional capital expenditures. Increase in the debt-burden ratio from FY 2003 to FY 2004 reflects the liabilities for the new residence hall, student union renovation and upgraded chiller system. The University has operated well within the debt-burden ratio general guidelines of less than 7%.

**2\textsuperscript{nd} item of evidence in support of Core Component B**

Management’s Discussion and Analysis of our finances finds us well positioned for the future.

**Evaluative statement for 2\textsuperscript{nd} item of evidence**

*Management regards the institution as well positioned to maintain its strong financial condition and outstanding service to students, the citizens of South Dakota, and the research community.*

**Discussion of 2\textsuperscript{nd} item of evidence**

Our continued success depends upon 1) our ability to recruit and retain the highest quality students, faculty and staff; 2) on stable financial and political support from state government; 3) on cost and administrative efficiencies; and 4) on growth in federally and externally supported research.

In FY 2005 state appropriations comprised 29\% of total revenues and consistently represent one of the largest sources of funding. The state’s economic outlook is solid, and current projections call for a revenue increase of 4\% for FY 2007. Education represents 25\% or $12.6M of the State’s planned FY 2007 budget increase.

SDSM&T continues to make progress in obtaining grants and contracts, and has increased externally sponsored programs by 26\% in one year, from $12.4M in FY 2004 to $16.2M in FY 2005. A Vice President of Research has recently joined SDSM&T with an expressed commitment to increase research activity for campus. His primary goal of increasing both research and funding for research aligns with the strategic agenda of state government and the Board of Regents.

The administrative management team believes the institution’s financial condition has historically reflected strength and is robust enough to withstand and adjust to economic uncertainties. SDSM&T’s financial position remained strong as of June 30, 2005 with assets of $44.6M and liabilities of $15M. Net assets, which represent the residual interest in the institution’s assets after liabilities are deducted, increased by $3.9M from 2004 to 2005 to $29.6M as of June 30, 2005.

Fiscal 2005 revenues increased from 2004 by 13\%, or $4.7M, while expenses increased 9\%, or $3.3M.

A review of the institution’s statement of net assets as of June 30, 2005 and 2004 show that the institution continues to maintain and protect its strong financial foundation. This financial health reflects the prudent utilization of its financial resources, including careful cost...
controls, conservative utilization of debt, and adherence to its long range capital plan for the maintenance and replacement of its facilities.

Current assets consist primarily of cash and cash equivalents; various research, sales-and-service, and student receivables; student notes receivable; and operating investments. Total current assets increased from 2004 by $.6M, or 10%, to $6.3M as of June 30, 2005, due primarily to increased research activity and related receivables as well as increased bond reserves for auxiliary operations.

Current liabilities consist primarily of trade accounts payable and accrued liabilities. Total current liabilities declined from 2004 by $.5M, or 18%, to $2.1M as of June 30, 2005. The decrease was a result of final settlement of the Tech Development Lab lease obligation and timing of M&R project payments to contractors and vendors. The institution’s current ratio (current assets to current liabilities) of 2.97 times reflects adequate liquidity and sufficient short-term ability to meet its upcoming obligations.

A critical factor in sustaining the institution’s academic and research programs and residential life is the development and renewal of its capital assets. SDSM&T continues to implement its long-range plan to modernize its complement of older teaching/research facilities and residence halls, balanced with new construction.

Final completion of several projects as well as research equipment purchases were the primary drivers for the $3.2M, or 9%, increase in non-current assets from $35.2M in FY 2004 to $38.4 in FY 2005.

The $.4M increase in non-current liabilities from $12.5M in FY 2004 to $12.9M in FY 2005 represents the lease obligation for the new residence hall furniture. Building and infrastructure projects completed in FY 2005 include the new residence hall construction; student union and library renovations; and electrical distribution and central cooling system upgrades. The details are as follows:

- The new residence hall is designed to accommodate 291 beds in traditional and suite-style rooms. It also includes features requested by students, including air conditioning, moveable furnishings, swipe card access, and more electrical outlets and Internet connections.

- The library renovation entailed finishing the top floor of the library building and updating the first floor facilities.

- The central chiller project encompassed the installation of a central cooling system to replace older inefficient systems and effectively provide air conditioning to classrooms, laboratories, offices, and new residence facilities.

- The primary electrical distribution project was a necessary upgrade to the campus’ electrical system.

These capital asset additions were funded by a System Revenue Bond, State of South Dakota Building Authority and Board of Regents Higher Education Facilities Fund (HEFF).

Construction in progress at June 30, 2005 totaled $1M and includes the Computational Mechanics Laboratory (CML) construction and the Technology Development Laboratory
(TDL) renovations. The CML is a computational facility with advanced hardware and software that is designed to bring together sophisticated methods of structural and applied mechanics, computer science, and applied mathematics for the solution of complex engineering problems. This project was completed during the winter of 2005. The TDL renovation encompassed building modifications to accommodate the needs of the Polymer Technology Processing and Composites Laboratory and was completed summer 2005.

Net assets represent the residual interest in the institution’s assets after liabilities are deducted. Net assets invested in capital assets represent the institution’s capital assets net of accumulated depreciation and outstanding principal balances of debt attributable to the acquisition, construction, or improvement of those assets. The $3.8M, or 15%, increase from $25.7M in 2004 to $29.6M in 2005 reflects the continued development and renewal of capital assets, in accordance with its long-range capital plan.

Restricted net assets are subject to externally imposed restrictions governing their use. This category of net assets includes $.7M of primarily federal loan program funds. Although unrestricted net assets are not subject to externally imposed stipulations, nearly all of the institutions unrestricted net assets have been committed for various future operating budgets related to academic and research projects and initiatives, as well as capital projects.

The statement of revenues, expenses, and changes in net assets presents SDSM&T’s results of operations. In accordance with GASB reporting principles, revenues and expenses are classified as either operating or non-operating. A summarized comparison of SDSM&T’s revenues, expenses, and changes in net assets for the years ended June 30, 2005 and 2004 is shown in figure 6.1 below.
Condensed Statement of Revenues, Expenses and Changes in Net Assets for the years ended June 30, 2005 and 2004

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2004</th>
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</thead>
<tbody>
<tr>
<td>Operating revenues:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Student Tuition and Fees</td>
<td>$ 8,463,818</td>
<td>$ 7,904,672</td>
</tr>
<tr>
<td>Sponsored Programs</td>
<td>$ 15,122,996</td>
<td>$ 12,418,987</td>
</tr>
<tr>
<td>Net Auxiliary Enterprises</td>
<td>$ 3,329,679</td>
<td>$ 2,964,696</td>
</tr>
<tr>
<td>Other</td>
<td>$ 704,511</td>
<td>$ 657,817</td>
</tr>
<tr>
<td>Total operating revenues</td>
<td>$ 27,621,005</td>
<td>$ 23,946,172</td>
</tr>
<tr>
<td>Operating expenses</td>
<td>$ 37,743,356</td>
<td>$ 34,838,171</td>
</tr>
<tr>
<td>Operating loss</td>
<td>$(10,122,351)</td>
<td>$(10,892,644)</td>
</tr>
</tbody>
</table>

| Nonoperating revenues (expenses): | | |
| General fund appropriation | $ 11,721,256 | $ 11,415,221 |
| Supplemental state appropriations | $ 623,059 | $ 743,780 |
| Net investment income | $ 58,435 | $ 127,097 |
| Contractual expense | - | - |
| Interest expenses | $(422,544.98) | $(429,260.97) |
| Capital appropriation | $ 1,528,034 | $ 1,195,501 |
| Capital grants & contracts | $ 1,057,320 | $ 443,259 |
| Loss on disposal of capital assets | $(590,449) | $(237,969) |
| Net nonoperating revenues | $ 13,975,110 | $ 13,257,628 |

| Change in Net Assets | $ 3,852,759 | $ 2,364,983 |
| Net assets, beginning of year | $ 25,777,265 | $ 23,412,282 |
| Net assets, end of year | $ 29,630,024 | $ 25,777,265 |

Figure 6.1 Comparison of net assets for FY 2005 and 2004

Figure 6.2 below illustrates SDSM&T’s revenues by source (both operating and non-operating), which are used to fund activities for the year ending June 30, 2005:

Figure 6.2 SDSM&T’s revenues by source (both operating and non-operating)
Tuition and state appropriations are the primary sources of funding for the institution’s academic program and represent approximately 48% of overall revenues. Net student tuition and fee revenue increased $559k or 7% from 2004 to 2005. This increase is primarily attributable to an 8% increase in student fee rates, off-set by a 2% decline in credit hours. Also contributing to the increase in student fees and tuition was a 9% increase in system-allocated tuition for instructional formula and salary policy, with a slight off-set for performance incentives.

SDSM&T also receives 38% of overall revenues for sponsored programs from government and private sources, which normally provide for both the direct and indirect costs of performing these sponsored activities. Revenues for sponsored programs increased from 2004 by 26%, or $3.3M, to $16.2M in 2005. This increase is primarily attributed to additional grants from the Department of Defense for various research projects and the State of South Dakota Governor’s 2010 Initiative for the Center for Accelerated Application at the Nanoscale (CAAN). Auxiliary enterprise revenues were earned primarily from residence halls, bookstore, and dining facilities.

SDSM&T experienced recent enrollment declines as a result of the challenges most South Dakota institutions are experiencing with declining South Dakota high school graduate population and stiff scholarship competition. The impact of these challenges is reflected in Figure 6.3 below.

![FTE Enrollment Trend](image)

**Figure 6.3** Enrollment trends 1999 to 2005

Current enrollment challenges are a primary focus of the management team. SDSM&T is allocating additional resources to new recruiting strategies and increasing scholarships. Stamats Communications Inc., a marketing consulting firm specializing in colleges and universities, was recently engaged to assist with enrollment and marketing strategies. In October 2005 an initial draft of a Strategic Enrollment Management plan (SEM) was published, and the campus is now in the process of reviewing the plan (RR289). The SEM will be a focus of discussion for our February 2006 all-campus meeting.
SDSM&T is committed to recruiting and retaining an outstanding faculty and staff and the compensation package is one way to successfully compete with peer institutions and nonacademic employers. The resources expended for compensation and benefits increased from 2004 by 6%, or $1.3M, to $22.6M in 2005. This increase is comprised of an annual compensation increase of 3% and the hiring of additional employees, primarily research scientists.

Contractual services expense increased 34% from 2004, or $1.8M, to $7.1M in 2005. This increase is primarily due to lease payments for the Tech Development Lab, increased utility rates, and realignment of contracted janitorial and maintenance costs to reflect increased square footage. Due to reduced amount of maintenance and repair as compared to the prior year and stability of research growth, supplies and materials expense declined 19% from 2004, or $.8M to $3.4M in 2005.

The 29% increase from 2004 in depreciation expense is due to the significant increase in capital additions in the past year. In addition to their natural classification, it is also informative to review expenses by function. The following is a graphic illustration of operating expenses by their functional classification:
Instruction, research, and public service expenses increased 3.2% from 2004, or $.6M, to $19.2M in 2005 due to 4% increases in instructional compensation and research growth (net of capital purchases) off-set by a decline in public service activities. Institutional and academic support expenses increased 11% from 2004 due to annual compensation increases, marketing and enrollment initiatives, research-reference search engines, accreditation reviews, and class room presentation technology.

Student services expenses increased 7%, or $.2M, from 2004 to $2.5M in 2005 primarily due to annual compensation increases and increased athletics spending to accommodate Title IX requirements. Plant-related expenses increased from 2004 48%, or $1M to $3.1M as a result of increased utility expenses and the facilities contract realignment with Aramark to cover increased square footage.

SDSM&T’s cash and cash equivalents declined from 2004 by $1.2M primarily due to use of funds for capital acquisitions and related financing activities. This decline was slightly off-set by positive flow of funds received from operations and state appropriations in support of operations. Cash received from operations primarily consists of student tuition and fees and sponsored programs grants and contracts. Significant sources of cash provided by non-capital financing activities, as defined by GASB, include state appropriations used to fund operating activities. Cash and cash equivalents declined by $1.2M in 2005, as compared to a decrease of $4.3M in 2004. This fluctuation primarily results from the timing of financing received and then use of funds for the new residence hall and student union renovation. These projects were completed by fall 2004.

3rd item of evidence in support of Core Component B

The SDSM&T Foundation has entered into the initial phase of a second major capital campaign.
Evaluative statement for 3rd item of evidence

The SDSM&T Foundation, a 501 c(3) corporation, exists solely to support the mission of SDSM&T. The second major capital campaign in the University’s history is now underway. This campaign, like every major university campaign, will be a multi-stage process with tentative completion date set for 2010. Internal and external (consultant) evaluation of the University’s preparedness for a campaign and the likelihood of success have been positive enough to encourage us to proceed into the feasibility study phase.

Discussion of 3rd item of evidence

The level of support the University received from 1995 to 2000 via our first-ever major capital campaign was exceptional because of its newness and because of market timing. In 2000, the SDSM&T Foundation completed the Vision 2000: Leadership for the Next Century campaign. The $16 million goal was exceeded by 27% for a total success of $20.4 million. Cash gifts accounted for 37% and endowed gifts for 63% of the funds raised through the capital campaign. Donors directed 41% of funds raised to scholarships/fellowships, and 41% was directed by donors to department/laboratory support. Unrestricted funds accounted for 10% of the total, and 8% was directed by donors toward endowed faculty support.

The number of endowments for scholarships or fellowships grew from 137 to 206. Therefore, 69 new scholarship endowments were created for a 74% increase in endowed awards. During the campaign period, Foundation policy set the minimum level of support for named endowments at $25,000. The number of department endowments grew from 12 to 31. Therefore, 19 new endowments to support department or laboratory operations were established. Total faculty endowment awards increased by 47% with the creation of one endowed chair ($1.3 million gift) and a total of seven endowed professorships ($100,000 minimum total gift accumulation each).

The total number of alumni or friends giving at $1,000 or greater was 858 or approximately 7% of living alumni. Of those, 251 gifts were at or greater than $10,000. Of those, 59 gifts were at or greater than $100,000, with 3 gifts greater than $1 million in the period 1995 through 2000. The total number of companies or foundations giving at $1,000 or greater was 241. Top-level gifts were as follows: 36 gifts at $10,000 range; 24 gifts at the $25,000 range; and 15 gifts at the $100,000 or greater range. The Kresge Foundation made a gift of $500,000. Total gifts from administration, faculty, and staff at $1,000 level or greater was 116, or approximately one third of the campus. Top-level gifts were as follows: 10 gifts in the $10,000 range; 10 gifts in the $25,000 range; and 6 gifts in the $100,000 or greater range.

Figure 6.6 below summarizes Institutional Support through the SDSM&T Foundation and the growth in SDSM&T Foundation assets since 1997.
Significant support for individual programs is provided through funds raised by the SDSM&T Foundation. Program support provided through Foundation funds is summarized in Figure 6.8.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>FY 02</th>
<th>FY 03</th>
<th>FY 04</th>
<th>FY 05</th>
<th>TOTALS</th>
</tr>
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<tr>
<td>Salary, Consulting, Honorariums</td>
<td>$196,739</td>
<td>$285,385</td>
<td>$244,067</td>
<td>$414,908</td>
<td>$1,141,098</td>
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<tr>
<td>Operations</td>
<td>$338,818</td>
<td>$202,862</td>
<td>$365,139</td>
<td>$198,260</td>
<td>$1,105,079</td>
</tr>
<tr>
<td>Travel, Conference Fees, Memberships</td>
<td>$170,943</td>
<td>$188,105</td>
<td>$151,434</td>
<td>$182,778</td>
<td>$693,260</td>
</tr>
<tr>
<td>Capital Improvements</td>
<td>$21,228</td>
<td>$560,378</td>
<td>$194,777</td>
<td>$776,383</td>
<td></td>
</tr>
<tr>
<td>Computer Equipment &amp; Software</td>
<td>$45,695</td>
<td>$92,459</td>
<td>$62,050</td>
<td>$70,772</td>
<td>$270,977</td>
</tr>
<tr>
<td>Equipment/Lab Equipment</td>
<td>$410,464</td>
<td>$179,134</td>
<td>$84,454</td>
<td>$146,378</td>
<td>$820,431</td>
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<tr>
<td>Office Furniture</td>
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<td>$11,085</td>
<td>$15,202</td>
<td>$27,885</td>
<td></td>
</tr>
<tr>
<td>Scholarships, Fellowships, Awards</td>
<td>$1,114,936</td>
<td>$934,942</td>
<td>$826,977</td>
<td>$891,437</td>
<td>$3,768,292</td>
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<td>Student Assistance In-Kind</td>
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<td>$8,249</td>
<td>$5,092</td>
<td>$4,989</td>
<td>$22,471</td>
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<tr>
<td>General Support In-Kind</td>
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<td>$332,110</td>
<td>$66,693</td>
<td>$23,891</td>
<td>$679,006</td>
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<tr>
<td>TOTALS</td>
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<td>$2,246,072</td>
<td>$2,377,371</td>
<td>$2,143,392</td>
<td>$9,304,883</td>
</tr>
</tbody>
</table>

Figure 6.8  Foundation program support
SDSM&T administrators, department chairs, and program directors have articulated cases for support and the intended areas of investment for the next capital campaign. The early projection is that $50 million will be the goal of this campaign. The actual goal will be determined after the feasibility study phase (August 2005 through May 2006) of the campaign. In 1994, the feasibility study phase of the Vision 2000 campaign at the institutional level found that the University did not have a well-developed statement of purpose, focus, and direction with respect to good reasons why alumni or corporations should invest via charitable gifts. The appeal of the Vision 2000 campaign was very general and was carried forward by a small number of people. The success resulted from the combination of 1) perfect market timing and 2) a large number of alumni who feel a genuine allegiance to their alma mater but had never been invited to give.

With the arrival of President Charles Ruch in July 2003, SDSM&T began a participatory process for identifying institutional goals and the strategic initiatives. This has been a labor-intensive process that involved getting every academic department to articulate a “business plan” detailing 1) what they currently do, 2) what they could do, 3) what they plan to do, and 4) what it will take to get them there. Some departments developed business plans with more investor appeal than others, but the fact that the campus, with assistance from the Foundation, has a menu of plans to share with potential investors differentiates this campaign from the last. Alumni “allegiance” remains strong, but fund raising nationwide is more difficult than ever. Both personal/family/planned giving and corporate giving are down nationwide, and the uncertainties of the stock market will likely continue to depress charitable giving. We hope to compensate for these trends by using a teamwork approach that involves key faculty members working alongside administrative staff.

The same consulting firm that assisted in the first campaign has been awarded the contract to assist in this second campaign. A major task for this firm, Braren, Mulder, German and Associates from Davenport, IA, will be to determine the feasibility of raising $50 million between 2005 and 2012. The stages of the campaign will be as follows: internal audit, case preparation, feasibility study, development of campaign organization, enlistment of leadership, identification and solicitation of advance gifts prospects, launching event and public announcement (with at least 50% of goal identified), solicitation, follow up and progress reports, and finally announcement of the successful campaign. The campaign feasibility study case book will be available in hard copy to the visiting team and is summarized in RR311.

Intended areas of investment for a $50 million campaign are currently defined as follows:

- Endowed Faculty Chairs $15 million
- Scholarships $10 million
- Capital Improvements $15 million
- Enhancing the Student Experience $10 million

**Core Component 2c.** The organization’s ongoing evaluation and assessment processes provide reliable evidence of institutional effectiveness that clearly informs strategies for continuous improvement.

**Evaluative statement for all of Component 2c**

_Evaluation and assessment activities are integrated into all levels of operation of the institution. The assessment culture that has now become pervasive was primarily driven by_
accrediting agencies. That shift met with resistance at the department level in its initial stages but has, with varying degrees of success, been adopted by all areas of the University. The institution-level assessment activities had been hampered by a lack of systematic data gathering and analysis capability, but a $1.6 million dollar Title III grant received in 2000 provided the funding necessary to implement the needed systems. Hiring an assessment officer also provided much needed coordination between assessment activities within departments and provided a focal point for institutional data gathering. Reliable evidence of institutional performance is now routinely gathered and analyzed. Using this data, weaknesses are identified and programs are implemented to address these concerns. Examples of initiatives which have been implemented as a result of data gathered are provided below. Some of these initiatives are too new to evaluate, but a process is in place to determine how well they are meeting the identified need or weakness.

Background

Evaluation and assessment activities are integrated into the operations of all levels of the institution. Data is collected which allows comparisons with other institutions within the state, with peer institutions, and with programs and departments across the country. Comparisons with peer institutions, identified as being similar in character, are done through the use of “dashboard indicators” discussed below. Another source for institutional comparisons within the state is the Board of Regents Fact Book published each year (http://www.sdbor.edu/publications/). Only one other institution in the state, South Dakota State University’s engineering college, is a member of our peer group, but the Fact Book provides insight into student attributes, revenues and expenses, and changes in those areas. Other sources of comparative data include the results of the Collegiate Assessment of Academic Proficiency examination, published by ACT and used to assess mid-career student performance, (RR14); the Student Satisfaction Inventory© (RR120, RR121, and RR190) produced by USA Group Noel-Levitz, Inc.; The National Survey of Student Engagement (RR80); and the recommendations of the institutional Academic Advisory Board (AAB) discussed under Criterion 2, Core Component A (RR138).

Prior to 2000, the collection and analysis of institutional data was not centrally organized. A Title III grant allowed the institution to develop the infrastructure capable of tracking the necessary information and generating summary reports used for planning purposes. Hiring an assessment coordinator was another significant step in improving our collection and use of institutional data.

At the program level, external accrediting agencies such as ABET provide detailed recommendations which are used to enhance the quality of those programs. Industrial Advisory Boards also provide important feedback to programs and departments. Gathering data, analyzing it, and acting upon it to improve the institution, programs, or individual courses is an accepted, and expected, part of all operations in the institution. Although these efforts have become more rigorously documented and more coordinated in the past five years, assessment activities have been a part of the University’s culture for many years.

Evidence cited:

1. Institutional assessment through collection of peer institution data
2. The presidential all-campus review sessions held three times a year
3. Program-level assessment through ABET

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4. Department-level assessments of courses and faculty

1st item of evidence in support of Core Component C

Peer institutions have been identified and data collected to allow comparison between SDSM&T and similar institutions.

Discussion of 1st item of evidence

Identifying “peer” institutions and systematically analyzing data from these institutions and our own has highlighted potential areas for improvement. Data on a cohort of 12 schools, including SDSM&T, is collected and analyzed. The peer institutions we have identified are as follows:

- South Dakota State University, College of Engineering (SDSU/Eng)
- Colorado School of Mines (CSM)
- Oregon Tech
- Montana Tech (MT Tech)
- Michigan Tech (Mich Tech)
- New Mexico Tech
- University of Nevada, Reno (UNR/Eng)
- University of Missouri, Rolla (U of MO-Rolla)
- Stevens Institute of Technology (Stevens IT)
- Rose-Hulman
- Illinois Institute of Technology (ITT)

Examples of data collected and comparisons made are presented below. These data highlight some of the institution’s strengths and weaknesses through comparisons with institutions we evoke as “peers” in the sense that we aspire to replicate the performance of some of them in key areas. No “peer” is a perfect match; however, the University of Missouri, Rolla is perhaps the most closely matched of the 11 institutions listed above. Clearly, much of the success story we believe we can tell for SDSM&T is relative to the resources and funding available. In comparison to the 11 “peer” institutions we use in the comparisons given in Figures 6:9, 6:10, 6:11, and 6:12 below, the total number of research and development dollars for SDSM&T ranks eighth, but on a per-faculty basis the ranking jumps to sixth.

In the classroom, SDSM&T has several strengths to mention. In comparison to the average for peer institutions, SDSM&T has a higher percentage of staff that are classified as instructional, a higher percentage of full-time instructional staff, and a higher percentage of SDSM&T faculty members who have Ph.D.s (RR152). The National Survey of Student Engagement (NSSE) indicates that, in comparison to national averages, SDSM&T students say that their courses are more challenging, involve more collaboration with classmates outside of class, require more study time outside of class, involve solving complex real-world problems more often, and provide more opportunities to work with faculty on research (RR78 and RR79).

These same NSSE results also clearly show us areas that need to be improved. For instance, the NSSE and other data indicate students do not receive sufficient writing experience in their classes. In response, a writing component has been added to every major, and communication skills improvement is included in the 2005-06 iteration of the strategic agenda action items. More significantly, NSSE data tell us that our 1st-year students do not
experience as much “engagement” (as measured by four of the five NSSE benchmark scores) as other science and engineering students nationwide (RR309). By the time students become seniors, their experience of “engagement” is on par with science and engineering students nationally; however, the scores at the freshman level have motivated much of the work currently underway to increase the use of active-learning techniques by faculty members and to create a coherent 1st-year experience.

Between 2003 and 2005, the Executive Council also worked to identify a set of “dashboard indicators” for the institution to monitor yearly as another means of identifying potential areas for improvement. These data were included in the 2005-06 strategic agenda (RR293) and are grouped according to our four strategic initiatives. These data indicators will be reported to the campus each year with renewed publication of the strategic agenda.

Figures 6:9, 6:10, 6:11, 6:12, and 6:13 below summarize the data we have examined on SDSM&T and the 11 institutions we regard as “peers” for the purposes of continuing to confirm our course or to set stretch goals for the institution.
<table>
<thead>
<tr>
<th>University</th>
<th>Enrollment</th>
<th># of Freshman</th>
<th>Financial Aid</th>
<th>Financial Aid/ # of Students</th>
<th>Tuition &amp; Fees (per semester)</th>
<th>Tuition &amp; Fees (per semester)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>U.G.</td>
<td>G.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SDSM&amp;T</td>
<td>2,094</td>
<td>383</td>
<td>731</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>CSM</td>
<td>2,585</td>
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<td>600</td>
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Figure 6.9 Peer data on undergraduate programs, 2003
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<th>University</th>
<th>#BS</th>
<th>#MS</th>
<th>#PhD</th>
<th>Common Fr. Yr.</th>
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<td>SDSM&amp;T</td>
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Figure 6.10 Peer data on enrollment at peer institutions, as based on institutional Web Pages, fall 2003

Criterion Two 92
<table>
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<tr>
<th>University</th>
<th>Faculty #</th>
<th>Ratio</th>
<th>R&amp;D $ 2001</th>
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<td>$17,115.00</td>
<td>43+</td>
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<td>$30,994.10</td>
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Figure 6.11 Peer data on academic indicators at peer institutions, fall 2003
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<td></td>
<td></td>
<td>(~30%)</td>
<td></td>
<td>(figures reflect 2.21% of U of MO system)</td>
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Figure 6.12 Peer data on development at peer institutions, as based on institutional Web Pages, fall 2003
Figure 6.13 Peer data on 1st- to 2nd-year retention and 6-year graduation rates
This data collection and analysis does result in a process of continuous improvement on campus. For example, analysis of enrollment trends showed we were losing more students between the freshman year and the sophomore year than peer institutions. At the May 2005 all-campus meeting the Vice President for Academic Affairs described to the campus how our retention and six-year graduation rate goals were set, in part, through comparison with the data collected on the University of Missouri, Rolla.

The institution has worked to improve retention in a variety of ways. First, a mentoring program was developed. Mentors are faculty members who have been selected to work with first-time freshmen because of their special interest in and commitment to new students. In addition to being the academic advisors for these first-time students, mentors provide encouragement, personal guidance, and a bridge to university services and resources that first-time students may be reluctant to seek out on their own. SDSM&T's mentors build bonds with these first-time undergraduate students through summer orientation mentoring sessions; through a weekly mentoring course (GES 115M) that is connected to the freshman introduction to science and engineering (GES 115) academic course; through social interactions; and through individual meetings during the semester.

In addition, increased emphasis was placed on advising and advisor training for all faculty members. New faculty orientation contains a section on academic advising, and for the past ten years, current faculty members have been able to participate in advisor training each semester. This has been particularly important as the University moved to on-line registration and automated degree checks. Each faculty member also possesses an advisor’s manual which is updated annually and which will be available on-line beginning fall 2005. Other advising material has been made available on-line through the Title III grant. As an example, [http://www.sdsmt.edu/titleIII/index.htm](http://www.sdsmt.edu/titleIII/index.htm) provides a link to advising resources.

Third, a peer advising program was initiated which provides advising help from upper-level students. Peer advisors provide a wealth of practical information to their peers, particularly with respect to appropriate course loads. The common problem of students wanting to take too many classes is most effectively addressed by those who have recently taken the courses.

Fourth, a review of academic advising was initiated fall 2005. Information gleaned from a series of focus groups with students, faculty, and staff will complement the data from the SSI and NSSE as we determine which aspects of advising are of concern to students and faculty. Our goal is to make advising more effective campus wide and more satisfying for our students.

Finally, our still developing freshman experience program and the freshman coordinator search we have underway (discussed in Criterion 3) are designed to address the retention issue. In spring 2003, the Vice President for Academic Affairs organized a campus-wide group that participated in Phase 1 of the Hallmarks of Excellence in the First Year of College (later renamed the Foundations of Excellence® ) project sponsored by the Policy Center on the First Year of College and supported by the Lumina Foundation for Education ([www.fyfoundations.org](http://www.fyfoundations.org)). This effort was carried forward into the 2003-2004 academic year with the engagement of a former faculty member to continue the project even though we had not been selected for Phase II. In 2003-2004 all aspects of the first-year student experience were studied ([RR45](RR45)) and in 2004-2005 the co-chairs for Criterion 3 took up leadership of the group as restructuring the first year became an institutional strategic initiative. In spring 2005, we submitted a STEM Talent Expansion Program (STEP) grant that included funding to hire a first-year coordinator and to partially fund a summer 2005 “Bridge” program. We
did not receive the STEP grant; however, we did received $20,000 from the Great Plains Foundation to fund the 2005 summer Bridge program. And, in spring 2005, the University Budget Advisory Committee approved a request for institutional base funding for the coordinator position. The search is still underway for a first-year coordinator.

A retention plan was previewed in May 2005 which proposes to improve student engagement in the learning process, strengthen student bonds to the campus, further improve advising, increase tutoring opportunities, and help students explore career goals (RR226). Final recommendations from the Retention Committee were submitted November 1, 2005 (RR313).

2nd item of evidence in support of Core Component C

Program-level assessment through ABET provides a framework for assessment of program effectiveness.

Evaluative statement for 2nd item example of evidence

The most recent ABET visit evaluated nine programs: civil engineering, chemical engineering, computer engineering, electrical engineering, environmental engineering, geological engineering, industrial engineering, metallurgical engineering, and mechanical engineering. The ABET 2000 criteria defines a framework within which each accredited program must have a sophisticated and ongoing process for assessment. All constituents of the program must be consulted; program objectives and outcomes must be defined and assessed; and each program must “close the loop,” that is, demonstrate that continuous improvements are made as a result of the data gathering and assessment.

The September 2004 team review was our first visit under the “new” ABET2000 criteria. All currently accredited programs were re-accredited without any citing of weaknesses or deficiencies. Environmental engineering is a new program and was applying for accreditation in 2004. A deficiency was cited in coverage of topics in the curriculum, and steps are being taken to correct this deficiency. All assessment programs met ABET standards, although some were cited as being stronger than others, and, as mentioned above, some will undergo refinements to respond to specific recommendations. Some assessment programs were cited as being too new to have closed the loop. Other programs were commended for having successfully made the shift to an assessment culture. In sum, ABET criteria continue to be important drivers in program-level assessment processes at SDSM&T.

Discussion of 2nd item of evidence

Each program is required to provide an outside evaluation of the program to the state every five or six years. Most programs fulfill this requirement through ABET accreditation, but other programs, such as mathematics or any of the graduate programs, hire consultants to evaluate their programs. The most recent ABET self-studies can be found at http://www.hpcnet.org/ABET2004Self-Studies. Examples of non-ABET program evaluation can be found at RR18, RR23, and RR246. Every program receives an external review and every program participates in program-level assessment in preparation for these visits.

Program-level assessments are also provided by Industrial Advisory Boards. Many suggestions are program specific, but, when multiple boards express the same concern, an
institutional response may be required. For example, several boards and departmental industry contacts encouraged the creation of a center for multicultural affairs and a “Women in Science and Engineering” (WISE) program to increase minority participation in science and engineering at SDSM&T. Recruiters and board members noted that SDSM&T lacks the diversity of graduates so important to industry. In response, grant funding was secured to create a Mentors & Mentees (M&M) program, to create a WISE program office, and to fund a WISE director (RR191). The M&M program, modeled after the successful program of the same name developed by Purdue University, is the cornerstone of the newly created WISE program office. The WISE program office will provide an evolving array of services to recruit women students to our campus as well as support and retain those already enrolled. The director of the WISE program will be assisted by both an internal and an external advisory board. The internal advisory board is a group of five faculty members, two students, and one representative from student affairs. The external advisory board may include representatives from industry, government and academia. Both boards are tasked with aiding in the vision, direction, and resource collection necessary to sustain effective program.

National instruments are another source of assessment data for programs. Exit examinations such as the Major Field Achievement Test (MFAT) and the Fundamentals of Engineering (FE) exam provide a nationwide comparison for individual programs. Common themes in these examination results can also initiate institutional action. For example, the subscores on the FE examination were found to be lower than those at peer institutions, and this lower level of performance appeared to be consistent across programs at SDSM&T. In response, the Engineering Assessment Committee (EAC) was tasked with investigating the cause of the lower scores.

After considerable discussion, a Math / Engineering Alignment Task Force was created in fall 2003. The task force asked the math department to look at the content of the standard 16-credit-hour sequence of calculus and differential equations taken by most engineering students. They asked that special attention be given to coverage of statistics, linear algebra, partial differential equations, and the possibility of mathematics and engineering faculty collaboratively teaching some material. In response, the math department first did a study of the current math curricula at peer institutions and found that the existing curriculum closely matched those of the peer institutions surveyed. A redesign proposal (RR185) which addressed the primary concerns of the task force was presented by the math department in spring 2005. The proposal, which was reviewed by the EAC, introduces the new topics of partial differential equations and linear algebra and reorganizes old topics to eliminate redundancy in the curriculum. Most students already take a separate course in statistics, and it was recommended that they continue to do so. An agreement on an implementation plan was not reached, and discussion of the details are ongoing.

3rd item of evidence in support of Core Component C

Department-level assessments and evaluations of courses and faculty provide evidence of effectiveness and inform strategies for continuous improvement.

Evaluative statement for 3rd item of evidence

In previous years, assessment activities have varied widely between departments. In the past five years, partly through the urging of accrediting agencies, assessment of departmental activities has become well-defined and integrated into the operation of each department. As
noted below, many of these assessments are conducted at the institutional level and the results used across all programs.

Discussion of 3rd item of evidence

Evaluation and assessment activities are integrated into the operations of all levels of the institution. At the department level, individual programs have assessment plans for evaluating the effectiveness of their faculty, of individual courses, and of the curriculum as a whole. Department chairs write an annual evaluation for each faculty member, and these evaluations are reviewed by the dean of the college and by the Vice President for Academic Affairs. The form and content of the annual evaluation is determined by the COHE/Board of Regents Collective Bargaining Agreement. The faculty member has the opportunity to respond at any point in the process, and prescriptive processes are in place for faculty members who do not meet departmental standards (RR20).

Individual courses are assessed via student opinion surveys (RR245), Small Group Instruction Diagnosis (SGID), and other means as deemed necessary. The SGID technique for assessing teaching effectiveness was introduced to campus in 1998. Since 1999, any faculty member can request a stipend of $100 in exchange for pairing with a colleague to conduct an SGID in a class. The person doing the assessment conducts a focus group with the students in the class by setting up small group discussions on pre-established topics. Only comments that all members of the student groups agree with are recorded, and the focus group leader meets with the course instructor to give the feedback and his or her analysis of the feedback. Since this occurs during the semester rather than at the end of the semester, the faculty member is able to make immediate course corrections to meet the needs of that group of students. It has been an effective tool for assessing and improving the effectiveness of individual classes.

Student opinion surveys are conducted in all courses at the conclusion of every course. The faculty member receives a summary report of the evaluations and meets with the department chair to discuss any corrections that may be indicated. Beginning with spring semester 2006, all regents’ institutions will begin using the Individual Development and Educational Assessment (IDEA) course survey, which will provide much greater detail on evaluation statistics and can be used in nationwide comparative analyses (See http://www.idea.ksu.edu/index.html for more information on this instrument). Faculty members are also evaluated through the tenure and promotion process (RR20).

The curriculum as a whole is evaluated in a number of ways. Exit interviews with graduating seniors, national standardized achievement tests, employer surveys, placement data, and alumni surveys all provide valuable input to the departments and the institution. Most departments also have an industrial or academic advisory group that consults with faculty, students, and administrators each year to provide a link with rapidly evolving industry expectations.
Core Component 2d. All levels of planning align with the organization’s mission, thereby enhancing its capacity to fulfill that mission.

Evaluative statement for all of component 2d

The mission of SDSM&T is central to all planning activities. As a state-assisted institution, the mission and subsequent defining of the high-level strategic objectives are done under the auspices of the Board of Regents and with the approval of the legislature and the governor. Our mission of providing science and engineering education and research is understood and endorsed by all levels of government and cascades down to all members of the campus community. Increasingly, strategic planning defines the direction and focus of activities at SDSM&T. At the department, program, and service-sector level, five-year plans provide a roadmap by articulating a vision which the faculty, administration, and Foundation can present to outside agencies and private donors/investors for resource requests (RR249 and RR250). The departmental visions are developed in conjunction with Industrial Advisory Boards and with other interested constituents. The University also has a well-defined strategic planning process for determining institutional priorities and directions. For example, the recent administrative reorganization was the result of this process. The University’s Academic Advisory Board and the Alumni Association provide industry perspectives and are active participants in this process.

Evidence cited:

1. The campus planning process enhances the capacity of the institution to fulfill its mission.
2. The activities of our Academic Advisory Board (AAB) enhance the capacity of the institution to fulfill its mission.
3. In January 2003, the Alumni Focus Group provided a comprehensive analysis of the university’s operations, which was part of the strategic planning process.
4. Facilities planning, the Campus Master Plan, renovations of existing buildings, and space-utilization assessment, assure that the physical infrastructure will enhance and support the mission of the institution.

1st item of evidence in support of component D

The campus planning process enhances the capacity of the institution to fulfill its mission.

Evaluative statement for 1st item of evidence

The campus planning process successfully and effectively brought together the full array of people interested in the future of the institution. The insights provided, relative to both the challenges we face and the opportunities for which we are well-positioned, were recorded and will be incorporated into the plans for the institution. The involvement of faculty, staff, students, alumni, community leaders, and government representatives provided coverage of all areas of the University’s operation. All discussions were conducted within the framework of the mission, and all potential action items were evaluated within that same framework. This process enhances the institution’s ability to fulfill its mission by providing critical analysis of current and future operations, and by promoting buy-in from all constituents on future directions.
Discussion of 1st item of evidence

During the first stage of our campus planning process in AY 2003-2004, all constituents of SDSM&T engaged in a conversation regarding our past, present, and most importantly, our future. The dialogue was informed by several existing planning documents and involved all students, faculty members, and staff who elected to participate. Alumni, community leaders, and interested citizens were invited, and many elected to join in the dialogue. The following excerpt from the president’s opening comments at our first session October 29, 2003 illustrates the publicly stated inclusive nature of the process:

As I promised during the opening convocation, we are going to have a campus-wide discussion that will chart the course for the future of the University. We will accomplish this through a mixture of small-group and campus-wide discussions. During (this session), we will scan the campus environment by reviewing our mission statement, ABET and HLC accreditation requirements, the most recent Academic Advisory Board report, the results of the marketing and planning efforts recently compiled, the STUDENT Project, the South Dakota Opportunities report, and the Alumni Association Focus Group Report. Following the environmental scan, the participants will break into smaller groups to discuss priorities and strategies for addressing those priorities. After that event, a smaller group of faculty and staff will read and discuss all the comments. An even smaller group will then distill the comments into a comprehensive report that will be sent to the entire campus community for additional discussion and comments.

This first all-campus session (of eight sessions held as of March 2006) was attended by 156 people, all but a few of whom participated in the full six hours of discussion and work. The following list of benchmark dates and events provide a sense of the process:

September 2003: Planning for October 29, 2003 all-campus strategic planning event
October 29, 2003: All-campus strategic planning session, 3:00 p.m. to 9:00 p.m.
November and December 2003: Small “think group” designated by the president met to analyze the transcribed input from the October 29 session and to draft preliminary statements about strategic planning areas and priorities
January 22, 2004: Second all-campus strategic planning session, 3:00 p.m. to 7:00 p.m.
February 2004: Small “think group” met to formulate a strategic planning statement to share with the Board of Regents in March 2004
February to March 2004: The Strategic Initiatives / Self-Study Steering Committee is formed
March 2004: Six Steering Committee members attend the HLC self-study planning workshop and annual conference in Chicago
March 2004: Strategy for aligning the self-study process with the strategic planning and implementation work is refined and set
March 25, 2004: Dr. Ruch meets with the regents to discuss the draft strategic plan
May 4, 2004: Steering Committee meets via conference call with HLC liaison Karen Solomon
May 11, 2004: Year-end all-campus planning session to set priorities for strategic initiatives and to introduce the plan for aligning the self-study process with the strategic planning and implementation
Summer 2004: Steering committee finalizes AY 2004-05 strategic initiative action items and to collect data needed for SWOT analyses in fall 2004

August 27, 2004: Steering Committee planning retreat, 9:00 a.m. to 2:00 p.m.

November 4, 2004: All-campus planning session, 3:00 to 9:00 p.m.

January 2005: Data Gathered by Criteria 1 Workgroup via survey; Electrical and Computer Engineering Department Vision Planning Session with students, faculty, community and business leaders, and state representatives

February 3, 2005: All-campus planning session, 3:00 to 9:00 p.m.

May 10, 2005: All-campus planning session, 9:00 a.m. to 2:00 p.m.

October 6, 2005: All-campus planning session 3:00 to 8:00 p.m. to discuss draft self-study, the capital campaign, and student advising.

February 2, 2006: All-campus planning session 3:00 to 8:00 p.m., agenda to be published in January

Through the late 1990s, while companies became increasingly accountable to shareholders regarding where strategic investments of time and money were being made, SDSM&T had to become more active in articulating its intended direction and focus. The strategic planning process at the department level is an important mechanism for doing this. The use and effectiveness of departmental strategic planning still varies across campus. Some departments/programs have been benefiting financially from strategic planning for several years, while others are being encouraged to increase their planning efforts as acquiring outside funding becomes mission critical and increasingly competitive.

The most recent departmental, program, and service-sector strategic plans can be found at RR249 and RR250. The term “department” refers to an academic, degree-granting division of the University. “Programs” include Athletics, Multicultural Affairs, Music, Drama, etc. “Service sectors” include Academic and Enrollment Services, Student Affairs, Information Technology Services, Library, Career Planning Service, etc.

2nd item of evidence in support of component D

The activities of our Academic Advisory Board (AAB) enhance the capacity of the institution to fulfill its mission.

Evaluative statement for 2nd item of evidence

Our Academic Advisory Board (AAB) has done a good job of providing SDSM&T the vital connections to business and industry needed to monitor the relevance of our curricula. The AAB meets twice each year and reviews changes and proposals that affect our ability to produce scientists and engineers equal to the challenges of the workplace. The AAB has provided direction on key issues, including developing fields such as nanotechnology; the skill sets our graduates will need that supplement their science and engineering curricula, such as business and presentation skills; and alerted us to larger, more global challenges such as the need to work in multicultural groups around the world. The AAB members bring a larger perspective and significant experience to the institution and have given us advice that has allowed us to anticipate and prepare for significant changes. The AAB often urges the leadership of the institution to challenge the status quo and recommends innovations

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which may or may not be possible within the framework of the state education system. Thus, not all suggestions can be implemented. However, the board provides the institution with direction, and the administration finds ways to realize their suggestions within the allowable parameters. Their input strongly enhances SDSM&T’s ability to fulfill its mission.

Discussion of 2nd item of evidence

The Academic Advisory Board (AAB) is comprised of 11 respected industry leaders who bi-annually consult with us to ensure that our curriculum is closely aligned with the ever changing needs of the business community. Among this distinguished group are representatives from Boeing, Caterpillar, Genesis Equity Fund, Matrix Consulting Group, Oak Ridge National Laboratory, and Stanford University Department of Biochemical Engineering. The executive leadership of SDSM&T, i.e. deans, Vice President for Research, and the Vice President for Academic Affairs meet with the eleven AAB members on the SDSM&T campus. The original group was established in 1995 to provide an outside perspective on the internal strategies and actions of our operation. Their focus was on identifying the key drivers, or trends, that would affect the University and the business of higher education in the future. Their findings, and those of subsequent boards, were presented in our discussion of Criterion 2, Core Component A. The following is an excerpt from the document which established the AAB and articulated its mission in 1995:

The Academic Advisory Board is invited to share experiences in industry and government to assist the South Dakota School of Mines and Technology in accomplishing the strategic objectives of the University, developed in support of a mission of teaching, research and service. The Board, appointed by the President of the University, will include representatives nominated by the colleges from industry and government service and the deans of the colleges. The Board will meet at least annually at the call of the Vice President for Academic Affairs and a distinguished alumni industrial leader who will serve as co-chair. The Board is invited to provide the President of the University comments and recommendations for the continued development of the University to prepare graduates for successful careers as leaders in industry and government service.

In April of 2005, the AAB met and, among other items, reviewed the significant drivers likely to affect the institution in the next five years as identified by the strategic planning process. Again, these drivers, or trends, have been discussed under Criterion 2a. The AAB, which was the inspiration for many of the drivers identified, helped us to refine our ideas and approved of the resulting list.

Implementing the advice of the industrial advisory boards requires a sharing of realities. Members of advisory boards are learning that the world of academia and the world of private/corporate business are different—to a degree. Members of the campus community are learning that in today’s competitive global economy, the perceived difference between academia and private/corporate business is just that—perceived, but not necessarily real.

SDSM&T, as a whole, is learning that change (additions, transformation, or eliminations) must take place, and the timeframe for discussions, and the resulting decisions, is much shorter than it was ten years ago. The world increasingly moves much faster than it did previously, and SDSM&T has to increasingly pick up the pace. The governor, legislative branch, Board of Regents, SDSM&T (administration, faculty, and staff members) and the
advisory boards continue to seek and implement the balance among these dynamic perspectives in pursuit of our University’s mission.

Naturally, since SDSM&T exists in a state system, the strategies and goals of the governor and Board of Regents significantly influence the strategies and goals of the university. Even though state financial support has been reduced to approximately 30% of the overall annual budget, the Board of Regents has authority to control nearly 100% of the University’s high-level decisions.

The historically slow speed at which academic institutions implement change is often a source of frustration for both the Academic and Industrial Advisory Boards—and some members of the campus community. The inherent layering of decision making processes will not be eliminated, but these layers can, at times, be a detriment to achieving success in an increasingly competitive environment. The strategic planning and decision making processes are changing and improving and allowing SDSM&T to move forward within the structures dictated by the multi-layered state and university system.

3rd item of evidence in support of component D

In January 2003, the Alumni Focus Group provided a comprehensive analysis of the University’s operations, which was part of the strategic planning process.

Evaluative statement for 3rd item of evidence

The involvement of the Alumni Association and their 2003 report strengthened the strategic planning process and began an intense dialog about the University’s future on and off campus. Having the involvement of a large number of alumni was valuable for the institution both because of the insights they provided and because the process increased alumni interest and awareness about issues on campus. However, some faculty felt the alumni were in danger of becoming too involved in the day-to-day operations of the campus. The resulting discussions became heated at times, but the result was an appreciation by both the on-campus groups and the alumni of the central issues that needed to be addressed. The Alumni Focus Group report was an important component of the strategic planning process, and many of its recommendations were adopted.

Discussion of the 3rd item of evidence

The Alumni Association convened an Alumni Focus Group in 2002 in response to imminent and changing influences on higher education in South Dakota in general and on SDSM&T in particular. The Alumni Focus Group (whose representatives included current faculty, retired faculty, campus administration, and local and national business/industry leaders) analyzed these influences from the perspective of SDSM&T alumni. Their intent was “to stimulate discussion and generate ideas among the members of the campus community and other stakeholders in anticipation of (a change in leadership).”

The Alumni Focus Group’s January 17, 2003 document “A Vision for the Future of the South Dakota School of Mines and Technology” precisely articulated an open, comprehensive process for determining a widely-shared vision of the future of SDSM&T (RR315). Contributions to the report were made by members of the current and former administration, the faculty, the Alumni Association, the Foundation, community leaders, and national
industry leaders (most of whom were SDSM&T alumni). The report resulted from a year-
long effort. At the outset, the Alumni Focus Group established a hierarchy of objectives, or
goals, for the University. The highest-level goals represent two periods of time—namely, the
first decade of the 21st Century and the entire 21st Century—and focus on achieving regional
and national prominence as an engineering and science university. The Alumni Focus
Group’s vision for the University has become the vision adopted by SDSM&T, albeit stated
in a slightly different way.

The following is an excerpt from the preface of “A Vision for the Future of SDSM&T” that
expresses the scope and motivation for the efforts of the Alumni Focus Group:

When discussing our ideas and soliciting input for this report, we were frequently
asked what motivated this effort. It was in response to imminent change in various
influences on higher education and the SDSM&T—a new SDSM&T President, a new
SD Governor, new state legislators, possibly new Regents—and in response to an
invitation for input from Dr. Robert T. Tad Perry, Executive Director of the South
Dakota Board of Regents and his charge to complete a SD Opportunities Report for
Higher Education (RR83). . . . It is not the intention of the Alumni Association to
attempt to set policy or determine the path upon which the institution will embark.
However, we are willing to assist in the planning process, raise questions, and
outline the ways in which the alumni can contribute to the success of the institution.
The alumni are stakeholders in the future of the institution and want to facilitate the
continuation of the tradition excellence.

4th item of evidence in support of component D

Facilities planning, the Campus Master Plan, renovations of existing buildings, and space-
utilization assessment, assure that the physical infrastructure will enhance and support the
mission of the institution.

Evaluative statement for 4th item of evidence

Recent planning for new buildings, renovation of existing buildings, and maintaining the
facilities, has been effectively integrated into the strategic planning process. The 2005
Campus Master Plan is an effective “living document” that was developed with input from
faculty, staff, students, administrators, and community members (RR233 and RR278). The
campus has been able to keep pace with expanding/changing space needs, but just barely.
Our increased emphasis on research continues to increase our need for research space. In
addition to successfully planning for renovations and capital improvements, we have acted to
ensure proper use of its facilities through a periodic Space Utilization audit. This audit was
most recently conducted in 2005 with input from faculty and staff. In consideration of our
mission, the results are incorporated into our strategic-planning process.

Discussion of 4th item of evidence

The most recent Campus Master Plan (RR233 and RR278) was presented to the campus at an
all-campus planning session in 2005, and suggestions continue to be solicited. Over the
coming years, as new funding opportunities become available, the document will change. It
is viewed by all as a “living document” which must adapt and be reviewed regularly.
Responsibility for reviewing and altering the Campus Master Plan resides with the President
and the Cabinet. The campus has been able to keep pace with expanding/changing space
needs, but just barely. With the increased emphasis on research came an increased need for research space. Only four primary sources of funding are available for buildings: 1) federal research funding, 2) Board of Regents (i.e., state) funding through the Higher Education Facilities Funds (HEFF) which comes directly from student-paid tuition fees, 3) debt-bond issuing, and 4) private donations/investment. These sources have been equally important in expansion/renovation.

The Board of Regents’ campus building and space utilization policy says that significant increases in square footage for academic purposes are generally not allowed. Therefore, as old buildings become obsolete or mature into a state of disrepair, like the chemistry/chemical engineering building on campus today, replacement may take place, but the old building is likely to be razed. To finance the replacement of academic facilities at state universities, the Board of Regents places 20% of tuition paid by students in the Higher Education Facilities Fund (HEFF). HEFF are allocated via a statewide project priority list. In the 2005 legislative session, HB 1025 was passed, which sets a new priority list for HEFF projects including a replacement for the SDSM&T chemistry/chemical engineering building as one wing of a combined chemistry/chemical engineering and research building to be built. Private funds will be raised for the research wing.

In addition to planning for new buildings and renovating existing structures, the University ensures proper use of its facilities through a periodic space utilization audit. This audit was most recently conducted by Aramark with input from faculty and staff in 2005. As expected, individuals tend to be territorial about space and these utilization studies can cause dissention. However, understanding utilization patterns facilitates more effective use of physical space for everyone.

The findings of the report demonstrate the SDSM&T is a typical college campus. Classrooms are heavily utilized on Monday, Wednesday, and Friday and labs are heavily utilized on Tuesday and Thursday. The conclusion of this part of the study is that capacity exists for expansion if classes are offered at non-traditional times. Classroom space was determined to be adequate at the present time. In addition, the study provided a “grade” for the classrooms/labs as defined by a standard A through F rating scale. Based on square footage, 70% of the classroom and lab area on campus received an A or a B and only 6% received an F.

The following are definitions of the room suitability scores used in Figures 6:14 and 6:15 below which grades all rooms on campus, not simply classrooms. (For a full explanation, see the utilization report at RR248).

- **46% A**: Excellent, per-student space is more than 14 sq-ft for fixed seats, 20 sq-ft with tablet style chairs, and 35 sq-ft for labs. Also, classroom/lab has more than adequate technology capacity, ventilation, windows, instructional space, lighting, etc.
- **26% B**: Above average
- **11% C**: Average
- **11% D**: Below average, space is inadequate for instructional space and needs upgrading in several categories
- **6% F**: Unacceptable, space should not be used for instructional purposes
Our prior Master Plan was completed in 1992 and addressed the following issues:

1. Land use
2. Vehicular circulation
3. Pedestrian circulation
4. Handicapped access
5. Parking
6. Campus housing
7. Recreation and open space
8. Image and aesthetics
9. Long-range Opportunities

In May 2005, the updated Campus Master Plan delivered by the architectural firm TSP was the culmination of an update project started by TSP in fall 2004. The space utilization part of this study was prepared by Aramark Facility Services in conjunction with TSP and SDSM&T. The purpose of the space utilization study was to inventory, categorize and identify the utilization of built space across the SDSM&T campus.

The second part of the master plan identifies potential capital improvement projects for the next fifteen years. This report identifies those projects by name, size, location and program. Figure 6:16 below shows how the SDSM&T campus may appear in the year 2020.

As Figure 6:16 above shows, changes are designed to make the central “campus green” area more pedestrian friendly. The drawing also shows an extended campus, which identifies additional property that is owned by SDSM&T and the SDSM&T Foundation. This document is meant to be updated on a yearly basis as projects are completed, as the campus develops and as additional property is acquired. As modifications are made over the next fifteen years, the project descriptions will be updated, drawings revised, and a new document, with revision dates, will be issued. This master plan is meant to be a conceptual guideline for campus development over the next 15 years.

Our master plan philosophy is one of inclusion. Input was gathered from various personnel, faculty, administration, departments, etc. throughout the campus. The design team met with key personnel identified by the administration and reviewed wants and needs for each area. At the conclusion of all the department meetings, the needs of the various departments were
incorporated into the plan. As the design team drew up the proposed physical layout of the
 campus, they worked under the assumption that the following issues would be addressed:

1. The parking areas and vehicular circulation should be moved to the perimeter of the
 campus to allow for a more pedestrian-oriented core to the campus.

2. Major pedestrian paths should be created to allow circulation throughout the campus.

3. The main vehicular circulation for the campus will be a loop road that will connect to
 St. Joseph Street on the east and west sides of campus. Parking lots will be oriented
 off of this loop road with only service vehicles having access to the interior of the
 campus.

4. The campus image along St. Joseph Street should be upgraded and unified from one
 end of campus to the other. A perimeter fence/wall will be constructed with a major
 entry gate/element east of the Surbeck Center and a minor entry gate/element at the
 loop road, east of O’Harra Stadium.

5. As new buildings are added to the campus, it is desirable to have the classroom areas
 oriented off of the interior “quad” of the campus. The growth areas to the campus
 will be to the south, through “the gap,” and to the west. SDSM&T has acquired
 facilities and property on St. Patrick Street south of the campus, and a road through
 “the gap” will allow better access to the entire campus. SDSM&T has started to
 acquire property west of the campus proper, along Kansas City Street and St. Joseph
 Street. As more property is purchased, the campus will naturally grow to the west.

Master plans are meant to be scrutinized and modified as needs and desires change. This is a
 “living document” that will assist in keeping the development of the SDSM&T campus
 moving in the right direction. The following list of facility renovations and additions from
 1999 to the present offers a sense of our ongoing efforts to plan for the future:

1999  Civil and Mechanical Engineering Building (Renovation) Funding Source: State and Private

1999  Caterpillar Student Excellence Center (Addition) Funding Sources: Private/Corporate

2002  O’Harra Stadium Track and Field Facilities (Renovation) Funding Source: State, City, and City School District

2003  King Center: SDSM&T Wellness Center (Renovation) Funding Source: State
 and Bond Issue supported by student fee increase

2004  King Center: Athletic Hall of Fame (New Addition) Funding Sources: Private

2004  Surbeck Center Renovations Funding Source: Bond Issue supported by
 student fee increase
2004 Howard Peterson Residence Hall (New—Attached to Surbeck Center) 
Funding Source: Bond issue supported by student fee increase and residence hall revenues

2004 Devereaux Library Renovations Funding Source: State

2005 Tech Development Lab (Acquisition of Commercial Building) Funding Source: Federal research

2005 Computational Mechanics Laboratory (Addition to CE/ME Building) Funding Source: Federal research

With our increasing reliance on research funding to supplement uncertain state appropriations, quality laboratory space becomes very important. Quality laboratory space for specific research projects is not adequate, but this shortage was greatly mitigated in 2004 with the SDSM&T Foundation’s purchase-for-lease of a commercial building adjacent to campus specifically for research. The lease to the university is being paid using federal grants dollars from the Army Research Laboratory source. The continuing need for quality laboratory space is being addressed by the 60,000 square-foot addition to the Chemistry/Chemical Engineering/Research building addressed above. Over the last year, we have seen promising signs that state funding for research will increase, prompted, in part, by the governor’s 2010 initiative. In addition to salary policy increases, we received an additional $500K in base funding for the new Ph.D. in nanoscience and nanoengineering and $500K in annual funding for the Center for Accelerated Applications at the Nanoscale (CAAN) from the state legislature.

Laboratories and computing facilities are essential to the fulfillment of our science and engineering mission. Laboratories may be institutional resources, departmental resources, or tied to specific research programs or grants. Institutional and departmental laboratories are upgraded on a schedule that is determined by the life-expectancy of the equipment involved.

For example, computer labs are upgraded every 3 or 4 years, while upgrades in chemistry labs over the last 20 years have been less regimented and are dependent upon available funding. Recent actions taken by the campus budget advisory committee and lab fee increases intended to address laboratory issues are discussed below under Criterion 3, Core Component d. Upgrading and maintaining computing facilities is done by Instructional Technology Services (ITS) which performs these duties according to a schedule agreed upon by members of the campus computing committee, the deans and department chairs, and by upper administration. The ITS budget also allows for campus-wide improvements such as providing network access to the dormitories, wiring the campus for wireless network access, replacing computers in institutional labs, and providing computers and projection equipment in all but a few classrooms.

Questions that arose from the self-study process relative to Criterion 2

1. How can SDSM&T direct resources to address shifts in demographics?

2. How can SDSM&T better utilize the results of assessment activities at the institutional level?
3. What resources can SDSM&T utilize in order to secure a stable financial future?

4. What is the long-range plan for the campus environment, particularly the physical location of various programs and departments and the allocation of space?

5. How can we involve more people in the campus planning process?

**Most Significant Actions taken**

1. Revision of the strategic planning process to include all-campus sessions, a budget oversight committee, revision of the campus plan (the new campus map), and creation of the University Cabinet. The strategic planning meetings are open to everyone. The challenge is to get even greater participation. Similarly, the current campus master plan was unveiled, but some faculty members desire greater input prior to finalizing those decisions.

2. Increased emphasis on marketing and recruiting

3. Increased attention on retention with targeted programs, such as the FIRST program, FIRST in the Classroom, WISE, and multicultural affairs

4. More collaboration for research and the development of new research centers

5. Consideration of a single campus-wide assessment committee to coordinate assessment efforts across departments

**Recommendations for moving forward**

1. Although more money has been spent on marketing and recruiting, the campus is not yet clear on how we will measure success. The Executive Council may have established a “dashboard” of key data and set metrics for success, but the campus has not fully internalized and embraced either. Recruiting and meeting the milestones identified must be parts of everyone’s job.

2. Research has demonstrated promising growth in recent years; however, local infrastructure is still seriously lacking to support these efforts. With local and state officials being more aware of technology as an avenue of economic growth, the time is ripe to seek support that would help address the needs of infrastructure for research.

3. Research activities must progress within a framework that is advantageous to the University as a whole. Increased faculty research activity is being strongly encouraged as is diversification of funding sources. Four broad core research competencies have been identified by both the President and Vice President for Research and independent consultants as representative of current faculty research activity:
   - materials science and engineering
   - atmospheric sciences
   - geological sciences and engineering
   - bio-engineering and related sciences (e.g., bioprocessing, biomedical)

4. Given our size, research activities will need to be coordinated and greater efforts directed toward a few select areas. Research activity must increase, but in a coordinated fashion, and funding sources must be diversified.
5. Enrollment shifts do present a challenge to the University. More rigorous admission standards and more resources directed to recruiting is an important first step in securing a more stable enrollment. However, the campus community should become more aware of how to more efficiently promote student success. This will not mean lowering academic standards or lowering expectations. Attention should be given to how to more effectively teach the skills necessary to achieve high academic standards and to promote a campus community that fosters and values student achievement. Faculty, staff, administrators, and students will need to find new and additional ways to interact.

6. Improving retention will require careful evaluation of policies and procedures. Too often students receive conflicting answers or are shuffled from department to department when faced with a registration or enrollment issue. As a technological university, we should place more information online and encourage all faculty and staff members to access the information in order to assist students. Students should feel helped rather than hassled.

7. While research is recognized as the means to advance many aspects of “preparing for the future,” this University must not lose sight of what has made it so good for so long. We cannot forget the value of providing an exceptional academic undergraduate experience to students through direct daily interaction with a faculty who delivers current curriculum involving hands-on methods. Serving the undergraduate student and providing technically-prepared engineers to industry must remain our primary objective.
Chapter 7: Criterion Three: Student Learning and Effective Teaching

Core Component A........p. 114
Core Component B ........p. 126
Core Component C........p. 131
Core Component D........p. 140
Chapter 7: Criterion Three, Student Learning and Effective Teaching

The organization provides evidence of student learning and teaching effectiveness that demonstrates it is fulfilling its educational mission.

Background

The Co-chairs (and working groups) for Criterion 3 worked on two key action items from the 2004-05 Strategic Agenda in conjunction with self-study:

1. Develop a coherent 1st-year experience and consider appointing a director for the program
2. Develop a comprehensive campus-wide program for assessment and improvement of student communication skills

Transformational curriculum began in 1997-98 with the initiation of a first year engineering course, a mentoring program, and the launching of the Center for Advanced Manufacturing and Production (CAMP). Development of an integrated and cohesive 1st-year experience began in 2003 with a campus-wide initiative to work under the national “Foundations of Excellence” program. During AY2004-05, the Criterion 3 committee devoted the majority of its time and effort to the 1st-year experience since gains in this area are so important to our success in fulfilling our mission and critical to our efforts to improve student learning and effective teaching.

In order to achieve our goal of being a leader in 21st-century science and engineering education and providing a well rounded education that prepares students for leadership roles in engineering and science, we had to more fully exploit the learning and teaching opportunities presented by the 1st year. The link between our mission and our intense focus on the 1st year is heightened by multiple factors:

- Our need to respond to demographic trends by dramatically improving recruitment and retention
- The fairly traditional and non-diverse profile of our freshman (i.e., white, Christian, full-time resident students aged between 18 and 23 years.)
- The challenge of achieving distinction among the group of our peer institutions
- The challenge of preparing our students for a diverse workplace in just 4 to 5 years

Although campus planning sessions also indicated a need to develop a more comprehensive program for improved communication skills, primary effort the past two years has been focused on development of a cohesive first year experience. At the time of this self-study, a first year management team has been identified, a search for a 1st-year experience coordinator is underway, an assessment plan and preliminary results are available, and proposals for external funding are being actively pursued. With the first year taking shape, effort during the next calendar year will begin to shift towards a comprehensive program for improved communications skills.
SWOT analyses and discussion of teaching and learning in the 1st year

During AY 2004-05, the Criterion 3 “Working Group” for the self-study conducted a campus-wide SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis and an all-campus discussion on the 1st year:

November 2004: A SWOT analysis of two potential administrative structures for the 1st-year experience was conducted at the all-campus convocation November 4. Half the attendees analyzed the option of a single coordinator for the 1st-year experience; the other half analyzed the option of using a steering committee to administer the 1st-year. Subsequently, the Criterion 3 working group analyzed the campus input on November 17 and approved the single-coordinator model. The co-chairs submitted a funding proposal to the University Budget Advisory Committee, and the proposal was funded as a base-budget item.

March 16, 2005: An all-campus discussion on the 1st-year experience involved 43 participants who were asked to explore issues related to the “distinctiveness” of 1st-year courses. Working in six groups for almost two hours, the participants explored the following three questions: (1) What are/should be the “distinctive” features of 1st-year classes? (2) What does “distinctive” mean when translated into a few clear, measurable practices? (3) What must we realistically have and do to institutionalize these practices in our 100-level classes?

Additional details on the work on the 1st-year are discussed below in connection with the appropriate Core Components under Criteria 3 and 4.

Core Component 3a. The organization’s goals for student learning outcomes are clearly stated for each B.S. program and make effective assessment possible

Evaluative Statement for all of Component 3a

SDSM&T has made substantial progress towards developing a culture of assessment and improvement at the program level. While virtually all programs now have well-defined assessment plans, like most universities, the campus continues to struggle with the development of an integrated plan that cuts across departmental boundaries or provides for an integrated approach for systemic campus initiatives.

Evidence cited:

1. All 16 undergraduate B.S. programs and most graduate programs have articulated objectives, and outcomes and have well-developed assessment plans.
2. Faculty and staff have designed and applied a variety of assessment tools and measurements.
3. Both curricular and co-curricular programs have established effective mechanisms for utilizing assessment data and have made refinements based on the data.

1st item of evidence in support of Core Component A

All 16 undergraduate B.S. programs and most graduate programs have articulated objectives, and outcomes and have well-developed assessment plans.
Discussion of 1st item of evidence

Figures 7.1 and 7.2 below confirm that all but two of our B.S. programs have functioning assessment plans that are up to date and guiding program improvement. The use of assessment data for continuous improvement is documented in the far-right column. The missions, objectives, and outcomes for all undergraduate programs can be viewed in the Virtual Assessment Office (VAO) by following the “Assessment in Individual Programs” link at [http://www.hpcnet.org/VAO](http://www.hpcnet.org/VAO).

<table>
<thead>
<tr>
<th>BS Programs</th>
<th>Level</th>
<th>Last update of program Mission</th>
<th>Last update of program-Level Objectives</th>
<th>Last update of Program-Level Outcomes</th>
<th>Does Evidence of &quot;Closing the Loop&quot; Exist?</th>
<th>Where can evidence and documentation be found of a genuine continuous improvement process?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining Engineering and Management</td>
<td>B.S.</td>
<td>12/10/2004</td>
<td>12/10/2004</td>
<td>1/20/2005</td>
<td>NO just created 12/05</td>
<td>See <a href="http://mining.sdsmt.edu/Default.htm">http://mining.sdsmt.edu/Default.htm</a> for program information</td>
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<tr>
<td>General Studies</td>
<td>A.A.</td>
<td>06/1997</td>
<td>06/1997</td>
<td>06/1997</td>
<td>no</td>
<td>The AA degree program was created system wide in 1997. **See note below.</td>
</tr>
<tr>
<td>Chemistry</td>
<td>B.S.</td>
<td>1/31/2003</td>
<td>1/31/2003</td>
<td>1/31/2003</td>
<td>NO</td>
<td>Alumni survey being deployed summer 05; analysis and actions will be at <a href="http://www.hpcnet.org/assessmentchemistry">http://www.hpcnet.org/assessmentchemistry</a> by 12/2005</td>
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</table>

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Criterion Three 115
<table>
<thead>
<tr>
<th>BS Programs continued</th>
<th>Level</th>
<th>Last update of program Mission</th>
<th>Last update of Program-Level Objectives</th>
<th>Last update of Program-Level Outcomes</th>
<th>Does Evidence of &quot;Closing the Loop&quot; Exist?</th>
<th>Where can evidence and documentation be found of a genuine continuous improvement process?</th>
</tr>
</thead>
</table>

Figure 7.1 Assessment Documentation for Undergraduate Programs

**the Associate of Arts degree was created by the Board of Regents in 1997 by Policy 2:26 (RR301). We are in the process of reevaluating the role of this degree in the SDSM&T curriculum. Few students enroll at SDSM&T with the intention of obtaining this degree, and we are considering the possibility that newly raised admission standards may further lessen the relevance of this program to our students.

Nine of these 16 B.S. programs underwent ABET accreditation review in fall 2004. All accredited programs were re-accredited, with weaknesses cited for only one. The environmental engineering program was seeking accreditation for the first time and was found deficient in curriculum. This deficiency is currently being addressed.

Assessment in our 13 graduate programs is not as advanced as in our undergraduate programs. Nonetheless, all but five of these programs offer evidence of continuous-improvement processes involving the use of assessment data, as seen in Figure 7.2 below. Graduate program assessment is overseen by the Dean for Graduate Education.

<table>
<thead>
<tr>
<th>M.S. and Ph.D. programs</th>
<th>Level</th>
<th>Last update of program Mission</th>
<th>Last update of Program-Level Objectives</th>
<th>Last update of Program-Level Outcomes</th>
<th>Does Evidence of &quot;Closing the Loop&quot; Exist?</th>
<th>Where can evidence and documentation be found of a genuine continuous improvement process?</th>
</tr>
</thead>
</table>
In order to improve the quality of our education, each graduate program undertakes an extensive review process every three to five years. Strengths and shortfalls of each program are evaluated via these reviews, and deficiencies identified during the process are corrected. These reviews, along with the missions, objectives, and outcomes, of SDSM&T graduate programs can be found at [http://graded.sdsmt.edu](http://graded.sdsmt.edu).

General education in the South Dakota Regents’ system is partially centralized at the Board of Regents’ level. All six Regent’s institutions have in common a core of seven general education objectives and outcomes. All general education courses in the system have common course names, numbering, descriptions, and pre- and co-requisites. The Executive Vice President for Academic Affairs oversees the Academic Affairs Council (AAC), which is

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<table>
<thead>
<tr>
<th>M.S. and Ph.D. programs continued</th>
<th>Level</th>
<th>Last update of program Mission</th>
<th>Last update of program-Level Objectives</th>
<th>Last update of Program-Level Outcomes</th>
<th>Does Evidence of &quot;Closing the Loop&quot; Exist?</th>
<th>Where can evidence and documentation be found of a genuine continuous improvement process?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Engineering</td>
<td>M.S.</td>
<td>yes</td>
<td>Mission &amp; objectives are the same</td>
<td>none</td>
<td>Partially</td>
<td>See <a href="http://www.hpcnet.org/MS_in_EE">http://www.hpcnet.org/MS_in_EE</a></td>
</tr>
<tr>
<td>Atmospheric &amp; Environmental, Studies</td>
<td>Ph.D.</td>
<td>none</td>
<td>01/01/05</td>
<td>01/01/05</td>
<td>No</td>
<td>See <a href="http://www.hpcnet.org/AtmosSci_PhD">http://www.hpcnet.org/AtmosSci_PhD</a></td>
</tr>
<tr>
<td>Technology Management</td>
<td>M.S.</td>
<td>Philosophy exists</td>
<td>Statement of expectations</td>
<td>Partially</td>
<td>Yes</td>
<td>See <a href="http://ie.sdsmt.edu/TMWeb/TM.htm">http://ie.sdsmt.edu/TMWeb/TM.htm</a></td>
</tr>
</tbody>
</table>

Figure 7.2 Assessment Documentation for Graduate Programs
comprised of the academic affairs vice president from each regents’ institution. The Director of Academic Assessment at the regents’ level chairs a statewide assessment committee to which the assessment directors from each institution belong.

Academic assessment of general education is partially administered at the regents’ level. All six universities have employed the CAAP (Collegiate Assessment of Academic Proficiency) since 1998 as a “rising junior” exam with cut scores that must be met in math, reading, writing, and science reasoning for a student to progress in his or her undergraduate degree program. Each year, the regents review institution-specific and comparative analyses of the CAAP scores (RR256, RR257 and RR14). In addition, ACT prepares a “gains report” that uses ACT and CAAP scores to measure “gains” in academic achievement between incoming students and students at the end of their general education program (RR295).

At SDSM&T, undergraduate academic assessment is entrusted to two committees, a General Education Assessment Committee (GEAC) and an Engineering Assessment Committee (EAC), which were created in 2001. A half-time administrative position (Director of Academic Initiatives) was created in 2001 for undergraduate academic assessment oversight. In 2005, SDSM&T reorganized, and assessment oversight duties were incorporated into the two newly created full-time dean positions. The GEAC and EAC continue to function and continue to be chaired by faculty members.

Initially, when the GEAC and EAC were created in 2001, a third campus-wide assessment committee was also created. However, the demands of general education assessment and program oversight were so great, that the humanities, social sciences, and sciences areas needed to collaborate in a single focused committee. Likewise, the assessment challenges under the EC2000 criteria of ABET gave the engineering programs distinct, common needs and collaborative opportunities. After approximately 18 months of effort to bring a campus-wide committee to life, we realized that a third committee was an unnecessary and undesirable dilution of effort. The mission of both the GEAC and EAC include the charge to work with one another. A humanities faculty member has actively served on the EAC since 2002, and an engineering faculty member serves on the GEAC.

Both the GEAC and the EAC have been extremely active since they were created in 2001. A sample summary of major initiatives undertaken since 2001 follows. A complete summary of GEAC and EAC activities may be found in the Electronic Resource Room (RR51).

- Embedded assessments for courses meeting general education goals piloted
- Engineering and GEAC Assessment mini-grants made available
- Sponsored a campus wide two-day assessment conference with external consultants
- Development of the Digital Archive Tool (DAT) for collection of student work
- Formation of a Math/Engineering Alignment Task force
- Development of campus speaking and writing rubrics
- Development of Science Reasoning rubric
- Training for faculty members in intercultural sensitivity modeling and assessment

The following two sections provide details about specific assessment data, tools and techniques used on campus and illustrative results from continuous improvement efforts.
2nd item of evidence in support of Core Component A

Faculty and staff have designed and applied a variety of assessment tools and measurements.

The following assessment tools and techniques are used campus wide:

The Digital Archival Tool (DAT) was designed and created in AY2002-03 after a group of faculty members investigated commercial software choices and found them to be more complex and costly than desired. We needed a very simple web-based tool that would enable students to upload digital copies of assignments and enable faculty members to assess, search and filter, and retrieve these samples. Using the tool entails being logged into the campus network; however, a schematic of the tool and a summary of features can be seen at http://www.hpcnet.org/digitalarchival. Currently, all GES 115 sections and key courses in metallurgical, chemical, and industrial engineering utilize the DAT.

The campus-wide writing rubric and the oral presentation rubric were developed by two task forces with disciplinary representation from across campus. The writing rubric was pilot tested in conjunction with the DAT in spring 2003 (RR251 and RR253), but after a year the rubric was being used more widely in engineering courses than in the writing sequence. In fall 2006 the writing faculty plan to explore choices for using the rubric in all writing courses and will hold campus-wide training sessions in its use. In fall 2005 the new “writing intensive” general education requirement will be in effect, and we anticipate a rise in use of the rubric. The oral presentation rubric is also being used (sometimes with adaptations) across campus; however, no efforts are being made to make the use of either rubric mandatory.

The Small Group Instructional Diagnosis (SGID) technique for assessing teaching effectiveness was introduced to campus in 1994. Since 1999 any faculty member can request a stipend of $100 in exchange for pairing with a colleague to conduct an SGID in a class. The person doing the assessment conducts a focus group with the students in the class by setting up small group discussions on pre-established topics. Only comments that all members of the groups agree with are recorded, and the focus group leader meets with the course instructor to give the results and his or her analysis of the feedback.

Student Focus groups on the SGID model are run by the Director of Academic Initiatives for any program upon request. Since 2002, most of the ABET accredited programs and two non-ABET programs have held student focus groups for program-level assessment purposes.

All but a few programs have an industrial or academic advisory board; an academic advisory board is being formed for the newly revised interdisciplinary sciences program, and the institution as a whole has an academic advisory board that meets twice yearly and is chaired by the Vice President for Academic Affairs.

Senior and alumni surveys are developed and used by all the ABET-accredited programs, and employer surveys are used by many programs. We do not use a single instrument but allowed individual programs to develop their own surveys as part of articulating their individual assessment plans. The surveys created by the industrial, electrical, and computer engineering programs are good examples of the high quality of many of these surveys (RR254, RR255, RR296, RR297).
Our system of program review runs on a six-year cycle. Figure 7.3 below summarizes program review history. Program assessment and the utilization of assessment results are addressed in program reviews.

<table>
<thead>
<tr>
<th>Year Scheduled</th>
<th>Department</th>
<th>Date of Visit</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996-97</td>
<td>Interdisciplinary Studies</td>
<td>Apr-97</td>
<td>Completed</td>
</tr>
<tr>
<td></td>
<td>Social Sciences</td>
<td></td>
<td></td>
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<td>1998</td>
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<td>1997-98</td>
<td>Mathematics</td>
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</tr>
<tr>
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<td>BS Geology</td>
<td>May-00</td>
<td>Completed</td>
</tr>
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<td>May-00</td>
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</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2000-01</td>
<td>Physics</td>
<td>Apr-02</td>
<td>Completed</td>
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<td></td>
<td>Atmospheric Sciences (MS)</td>
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<td>Interdisciplinary Sciences</td>
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<td></td>
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<tr>
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<td></td>
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<td></td>
<td>Computer Science MS</td>
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<td></td>
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<td></td>
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<td>ABET Reviewer</td>
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<td>Oct-04</td>
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<tr>
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<td>Metallurgical Engineering</td>
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<td></td>
<td>Physical Education</td>
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<td></td>
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<td></td>
<td>Paleontology - MS</td>
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<td></td>
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<tr>
<td></td>
<td>Geology and Geological Engineering (MS &amp; PhD)</td>
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</tr>
</tbody>
</table>

Figure 7.3 Program Review History During this Accreditation Cycle
The following academic assessment data are collected at an institutional level:

The CAAP exam is given as a “rising junior” exam to all students who have completed 64 credit hours, which corresponds to completing the general education program. The regents review and compare the CAAP scores from all regents’ institutions yearly (RR256 and RR295). Since the South Dakota system first employed the CAAP exam for all public universities as its “rising junior” exam, SDSM&T students have scored above students nationally and system wide in all areas, as illustrated in Figure 7.4 below.

<table>
<thead>
<tr>
<th></th>
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<th>Science Reasoning</th>
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<td>NATL SDSMT SYSTEM</td>
<td>NATL SDSMT SYSTEM</td>
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<td>F98/S99</td>
<td>65.9 65.0 64.4</td>
<td>64.5 59.9 57.9</td>
<td>65.9 64.1 62.9</td>
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<td>F99/S00</td>
<td>65.0 64.8 64.3</td>
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<tr>
<td>F00/S01</td>
<td>65.5 64.9 64.3</td>
<td>63.8 59.4 58.4</td>
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<td>65.1 62.8 61.0</td>
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<tr>
<td>F01/S02</td>
<td>65.9 65.2 64.5</td>
<td>63.2 59.4 58.5</td>
<td>65.1 63.9 62.9</td>
<td>64.7 62.9 61.1</td>
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<tr>
<td>F02/S03</td>
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<td>62.6 59.1 58.3</td>
<td>64.0 63.3 62.9</td>
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<tr>
<td>F03/S04</td>
<td>65.7 65.3 64.5</td>
<td>62.6 59.2 58.1</td>
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<tr>
<td>F04/S05</td>
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<td>63.1 59.3 58.1</td>
<td>65.2 64.0 62.5</td>
<td>65.1 63.1 61.1</td>
</tr>
</tbody>
</table>

Figure 7.4 Mean scores of SDSM&T students compared to SD system and national means

The Career Planning, Placement and Cooperative Education office administers an “Employer survey” to recruiters who visit campus to interview students during career fairs. Results from the last two years (RR232) suggest overall high levels of satisfaction but a desire to see communication skills more developed in our graduates.

We have participated in the NSSE (National Survey of Student Engagement) since 2002 and the FSSE (Faculty Survey of Student Engagement) since 2003 (RR80). We are in the process of shifting into a less frequent levying of the surveys.

The Freshman Survey is given to nearly all incoming students during orientations; it asks 24 questions about student background, preparation, and motivation (RR46 and RR47). The results have been broadly distributed through the Institutional Assessment Data booklet since 2002.

The Student Satisfaction Inventory is a Noel Levitz instrument given to all students when they sit for the CAAP exam. The “gap analysis” results this instrument produces are used in program-level assessment and in Student Affairs assessment (RR190, RR120, and RR121).

In spring 2004, brief face-to-face interviews were conducted with 102 SDSM&T students, and questions were asked about the effectiveness of the pedagogical techniques experienced in the classroom. No decision has yet been made about continuing this assessment (RR194).
The following are examples of assessment tools and techniques used by specific programs or areas:

The freshman engineering and science course, GES 115, is a required course for all engineering programs plus the geology and interdisciplinary science degree programs. All sections follow a common syllabus (RR298) and employ common assessment rubrics for web pages, problem solving, data analysis, and the design project report. In addition, all GES 115 students take a software survey at the beginning and end of the semester to self-rate their working knowledge of various standard programs and computer skills. During AY 2003 assessment was also performed using the Student Assessment of Learning Gains (SALG) from the University of Wisconsin. During 2002-04, faculty teaching enhancement projects focused on developing ethical reasoning modules (and accompanying assessments) for the curriculum; however, because of SALG results, these modules have since been dropped as a formal component of GES 115.

In AY 2002-03, the industrial engineering faculty employed the then newly developed campus writing and oral presentation rubrics to score project reports in 300- and 400-level courses in conjunction with scoring the same reports using project and presentation rubrics already in use in the program (RR266). The project did not result in replacing the program-specific rubrics with the campus-wide instruments, but it confirmed the usefulness and satisfactory quality of the campus-wide rubrics.

Tools and techniques developed since 2002 to broaden the base of general education assessment beyond the CAAP exam have included the development of a science reasoning rubric, a “multimedia” assessment, and the exploration of the use of the Intercultural Development Inventory. A physics faculty member on the General Education Assessment Committee (GEAC) worked over AY 2003-04 with faculty members from chemistry to develop and pilot test the science reasoning rubric (RR209). The “multimedia” assessment is the project name for a group of humanities and social science faculty members. The instrument elicits a written response from a student in conjunction with viewing, reading, or hearing a cultural artifact. The assessment has been tested in a range of general education classes and has employed musical, poetical, sculptural, and painterly artifacts (RR258). The Intercultural Development Inventory (IDI) is a commercially produced assessment of human development according to the Developmental Model of Intercultural Sensitivity (DMIS). Using the IDI requires training and certification in the model. Since spring 2004, five faculty members and one administrator have received the training, and the IDI was pilot tested in a range of general education courses in AY 2004-05. The results of this work to date will be presented at a national conference in fall 2005 (RR259). We are working toward using the IDI as an assessment of our general education goals 3 and 4, which include diversity outcomes as of fall 2005. We anticipate broader use of the IDI in many of our majors as a result of the “global awareness” newly required in select 300- and 400-level courses as of fall 2005.

As a result of the general education “writing intensive” requirement effective fall 2005, each program must identify specific courses in which writing skills are explicitly assigned and assessed (RR148). The programs were given the freedom to design discipline-specific responses to this requirement, but we believe campus-wide coordinated assessment efforts (such as longitudinal studies of specific skills) will be encouraged through the AY 2005-06 strategic initiative of improving communication skills campus wide.
All engineering programs encourage students to take the Fundamentals of Engineering (FE) exam, and many have made it required for degree completion. The EAC compiles and reviews the FE results across programs (RR42), and the analysis done in 2003 was the basis of the work done by the Math / Engineering Alignment Task Force and the proposal by the math faculty to redesign the math sequence that is now being moved forward.

In AY 2003-04, SDSM&T participated in a national study on the impact of the EC2000 criteria conducted by Penn State under the auspices of ABET. Graduating seniors in mechanical, electrical, civil, and chemical engineering were surveyed, and 81 responded. The results were analyzed by the EAC and by the faculty of these four programs. The full EAC met with the VPAA and, in December 2004, summary conclusions and action items for improvement were published (RR29). The action item most immediately followed up on entailed interviewing 101 students about the pedagogical techniques they experience in the classroom. The results of this survey were compiled in May 2005 and have been disseminated to faculty and staff (RR194).

Considerable work has gone into assessing faculty and staff development efforts since 1989. A planning grant from the Bush Foundation in 1998 set the stage for receipt of a $300,000 Faculty Development grant in 1999 (RR271). In 2002, a second $300,000 grant was secured from the Bush Foundation for faculty and staff development (RR272). Professional development needs and the effectiveness of the subsequent program activities were extensively assessed at every stage of both grants through focus groups, grant-report analyses, external consultants, and quantitative analyses of how project, workshop, and travel re-grants were allocated. See RR40 and RR264 for 2003 and 2005 assessments of faculty and staff development efforts.

The resident assistants, who live in the dorms, are supervised by the director of Residence Life. They encourage all students to take the online Living, Learning, Leading Outcomes Assessment found at http://www.hpcnet.org/sdsmt/reslife/l3checklist. The tool queries students about academic skills, civic and community responsibility, leadership skills, personal (developmental) skills, and their ability to understand human differences. This assessment initiative and the survey results have provided focus to the programming and activities that Residence Life staff provides.

The Counseling Center staff at SDSM&T employs the Counseling Services Session Rating Scale and Outcome Rating Scale. The Session Rating Scale (version .3.0) measures the client experience of the quality of the relationship with the counselor and gives feedback for the counselor to improve interventions. The Outcome Rating Scale (ORS) is used to track overall improvement in how well the client is doing over the course of treatment (RR260).

Our Student Activities Office employs the Biennial Review of Alcohol use as part of its efforts to comply with the Drug-Free Schools and Campuses Regulations of the US Department of Education. It is a summary of alcohol policies, prevention activities, disciplinary activities and assessment of effectiveness of alcohol and other drug programs. It is written by the Director of Counseling with the help of the Student Affairs Division. It is kept on file in the Dean of Students office and may be audited by the US Department of Education. The Director of Counseling Services collaborated with a faculty member in psychology to secure $284,000 to fund a multi-institutional “Prevention of High Risk Drinking Among College Students” program beginning fall 2005 (RR252).
Every year, the Student Senate designs questions for and levies the Student Senate Annual Survey. The 2004-05 survey is on-line at [http://interact.sdsmt.edu/sa/survey.htm](http://interact.sdsmt.edu/sa/survey.htm). Student opinions are solicited on facilities, education, Surbeck Center, residence halls, and student organizations. One of the most effective surveys was conducted in the fall of 2001 regarding "auxiliary service improvements". The results contributed to an increase the General Activity Fee by $3.50 per credit hour to fund major renovations and purchase of new equipment (with a provision for annual equipment upgrades). Renovations to the Wellness Center were completed in 2003, and major renovations to the Surbeck (student) Center and the construction of the new residence, Howard Peterson Hall were completed in August 2004.

Student Affairs annually reviews results from the Student Satisfaction Inventory (SSI). Annual goals are set for achieving satisfaction levels for specific “scales.” The results from select “scales” are separated out and carefully scrutinized as assessments of these annual goals and because of their particular relevance to student life and student services ([RR299](#) and [RR120](#)). In addition, Student Services levies a Summer Orientation Comment sheet.

Academic and Enrollment Services (AES) levies a Freshman (incoming student) Survey to collect information in four areas: planning for college, academic preparation, educational goals and plans, and expectations about college life. The information is used to evaluate recruitment and marketing efforts and to provide the Freshman Mentors with the background information they need to be effective advisors and mentors of 1st-year students. AES also creates and publishes the Enrollment Projection Report (EPR). The initial EPR was created in 1987 and for many years was called the Monday Report. With time, the report evolved, was modified and refined by Registrar’s Office and later by AES staff. In 2003, the EPR was greatly enhanced in appearance and content in order to make it more effective as a tool for informing campus of our progress toward our enrollment goals for both for new and continuing students. In addition the report allows department chairs and deans to track the enrollment projections for their departments and colleges; therefore, the EPR has become a tool for academic program assessment and management as well ([RR265](#)).

3rd item of evidence in support of Core Component A

Both curricular and co-curricular programs have established effective mechanisms for utilizing assessment data and have made refinements based on the data.

The following are representative examples of how specific programs have used assessment results to inform continuous-improvement actions:

**Industrial engineering** now provides an opportunity for all campus majors to participate in an occupational safety minor. This development is a direct result of industrial advisory board recommendations. New “lean manufacturing” and “six-sigma” courses have been created as a result of alumni feedback. Student Advisory Board input led to the creation of new elective tracks which include safety, lean manufacturing, industrial hygiene and six sigma. These tracks have led to a green-belt certificate program in six-sigma quality that is available to all students on campus. Technology-enabled review modules in selected topics of probability and statistics, operations research, finance, and management have been created (see, for example, [http://ie.sdsmt.edu/statweb/probstat.htm](http://ie.sdsmt.edu/statweb/probstat.htm)), and the prerequisites for Stochastic Models have been changed from Math 231 to Math/IENG 381.

**Geological engineering** has used feedback from constituencies to modify program objectives as well as the curriculum. GEOE 451 is no longer required, and in its place an elective
course has been added to the curriculum. An economic geology student advising handbook has been developed and given to all students in the program. On the basis of feedback from the professional advisory board and other constituencies, the content of the senior engineering design sequence has been modified. Results from alumni surveys, an employment census, senior exit interviews, and senior surveys resulted in the required course, GEOE 451, Economic Geology, being made an elective option along with courses in water resources, environmental engineering, petroleum, and mining-related areas designed to help students prepare for practice in their chosen field of interest within geological engineering.

The chair of physics has developed and pilot tested a Science Reasoning Rubric. Results have led the program faculty to consider doing pre- and post-assessments of scientific reasoning skills in large introductory-level courses using the Hestenes Force Concept Inventory.

Materials and metallurgical engineering has adopted a Writing Across the Curriculum (WAC) approach to the MetE lab sequence in order to make improvements in writing skills. Assessments led the program faculty to redouble its efforts on communications, specifically report writing and rewriting, and on cognitive development. The model offered by industrial engineering is being followed and tracking of student development through the Steps for Better Thinking Model has been initiated.

The writing faculty reviewed all assessment data collected to date that informed understanding of students’ communication skills and, in spring 2004, issued a “closing the loop” report that contained a list of specific action items for AY 2005-06 (see http://www.hpcnet.org/GEPObjective1). These action items include sharing a “Top-10” error hit list created in spring 2005 with all faculty members and initiating a series of training workshops that will focus on evaluating writing and providing feedback on writing.

The assessment process in civil and environmental engineering identified three areas of concern: senior design experience, transportation component in the curriculum and integration of social, ethical, contemporary and life-long learning issues. In response the program faculty developed a process for having senior design students interact with local private consulting firms, State agencies, Ellsworth Air Force Base and Rapid City government. Student design teams in the program work on real-world projects with a private sector contact and a faculty mentor. A course that is co-taught with the South Dakota Department of Transportation has been developed, as has a speaker series to address social, ethical, contemporary and life-long learning issues. For two years, this speaker’s series was supported via faculty development funding, but in AY 2005-06, the series became self-supporting via corporate funding. For a list of speaker topics, please see RR318. Reassessment has shown significant improvement in the areas of concern.

Assessment of the electrical and computer engineering curriculum by the program’s academic advisory board led to the creation of EE/ME 351, Mechatronics, and an increased emphasis on teaming. In summer 2004, a detailed alumni survey was created and levied. The open-response questions evoked considerable input, and this is still being assimilated by the program faculty.

The math and computer science faculty revised the math degree to create a new "Applied and Computational Math" degree (2001) largely as a result of suggestions made by the Society of Industrial and Applied Mathematics (SIAM). The computer science Senior Design course (CSC 465) was modified based on feedback from business partners and alumni. In particular,
the new course has an increased focus on customer orientation including increased project documentation.

The chemical engineering program has actively assessed and examined its program over the last several years and, as a result, has added a biochemical engineering emphasis to enhance student opportunities in biotechnology. The curriculum has been revised to include integrated design instruction, integrated advanced software instruction, and integrated laboratory experiences throughout. The laboratory experiences, through industrial- and NSF-funded grants, were changed to include a novel, hands-on, “design-build-test” concept. Adoption of this model has greatly increased the experiential learning aspects of the laboratory component.

In mechanical engineering, ME 477 Mechanical Engineering Design I and ME 479 Mechanical Systems Design II were augmented by the creation of two labs, ME 481L and ME 482L, as a result of senior exit exams, feedback from the department. Curriculum Committee and an SGID-style student focus group. The focus group results made clear that the credit/workload imbalance in senior design was a strong issue for the students. Hence the faculty took a serious step and converted one 3-credit senior elective into additional senior design credit. Senior design now accounts for 7 credits and one ME senior elective course requirement has been eliminated. The ME faculty were responding to the increasing sophistication of senior projects and believe that the initial impact has been positive.

Student Affairs conducts a biennial review of alcohol and has used results from the Resident Life Survey to improve staff training and address issues in facility maintenance and improvement. The “gap analysis” technique afforded by the Student Satisfaction Inventory (SSI) has been exploited to guide improvements in services in the Office of Multicultural Affairs, development of academic plans for fraternities and sororities, changes to Student Health Center hours, and creation of targeted programs and activities to address specific needs.

**Core Component 3b. The organization values and supports effective teaching**

**Evaluative Statement for all of Component 3b**

**SDSM&T values and supports effective teaching. Like many universities, it is struggling to define the most effective balance between teaching, research, and the scholarship of teaching. However, with the refocusing of the strategic plan, a renewed interest in engineering and science education and a revitalized discussion of the differences between and the value of each of these three areas is occurring. We have made significant efforts in the support and professional development of faculty members, and our students are experiencing the positive impacts of these efforts in the classroom.**

**Evidence cited:**

1. The institution sets and expects high standards for teaching, but these standards don’t always translate into appropriate rewards and support for faculty.
2. The institution has a good record of supporting individual innovation and improvement in teaching.
3. The institution uses reinvestment money to develop campus-wide projects designed to strengthen teaching and learning.

1st item of evidence in support of Core Component B

The institution sets and expects high standards for teaching, but these standards don’t always translate into appropriate rewards and support for faculty.

Teaching expectations for faculty members are established at the outset through the negotiated agreement between the Board of Regents and the Council of Higher Education (RR20). The COHE agreement stipulates the evaluation of all faculty members must include an annual evaluation of instructional performance. In fall 2002, SDSM&T adopted an institutional statement of priorities for Faculty Performance (RR85). In this statement, the institution identified student success as its institutional priority. The document also establishes institutional performance standards and expectations for teaching, scholarship, and service.

Faculty performance in teaching is evaluated as either “not achieving,” “achieving,” or “exceeding” expectations. Teaching activities to be considered in the annual performance appraisal (commonly referred to as “Appendix F”) require that faculty demonstrate competence in teaching and in the evaluation of student performance through a variety of activities that include

- Offering consistently challenging and current courses
- Incorporating scholarly activities on a regular basis
- Periodic review of course content and evaluation that is consistent with national expectations for content and quality
- Required use of technological resources employed by professional practitioners

While the current salary process favors teaching in the determination of annual raises, it is not without its problems. In spring 2004, 53% of all unit faculty members and 56% of non-unit faculty members exceeded expectations. In large departments (7 or more evaluations), the unit percentages for exceeding expectations ranged between 27% and 86%. Since merit salary increases are based on teaching performance evaluations to some extent, this disparity is cause for some concern. As a result, the Board of Regents and the institution have initiated a review of departmental performance standards. Institutional and departmental level performance standards are under development with a revised due date of May 2006 (RR267).

In addition to recognition of the value of high teaching standards in both merit salary increases and in the promotion and tenure process, SDSM&T annually recognizes outstanding performance of its faculty and students at the Honors Day Convocation. One of the awards, the Ennenga award, is given to one faculty member each year for recognized excellence in teaching. The Benard A. Ennenga Faculty Award was established by Mr. Ennenga to recognize any Teaching Assistant, Assistant Professor, Associate Professor or Full Professor who has demonstrated excellence in teaching and/or motivating students. Thirteen faculty members from across campus have earned this award since its establishment in 1993. Of those, five have gone on to earn the SDSM&T Outstanding Professor award in subsequent years. Three of those five have earned the award primarily as a result of research activities associated with engineering and science education. Two of those three were named by the Carnegie Foundation as the South Dakota Professor of the year.
Although the institution both values and recognizes excellence in teaching, there remains a concern that the incentives as well as the support functions for excellence in teaching are not yet at the level needed. As a body, the SDSM&T faculty is unusually committed to classroom instruction, but only one faculty member each year is recognized for his or her contribution to excellence in teaching. Perhaps even more troubling is the perception that excellence in teaching is not a recognized element of the overall workload. In general, faculty members do not feel that scholarly publications on teaching carry as much weight as a research paper within the discipline. A recent request for proposals (RFP) for 1st-year teaching enhancement grants by the faculty development committee was met with limited response. More than one faculty member indicated that although they would have enjoyed working on 1st-year development efforts, they felt that for promotion and tenure purposes their primary focus needed to be on research within the discipline.

2nd item of evidence in support of Core Component B

The institution has a good record of supporting individual innovation and improvement in teaching.

SDSM&T has been a member organization of the Collaboration for the Advancement of Teaching since its inception. Currently the Vice President for Academic Affairs serves on its Board of Directors and the Director of Academic Initiatives facilitates a regional colloquium on assessment for the Collaboration; the assessment colloquium has 25 member institutions. Faculty members have attended and presented at all but 2 of the bi-annual Collaboration conferences between 2001 and 2006, and two faculty members have served on conference committees. One hundred institutions belong to the Collaboration.

SDSM&T has received four 3-year $300,000 grants from the Bush Foundation for enhancing faculty development activities related to the improvement of teaching. In addition, institutional funding for faculty professional development and assessment is approximately $50,000 per year. Since 1991 it is estimated that faculty development funds (both institutional and Bush grant) have supported nearly 600 faculty development activities ranging from campus workshops to travel grants to teaching enhancement grants. The Bush Foundation funding and institutional support monies are currently used to promote faculty professional development in three areas:

- Student / faculty collaboration through research and design
- Improving pedagogy and the curriculum
- Integrating and linking curricular concepts (e.g., teaming and leadership, ethical reasoning, multiculturalism)

Recent teaching enhancement awards have funded the development of more active pedagogies in large enrollment 100-level courses. These grants are leveraged through reinvestment funds through the VPAA’s office to support a campus-wide initiative to redefine the 1st-year curriculum (more on this in Core Component 3c). A second enhancement award in the summer of 2004 provided a small stipend for three faculty members to research funding agencies for curriculum development and improvement. The effort resulted not only in a substantial list of funding agencies but also in the submission of four separate grant proposals totaling nearly $3,000,000. Examples of other faculty development teaching enhancement grants and results connected to teaching may be found in an online archive of all faculty development projects at http://www.hpcnet.org/BushGrantArchive or at (RR41).
In January 1998, then Governor William J. Janklow announced a special awards program to support university teaching with computer technology. This competitive program supports faculty members of South Dakota’s public universities with grants that provide summer development support for distance education and technology-enhanced curriculum. From 1998-2004, a total of 45 SDSM&T faculty have received Governor’s Awards for teaching with technology. Since its inception, SDSM&T faculty members have received over $1,000,000 in technology development funding through this program (RR57).

As a complement to the technology enhanced learning initiatives, the Board of Regents established statewide awards for faculty projects demonstrating excellent use of technology or technology enabled components. Two SDSM&T faculty members have earned these awards for their use of technology to enhance student writing and the study of humanities within the curriculum.

**3rd item of evidence in support of Core Component B**

The institution uses reinvestment money to develop campus-wide projects designed to strengthen teaching and learning.

In 1996 the Executive Branch of the State Government reduced its budget by 10% in order to keep a pledge to reduce property taxes and asked the regents’ schools to do the same. The state legislature subsequently allowed the universities to retain the funds cut for use as a “reinvestments” pool.

In 1997, all campuses were directed to use some of their “reinvestments” funds to develop a “center of excellence.” Each campus developed a center that would advance its mission and be revolutionary in its approach to education. As its Center of Excellence, SDSM&T chose to establish the Center for Applied Manufacturing and Production (CAMP.) Students, faculty and industry partners developed project-based learning approach to engineering and science education. The program addresses the needs of industry through the use of multidisciplinary teams, electronic communications and a focus on manufacturing (RR15, RR168, RR169, and RR238). CAMP addresses many of the issues of student success. It is primarily aimed at 3rd- and 4th-year students, but 1st- and 2nd-year students are encouraged to join project teams to design and develop devices for outside industry, campus researchers, or for engineering competitions. There are presently 24 CAMP honor student members who must maintain a 3.0 GPA and serve as leaders of the CAMP activities. Approximately 175 additional students are involved in the CAMP projects. Students who wish to be heavily involved in the projects spend from 10 to 50 hours per week on them. Now in its seventh year, CAMP is thriving and respected on campus and in the community. It received the 2000 Boeing Outstanding Educator Award and the 2001 NSF Corporate and Foundation Alliance Award. Further, because of the developmental skills promoted within the program, the program is highly valued by corporations seeking to hire SDSM&T graduates.

Also in 1997, a major portion of the SDSM&T “reinvestments” funds were used to develop a mentoring program and an introductory engineering course for 1st-year students.

The Freshman Mentoring program was established in 1997 to serve first-time, degree-seeking undergraduates. Our goal was to transition academic advising from an administrative function to one grounded in student developmental theory. In creating the program, the
responsible faculty and staff searched the academic advising, retention, and student development literature for guidance and ideas and attended First Year Experience (FYE) conferences offered through the National Resource Center for the Freshman Year and Students in Transition at the University of South Carolina. In the summer of 1997, a mentoring/advising handbook was developed; it is updated and distributed every fall to mentors and advisors (RR300). In addition, a guidebook for parents was created, which is distributed at the summer orientation/registration sessions (RR304). This guidebook acquaints parents with the mentoring program and campus services available to help students adjust to their increasing independence as a college student.

As a response to changing practices in industry, SDSM&T faculty initiated a revised curriculum for 1st-year engineering students in 1997 with a pilot program of 25 students. The course (GES 115, Professionalism in Engineering and Science) is now required by all 10 of the engineering programs plus 2 of the science programs and serves roughly 360 students per year. Coordination of the GES program has been largely volunteered as an overload by several of the faculty members involved with the instruction of the program since there currently is not a funded coordinator position. Aspects of the GES curriculum have been adapted from elements of the EPICS program at Colorado School of Mines, the Foundation Coalition, and the SUCCEED Coalition and is structured with a strong focus on problem solving. Currently, the curriculum incorporates elements from project-based learning, linked or integrated curricula, cooperative learning, and technology-enabled learning. Developmental work has received limited funding, primarily through an affiliate grant from the Foundation Coalition and reinvestment monies from SDSM&T.

A primary purpose of the GES curriculum is to provide the knowledge base and foundational skills in math and science necessary for effective problem solving. Primary components of the curriculum include career exploration, team development through 1-5 weeklong projects, applied problem solving, and experimentation. Throughout, technical communication skills have been emphasized as well as data analysis and interpretation. A curriculum map outlining areas of study and linkages between those areas is shown below in Figure 7.5.

![Figure 7.5 General Engineering and Science program Concept Map](image)

The GES curriculum is updated and revised on an annual basis, and, starting in fall 2005, the curriculum was aligned with the mentoring program required of all incoming freshman. Syllabi for GES 115 and mentoring will be aligned, and students will earn 15% of their GES 115 grade through participation in the mentoring program.
Assessments include assessment of student portfolios using the GES 115 project rubric, attitudinal assessment through the Student Assessment of Learning Gains (SALG – http://www.flaguide.org); knowledge gains in technology applications through an online student survey, and student tracking student use of technology enabled learning modules. Assessment data indicates that strengths of the GES curriculum are problem solving, team based projects, and the level of support provided individual learners. Student support is accomplished primarily through team projects that facilitate student-student and student-faculty interactions. Supplementary support materials are included on the course CD, the student online GES support page, (http://www.hpcnet.org/pes), through a supplementary functions review site (http://ie.sdsmt.edu/functions/functions.htm).

The Technology Fellows Program, funded since 2000 primarily by the State with campus matching funds, provides a unique opportunity for undergraduate students to develop professional-level technology skills, learn to work in a team-based environment and to be remunerated while learning. The program is designed so that Tech Fellow students assist Faculty members in learning new technology that can be integrated into their course curricula. The scope and type of projects are determined by the needs of the faculty. In addition to their assigned projects and tasks, Technology Fellows spend one hour per week in a seminar course. This course draws on the expertise of various faculty members, staff members and even the Tech Fellows themselves.

Technology Fellows projects have included faculty/staff workshops on PowerPoint, FrontPage, 508 Compliance, Email Archiving, MSDN usage and Polycom usage. Samples of recent projects include the development of animated flash plots for use in the GES curriculum and user-friendly manuals for ADS software. Faculty may make requests for project assistance at any time during the semester. Additional information and sample projects may be found at http://its.sdsmt.edu/techfellows.htm.

**Core Component 3c. Organization creates effective learning environments**

**Evaluative Statement for all of Component 3c**

SDSM&T identifies effective teaching and learning environments as a central core value and continually seeks to strengthen and improve programs that serve the needs of all our students. We have identified the 1st-year experience and student communications skills as the two key strategic areas for improvement. Like many universities trying to find the most effective management mechanism for curricular reform, SDSM&T has struggled to build a common research base and consensus for reform efforts. However, recent efforts hold promise for implementing a management structure for building a consensus and sustaining curricular transformation.

**Evidence cited:**

1. The institution has identified reshaping teaching and learning as a primary strategic initiative and supports new programs designed to meet the initiative.
2. The institution provides access to programs designed to assist students and their parents in the transition from high school to college.
3. The institution continues to update and strengthen programs designed to support and expand underrepresented groups.
1st item of evidence in support of Core Component C

The institution has identified reshaping teaching and learning as a primary strategic initiative and supports new programs designed to meet the initiative.

Foundations of Excellence (http://www.hpcnet.org/1styear): During late fall 2003 and early spring 2004, SDSM&T participated in the national Foundations of Excellence in the First College Year. Although we were not selected to continue in the Foundations project as a foundational school, we elected to continue the work begun in December 2003. During spring 2004, a First College Year Steering Committee was convened by the Vice President for Academic Affairs and charged with developing a plan for the 1st-year of college at SDSM&T. In addition to completing and submitting the Foundational Dimensions™ Performance Indicators forms, the group formulated a statement of student outcomes for the 1st-year, conducted a current practices inventory for the 1st-year activities, and made specific recommendations for improving the 1st-year (RR45). Among the specific recommendations made by this group were the following:

1. Combine GES 115 and Mentoring to create a required 1st-year course for all incoming students.
2. Create a focus group to determine what can be done to enhance student success in all 1st-year course work, especially in the large class size courses required: math, physics, chemistry, English.
3. Expand and coordinate our methods for early identification and the delivery of interventions for students having difficulties.
4. Create a position of 1st-year experience coordinator.

In addition, the committee made the following specific recommendations for improvement in the 1st-year:

1. Improve/expand 1st-year initiatives currently in place,
2. Undertake new 1st-year initiatives, and
3. Implement mechanisms for coordination, self-assessment, and continued improvement.

1st-year Experience: At the May 11, 2004 campus-wide strategic-planning session, focus groups of faculty and staff members identified the 1st-year experience and student communications skills as the two most important areas for reshaping the teaching and learning environments. The HLC Criterion 3 co-chairs identified a working group to identify needs, develop a 1st-year model, and address a management structure for the development of a campus wide initiative for the 1st-year. By the fall 2004, the group had identified a set of objectives and outcomes for the 1st-year (RR192). The group also expressed preference for using a learning community model for improving/expanding the 1st-year experience. Elements of the learning community include the FIRST program already established in the residence halls, mentoring, and curricular components. A STEM Talent Expansion Pool (STEP) proposal was submitted in the spring 2005 to help development efforts for the learning community. Although not funded, reviewer comments favored the developmental aspects of the proposal. A new proposal is being submitted that will address NSF reviewer concerns and strengthen the developmental aspects of the learning community through increased collaboration with residence life, leadership development, GES and the bridge program. A request for a 1st-year experience coordinator was also approved by the University budget committee and, at the time of this writing, a search is underway.
1st-year experience coordinator: Both the Foundations for Excellence group and the 1st-year Experience group endorsed the need for a 1st-year experience coordinator in order to move SDSM&T to the forefront of engineering and science education. The role of the coordinator will be to develop curricula and co-curricula to address the needs of all new students at SDSM&T. The Coordinator will help to coordinate and integrate a number of initiatives currently in place including GES 115, mentoring, FIRST, leadership development, residence life, and other support services available through Student Affairs. Coordination of these activities will help to develop a successful learning community for the campus and help establish SDSM&T at the forefront of engineering and science education. The request for a 1st-year experience coordinator was approved in spring 2005; however, by July 2005 the search pool was deemed inadequate. An interim solution for managing a 1st-year experience was developed in summer 2005, and a 1st-year Program Committee (FYPC) that reports directly to the Vice President for Academic Affairs was formed for AY 2005-06. Figure 7.6 below illustrates the areas that are being coordinated through this FYPC while the coordinator search continues (RR275).

![Figure 7.6 Areas coordinated through the FYPC](image)

Tech STEP: STEM Talent Expansion Program Grant Proposal: A Science, Technology, Engineering, and Math (STEM) Talent Expansion Program (STEP) grant proposal was submitted to the NSF in February 2005. In addition to providing an external funding source for developing a 1st-year learning community, the proposed program also addresses a number of areas identified by the 1st-year group. Specifically,

- It provides a common umbrella through the establishment of a developmental learning community for curricular and co-curricular activities,
- It establishes a management structure for developing a transformational curriculum and co-curriculum,
- It provides an integrated, systematic assessment process for evaluating and improving 1st-year programs.
Funding of this STEP grant will greatly facilitate improved retention in STEM areas through the establishment of a comprehensive learning community that helps students develop the complex thinking skills required in STEM disciplines. The student experience will be improved by providing a curriculum that is challenging while simultaneously providing the foundational support necessary for student success. That support is provided through an integrated developmental plan linking psychosocial, personal, and intellectual development. The objectives of the Learning Community are to increase the number of pathways available to underrepresented groups in pursuit of STEM baccalaureate degrees, to develop an integrative model linking pre-matriculation programs through the end of the first year, and to achieve measurable cognitive gains in student complex thinking patterns. Although not initially funded, the STEP proposal provides a useful framework for managing and improving our 1st-year experience that is soundly rooted in developmental research. A revised proposal that strengthens the collaboration between residence life and curricular components will be submitted in the spring. Additional information on the STEP proposal, developmental objectives, and key components may be found at http://www.hpcnet.org/1styear and (RR224).

FIRST in the Residence Halls (http://www.hpcnet.org/sdsmt/reslife/success): FIRST, Freshmen Introduction to Real Success at Tech, supports 101 1st-year students in making strong social connections to each other and the University. The program combines community development activities and adventure based orientation to campus with in-hall academic support. Incoming 1st-year students self-select to be in the program and must sign a participant agreement before being accepted into the program. More than 40% of all first time students living on-campus participate in this program.

During this first year of the program, participants benefited from an adventure-based orientation the weekend before classes began. Participants had the option of going camping, doing community service, mountain biking, learning more about leadership development, or visiting local attractions including the Ellsworth Air Force base. The social connections developed and maintained through the adventure based orientation program appear to be strong relationships, which are relatively healthy. Additionally, academic support was provided within the residence hall environment through peer tutoring—tutors had office hours in the dorm and also coordinated study groups for specific subject areas and study sessions for specific exams.

FIRST has a well-defined set of objectives and outcomes and enlists a variety of assessments for measuring both program success and student success. Based on student experience and assessments the following aspects of the program were improved after year one:

- **FIRST Connections activities were improved.** In conjunction with Kick Start Registration, all FIRST students stayed overnight in Howard Peterson Hall with their respective roommates for fall. Activities and workshops were used to get them into the community and community-responsibility mode.
- **FIRST Adventure Weekend activities were improved.** An interest survey was completed by the FIRST students and helped establish the types of Adventure Weekends and programming offered.
- **Learning Community Assistants (LCAs) replaced Resident Assistants (RAs) and FIRST Assistants.** LCAs have more interpersonal interactions, focus on personal needs, and develop more programming with a community focus. An offer was made that LCAs be used in the classrooms with classes in the student cohort groups; but because of limited resources, the organization and training elements required to...
FIRST in the Classroom: The FIRST in the Classroom Project was initiated in the summer of 2005 as a faculty complement to the FIRST program begun in the resident halls summer 2004. The goals of FIRST in the Classroom are to increase substantially the amount of student engagement in 100-level general education courses, to increase involvement in the scholarship of teaching and best practices, and to create a learning community of faculty members, Students Affairs (SA) personnel and Academic and Enrollment Services (AES) personnel who will work together to improve the 1st year experience. The project provided summer training and support for five faculty members, each of whom teaches large-enrollment general education courses, to learn about various “engaged pedagogies” and to implement them in fall 2005 and/or spring 2006.

The courses are in psychology, American history, basic writing, college algebra, and physics. The faculty members were selected through review of their applications by the Faculty Development Committee and the 1st Year Experience Working Group. Pedagogy training for the FIRST participants included a series of seven summer seminars on developmental theories, basic research on learning, basic techniques in active/collaborative learning, assessment basics, assessment resources, and teaching assessment techniques. These seminars were made available to the entire campus. In addition to summer support and a modest travel budget, the five faculty cohort members were also provided a reduced section size, a one course release, or other comparable benefit for fall 2005, depending on the nature of their course redesign plan (RR225).

This program was prompted, in part, by our NSSE scores. Our seniors appeared to be having much the same experience as the comparison group. However, our freshmen reported significantly less engagement and interaction in all areas.

Tablet PC program: We will implement a tablet PC program beginning fall of 2006 and are piloting the program with 25 students during AY 2005-06. Four classes, Freshman Composition (ENGL 101), Professionalism in Engineering and Science (GES 115), Introduction to Humanities (HUM 100), and Introduction to Sociology (SOC 100) were redesigned during summer 2005 to incorporate the tablets into the classrooms. The faculty members involved began receiving relevant professional development in spring 2005. This program will allow students access to the internet anywhere on campus via wireless access points, and will open up a wealth of tools to the faculty. The tablet functionality will allow the students to write on their screens as if they were writing on a piece of paper, and will digitally store all their notes, etc. Students will also be able to work in groups and submit work real-time with the instructor. Homework can be graded and commented on without ever sending a piece of paper to the student. With time, all students may become part of the program by fall of 2008 and hopefully many more classes will be redesigned to use the tablet’s unique technology.

Improving and strengthening communication skills: Although the focus of the 1st-Year Experience (FYE) group has been on creating coherence among the programs that serve the 1st-year students, work has begun on the second major charge of the FYE group. ABET criteria for accreditation of our engineering and computer science programs explicitly require that written and oral communication skills be developed within the context of the major. Each undergraduate academic program has identified an existing or proposed course (or courses) within the major that requires substantial writing, where writing competencies are
evaluated and improved, and where the quality of the writing is a component of the course grade. These writing-intensive courses require significant writing in the learning of course content and provide individualized instructor feedback that enhances student achievement of the Board of Regents’ System General Education Goal #1, “Students will write effectively and responsibly within their own disciplines.” Rubrics for evaluation of written and oral presentations have been developed collaboratively and piloted by English, science, and engineering faculty and are available for use by all programs (RR251 and RR253). The English faculty is planning a series of AY 2005-06 workshops to provide all faculty members guidance in assigning and evaluating writing.

2nd item of evidence in support of Core Component C

The institution provides access to programs designed to assist students and their parents in the transition from high school to college.

Orientation (“Kickstart”): “The Kickstart Registration” experience is offered multiple times during the summer. It is designed to be a compact and convenient event to ‘wow’ the parents and students with two overreaching goals 1) to get the potential student effectively tested, mentored and registered into classes for fall and 2) to impress the student and parents with the hands-on, career focus and uniqueness of the South Dakota School of Mines and Technology.

The Parents Program: In 2005, SDSM&T started a formal program for bringing parents together to support each other and the school in educating their sons and daughters. The following are just 4 of the 10 program goals:

- To give the school the vehicle to co-opt parents in school culture, traditions and goals
- To increase parental understanding of school missions and programs
- To monitor parent perception and concerns regarding school
- To support school advancement and admissions programs

In AY 2004-05, the parents program was held in conjunction with Tech Family Weekend activities.

First Connections: In 2005, FIRST Connections program began emphasizing connecting 1st-year students to campus and each other before starting classes in the fall. The program is held in June and is a feature of the FIRST program. Students who have self-selected to be in the FIRST program will attend summer registration during this time. In addition, these students will stay over night with their assigned roommates for fall. The University will provide multiple activities to strengthen social connections through community development activities and academic related support workshops.

First Links: FIRST Links, designed as an adventure-based orientation program, affords the 101 1st-year students in the FIRST program additional time to learn more about the area, community, each other and the University. The participants are placed in cohorts of 4-5, based on their self-reported interests. These cohorts will participate in an overnight adventure-based orientation program. FIRST staff will continue to work with these groups as cohorts and in relation to their interest areas.

Computer Science, Engineering, and Mathematics Scholarships program: SDSM&T has been successful in competing for two multi-year grants from the National Science Foundation.
for scholarship funds from their CSEMS program (RR170). The objectives of SDSM&T’s second CSEMS program are to help a cohort of CSEMS scholars progress toward fulfilling their educational and personal goals by providing

- Increased interdisciplinary student-to-student mentoring.
- Hands-on real world engineering and science project experience through competitions.
- Opportunities for teaming and leadership development.
- Practical experience in fund raising and budgeting.
- Life/career enrichment activities outside the technical area yet essential to success.

The current grant, awarded in 2004 for a four-year period, provided SDSM&T a total of $400,000. This funding is enabling us to increase the involvement of 30 financially needy, academically talented freshman/sophomore students a year in SDSM&T’s nationally recognized Center for Advanced Manufacturing and Production (CAMP). By joining this CSEMS scholarship program with CAMP we provide students with financial support to replace minimum wage, menial jobs with work on actual engineering projects that develop a broader view and better understanding of societal needs. These rewarding and exciting engineering projects early in their college program provide incentive for students to complete their rigorous engineering and science curricula. Students receive tuition and fee assistance of $3,125 a year for up to two years. The balance of each year’s budget is used for salaries for eight student mentors and materials and supplies.

Scholarship opportunities at SDSM&T: The institution increases access to higher education for incoming students through its institutional scholarship program, coordinated by a campus-wide scholarship committee. The Scholarship Committee is appointed by the President and is currently made up of a Chairperson, the College Deans, the Financial Aid Director, the Scholarship Coordinator, and one representative each from athletics, the faculty and the Foundation. The committee reviews current policies and makes revisions as necessary to meet the recruitment and retention goals of the University. A sub-committee charged with adhering to the established awarding policies reviews the freshman scholarship applications and the committee-awarded scholarships for upper-classman scholarships and then submits award recommendations to the Scholarship Committee Chairperson for award approval.

- The top tier of scholarships for incoming freshmen: Homer and Margaret Surbeck Distinguished Scholars: Two $7,000 awards to incoming freshmen with a preference to South Dakota high school graduates, renewable for up to 4 years. ACT/SAT score, high school GPA, and high school rank are the primary selection criteria.
- Presidential Scholarships: Multiple awards ranging from $1,000 to $3,000 for incoming freshmen with a combination of one year non-renewable, two-year renewable, and four-year renewable awards. ACT/SAT score, high school GPA, and high school rank are the primary selection criteria.

For current students, the top award is the Frank and Marilyn Richardson Scholarship: Richardson Scholars are outstanding sophomore and junior and senior students from the College of Earth Systems, College of Materials Science and Engineering and College of Systems Engineering. Nine $5000 awards are given each year.

The “Regents’ Scholarship” program was enacted by the South Dakota Legislature in 2003, but the legislature failed to fund the program. The program was funded in 2004, but the name was changed to the South Dakota Opportunities Scholarship (SDOS) Program. The SDOS
has as part of its basic eligibility criteria that students must meet the “Regents’ Scholar” curriculum for graduating high school seniors. The SDOS is a $5,000 scholarship awarded over four years ($1,000 each of the first three years and $2000 for the 4th and final year) to high school graduates from South Dakota who complete a challenging high school curriculum and maintain certain academic standards. A total of 67 SDSM&T students were originally awarded SDOS for the AY2004-05. Forty-four students met the eligibility requirements for continued funding in 2005-06. Eight students who have lost eligibility can regain funding if they raise their cumulative GPA to at least 3.00; however, they can not regain lost semesters of eligibility. The remaining 15 students have lost eligibility in its entirety due to completing fewer than the required 15 credits hours per semester.

**College Prep Program:** The SD CollegePrep Project was initiated in the fall of 2002 after the South Dakota Legislature enacted Senate Bill 16. The law requires all public school districts to annually provide the Board of Regents names and mailing addresses for all students grades seven through twelve by November 1 of each year.

The main objective of the SD CollegePrep Project is to help as many South Dakota students and their families prepare successfully for education after high school. Each year in the fall and spring, the Board of Regents mails CollegePrep flyers to students in grades seven through twelve. Students can obtain more CollegePrep information at [www.sdcollegeprep.info](http://www.sdcollegeprep.info).

**3rd item of evidence in support of Core Component C**

The institution continues to update and strengthen programs designed to support and expand underrepresented groups.

**Ivanhoe International Center:** Ivanhoe International Center works to promote global and cultural awareness by working with international students and diverse populations to develop and promote activities and projects that include all students. These activities and projects include cultural awareness presentations in the classroom and with various student groups, Cultural Expo, and the Diwali Celebration. Other engaging, interactive programs include the Cultural Etiquette Luncheon, small group simulations, and one-on-one connections between international students and the mainstream population.

**AISES:** The University has made special efforts to reach out to Native American communities in K-12 in an attempt to bring to campus more of those Native American students who have a passion and aptitude for science and engineering and once here, to help them succeed. The American Indian Science and Engineering Society (AISES) program was established in 1989 at SDSM&T. The program started with 8 Native American students, and two years later had 32. From 1990-2001, aggressive K-14 programming (summer-residential and after-school programs) was made possible through the Scientific Knowledge for Indian Learning and Leadership (SKILL) program. Dramatic improvement was achieved in Native American retention at the secondary level; the high school graduation rate of participants was 100% compared to 47% for non-participants.

In 1991, the Minority Study Center was established to promote and preserve American Indian culture on campus and to provide space for students to study and learn. In 2001, the State assumed funding for the Director of Multicultural Affairs and operating costs. The Minority Affairs Advisory Committee and the Minority Student Program Policy were established to study a renewed approach to Native American issues.

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In 2004, a Multicultural Activities Office was established and a coordinator hired full time. The office provides supplemental tutoring; workshops for time management, test taking, study skills, communications and stress management; administration of scholarship programs; advocacy for other sources of financial assistance for students; assistance in placing students in coop/internship placements and full-time employment; a study lounge where students can interact.

Multicultural Committee (MCC): The Multicultural Committee began reporting directly to the SDSM&T president in 2004 with a charge to “achieve and maintain national prominence for the recruitment, retention and graduation of American Indians seeking mathematics, science, and engineering at the graduate and undergraduate levels while respecting their ethnic heritage.” The MCC ensures that all students are provided access to South Dakota public higher education and to SDSM&T in particular. The committee provides recommendations to the campus and develops articulation agreements between SDSM&T and tribal colleges (RR73, RR74, RR207).

Multicultural coordinator: The coordinator was hired in August, 2005 to serve as the advisor for the American Indian Science and Engineering Society (AISES) chapter at SDSM&T and to provide leadership for American Indian students pursuing careers in engineering and sciences. The University seeks to develop educational opportunities for qualified students of color and to work with reservations and urban schools in recruiting American Indian students. Partnerships with American Indian nations in the development of technology on their respective reservations are also goals of the coordinator.

Women in Science and Engineering (WISE) Program: Although high attrition rates for female STEM students at the college level are cause for concern nationwide, SDSM&T lags significantly behind national trends in several ways. Nationwide, women earn nearly half of all baccalaureate degrees in science and engineering combined, but in 2003, only 15% of the SDSM&T graduating class was female STEM students. At the national level, approximately 20% of STEM graduates are female engineering students, and in 2003, fewer than 10% of the graduating engineering students at SDSM&T were female. The focus of the WISE program is therefore to help recruit women into STEM fields and to address the loss of female STEM students on the campus through a variety of resources and programs. The NSF-funded mentoring program described below connects 1st-year female students with third year female students and second year female students with fourth year female students. A Women in Science and Engineering coordinator was hired in August 2005 (RR286), and an ADVANCE grant proposal was submitted in July 2005 in the hopes of greatly expanding the WISE program (RR268 and RR269).

Mentors & Mentees Program: One of the major factors affecting the recruitment and retention of female STEM students is the low self-confidence of the female students. While some women who leave STEM disciplines are under-qualified, many women of high ability leave STEM fields at the same rate as men with lesser credentials, and the exodus of these women may be related to low self-confidence. The freshmen year of college is a significant milestone in the loss of self-confidence. The program chosen for emulation via the grant funded in 2005 (RR191) is the Mentors and Mentees (M&M) at Purdue University. We are creating at SDSM&T a forum that will encourage females in science and engineering to come together as a group, and to share concerns, strategies, opportunities and solutions. The M&M program has been shown to increase student self-confidence and provides support in the decision to pursue technical careers. The goal of implementing a mentoring program for the women STEM students on the SDSM&T campus is to create the necessary caring community
where all of the members will support one another’s success. Through this caring community, women STEM students will have a supportive environment where some of the issues that lead to switching majors, such as the transition from high school to college level expectations, can be put in their proper context.

**Bridges to Success:** The Bridges to Success program is designed to provide support for Native American students midway through their efforts to achieve a bachelor’s degree in Science, Technology, Engineering, or Math (STEM). This program is funded by the National Science Foundation through Salish Kootenai College and is jointly operated by Oglala Lakota College and SDSM&T. AY 2004-05 was the third year of the program. The program ran on campus in 2005 from approximately June 6 to July 29. Student participants worked 40 hours per week as Research Assistants in various labs across the campus, working with teams of professors, researchers, graduate students, and undergraduate students. Throughout the eight-week program, professional development workshops (campus tours, use of library, computer software, resume writing, business etiquette, poster skills, presentation skills, networking, professional society involvement, etc.) were held. Students produced a report (written, verbal, and/or poster) for the Research Symposium at summer’s end. Students received a stipend of approximately $2500 for the eight-week program (RR235).

**Freshman Summer Bridge program:** Begun in summer 2005, the four-week summer bridge program provided instruction in college algebra and introductory chemistry courses, two courses that are highly correlated with academic success at SDSM&T. All freshmen accepted for admission whose ACT math subscore was below 25 were invited to participate in the Freshman Bridge Program, which included coursework in college algebra and introductory chemistry. A Tuesday and Thursday afternoon “Student Development Series” introduced students to the majors we offer and the co-curricular opportunities that complement the curriculum. Also provided were sessions on study skills and time management and tours of local industries. Recreational opportunities included use of the campus pool and weight room and biking on the seven-mile bike path that runs through the town along Rapid Creek. Weekend outings for the first three weekends featured the Black Hills and its recreational opportunities and gave students time to form friendships and a sense of community. Supervised study halls on Sunday through Thursday evenings reinforced study skills and time management (RR180).

**Core Component 3d. The organization’s learning resources support student learning and effective teaching**

**Evaluative statement for all of Component 3d**

*SDSM&T supports student learning and effective teaching through a variety of learning resources. As a technological university, it strives to provide students with up-to-date research laboratories and state-of-the-art electronic technologies. It also acknowledges the diversity of today’s learners and seeks ways to provide support for their needs. Like many small, state-supported schools, SDSM&T struggles to find the resources required for continual updating of equipment, particularly in its classroom laboratories. Nevertheless, a number of recent efforts demonstrate its commitment to equipping classrooms and laboratories with the resources essential for a quality student learning experience.*
Evidence cited:

1. The institution provides for the updating of research laboratories and classrooms.
2. The institution supports student learning through innovative and state-of-the-art technologies.
3. The institution provides support for the diverse needs of students through tutoring, ADA assistance, and professional counseling and peer advising.

1st item of evidence in support of Core Component D

The institution provides for the updating of research laboratories and classrooms.

Title III equipment grant: In 2000 SDSM&T successfully competed for a Department of Education Title III, Part A, Strengthening Institutions Development grant in the amount of $1,672,820 over five years (October 2000 through September 2005). SDSM&T’s proposal focused on two activities. The goal of Activity I was to strengthen student success through student data system enhancements and the goal of Activity II goal was to strengthen academic programs through equipment upgrades.

The majority of the Title III monies ($708,296) have gone to fund Activity II. Although funding equipment upgrades is a significant problem in every department, SDSM&T chose to focus their proposal on five main departments – chemistry (including biology), chemical engineering, civil engineering, mechanical engineering, and industrial engineering. In addition, assistive technology was purchased to insure that our ADA students in all disciplines have appropriate resources to facilitate their learning.

The rationale for choosing the chemistry (biology) and chemical engineering departments was the growing interest in health sciences and environmental science and engineering and the strong advocacy of our industrial advisory boards for curricular changes in response to advances in biotechnology. In December 1999, SDSM&T received formal approval to begin offering a baccalaureate program in environmental engineering and Cargill provided $225,000 in funding to develop faculty expertise in biochemical engineering.

The Title III grant provided $283,834 for the purchase of essential biology and biotechnology equipment. Equipment purchased for the biology labs included microscopes, computers, an autoclave, an incubator, and a 10-liter bench top bioreactor. These are essential components of a quality teaching laboratory.

Since 1993, the Chemistry and Chemical engineering Department has had a 300 MHz nuclear magnetic resonance (NMR) spectrometer, the only one of its kind in western South Dakota, and an instrument considered essential to a modern analytical laboratory. Title III funds were used to complete a major refurbishing of the NMR and extend its life. Extruder accessories were purchased to augment the existing equipment in the Chemistry and Chemical engineering Department’s polymer technology course and facilitate the students training in the polymer process technique of extrusion. A Thermogravimetric Analyzer/DTA, a dual purpose instrument able to perform simultaneous thermogravimetric and differential scanning calorimetry, was also purchased.

The rationale for choosing the civil, mechanical and industrial engineering programs was to capitalize on earlier legislative approval to expend $3.75 million to renovate the
Civil/Mechanical (C/M) Building that houses one-third of SDSM&T’s student population and the efforts of the campus Capital Campaign to raise an additional $300,000 in private funds to provide additional student project and laboratory space for the C/M building.

The Title III grant provided $370,481 for funding of CEE, ME, and IE equipment initiatives, including the Supersonic Wind Tunnel Module, built in-house using Title III monies. The lab modules made possible through Title III provide students with hands-on instruction that enhances the learning experience. The newly completed Computer Integrated Manufacturing (CIM) Lab provides a fully integrated small-scale machinery lab experience for undergraduate students. The CIM Lab equipment is also used by middle and high school students in SDSM&T’s summer outreach programs (NASA Honors Program and Youth Engineering Adventure). Title III funds allowed for completion of the lab five years ahead of the institutional projected completion time.

Title III funding for ADA (Americans with Disabilities Act) equipment and software purchases has been vital in providing assistance to SDSM&T students with learning disabilities and physical disabilities. The equipment is allowing ADA students to improve their reading and writing capabilities by hearing texts and worksheets read orally and dictating papers and assignments. This has been especially helpful for students with multiple sclerosis, dyslexia, and language disabilities. These assistive technology resources have been incorporated into individual student ADA plans. Title III funding of $25,581 was used for ADA purposes.

Overall, Title III funding for equipment has provided the following benefits:

- Hands-on-learning can be readily invoked in classes previously devoted only to lecture.
- Much less time is spent on troubleshooting problems with the experimental hardware and maintaining old, out-of-date equipment.
- Preparation time for labs is reduced which allows faculty to concentrate on the experimental approach to labs with their students.
- Courses have been revised/updated/added to utilize this equipment.
- Students have expressed an appreciation for the opportunity to use new equipment and instrumentation more closely aligned to industry standards.
- Faculty morale has increased because they have adequate tools to augment their instruction.
- Having access to state-of-the-art equipment is a good tool for recruiting new faculty.

Lab fee increase: Laboratory work is a critical, but costly component of the education of all engineering and science majors. To provide our students with a laboratory experience that will allow them to be as competitive and knowledgeable as their peers in other institutions, we must find ways to finance the operation of laboratories and the replacement of instrumentation on a reasonable schedule. SDSM&T is continually seeking opportunities to acquire external funding for its laboratories. Our current Title III grant has provided approximately three quarters of a million dollars over the past five years for the acquisition of modern laboratory equipment. Industry supporters such as Cargill, Caterpillar, and Dow Chemical have donated approximately the same amount over the same time period. Within our reinvestment budget, we have earmarked $75,000 annually for non-computer laboratory upgrades. These funds have been used to address critical needs both for our engineering laboratories and our science laboratories.
Nevertheless, much of the undergraduate laboratory equipment and instrumentation is past its projected usable lifespan, and lab fee revenues fall short of supporting the basic operating costs of the laboratories. Department chairs report that they do not show prospective students the labs because of the condition and obvious age of the equipment. Last fall SDSM&T had its required six-year general review of engineering programs by ABET. At the exit interview, the visiting team applauded our efforts to obtain external funding to improve our laboratories. At the same time, they made it clear that they felt it was imperative that the institution find continuing sources of revenue to operate and upgrade its engineering laboratories.

In spring 2005 we requested from the regents a three-year phased increase of the per course laboratory fee (from $23.30 to $50) on all laboratory courses that carry an engineering CIP code. Phase one of our proposal was to increase such lab fees by a 20.17% from $23.30 to $28.00 per course. The regents responded by approving this increase on all lab courses regardless of CIP code. Completion of the three-year plan would increase the lab course fee to $50.00 per lab course and generate approximately $133,000 in FY08 as compared to the FY04 operating expense of $123,600. The issues of upgrading outdated equipment and modernizing laboratory infrastructure remain critical but are not adequately addressed by this fee request.

Budget adjustments: role of the Budget Advisory Committee: The SDSM&T Budget Advisory Committee (BAC) was established in fiscal year 2004 to support the shared governance goals of our campus. The President’s mission for this Committee is, “to develop recommendations for 1) future budget requests to the Board of Regents and 2) adjustments to the annual operating budget consistent with regents’ allocations and directions.” Comprised of representatives from across campus, the BAC is responsible for reviewing and prioritizing all budget increase requests submitted by anyone on campus and making recommendations to the President (RR270). The prioritization process includes consideration and weighting of the each proposal’s impact on strategic initiatives and performance metrics (80%), impact on the overall campus (10%), and other considerations, such as cost benefit, leveraging/matching funds, and measurable outcomes (10%). As a result of the BAC’s process, a total of $154K incremental budget was awarded for fiscal year 2005 and in excess of $250k for fiscal year 2006.

For Fiscal Year 2005, the budget awards made it possible to
- enhance presentation classroom technology
- improve biology laboratories
- add science research resources to the Library’s electronic databases
- improve chemistry laboratories

For Fiscal Year 2006, the budget awards made it possible to
- add a 1st-year experience coordinator position
- enhance marketing and recruiting activities
- supplement orientation and peer advisory retention programs
- improve chemistry laboratories
- add geotechnical laboratory equipment
- update surveying equipment
- improve biogeochemistry laboratory and field instrumentation
- replace an impact tester for materials testing
2nd item of evidence in support of Core Component D

The institution supports student learning and quality teaching through innovative and state-of-the-art technologies.

Faculty computers: In spring 2001, outgoing governor William Janklow provided state funds for the purchase of new Dell desktop computers for all full-time faculty members in the six regents’ universities. This one-time purchase significantly improved computing capability for the SDSM&T faculty. Such a blanket purchase would have been impossible for most departments, who routinely scheduled computer replacements on a rotational basis for teaching faculty. The gift is not without its downside since the Dells are nearing the end of their full usefulness, and departments will need to plan for upgrades and/or replacements out of their OE budgets. In summer 2005, as part of a pilot program of PC notebook tablet computers, 25 notebooks were purchased for faculty members who volunteered to exchange their Dell PC desktop units for the laptop units.

Classroom computer presentation equipment: In 2003, Information Technology Services (ITS) began equipping all classrooms with computer projection/presentation equipment in order to make possible the integration of PowerPoint into lectures, classroom access to the Internet, and the projection of videos/DVDs through the computer system. An increase in budget awarded through the Budget Advisory Committee process in May 2004 allowed for completion of the project, and all classrooms on campus now have updated presentation equipment. ITS staff provide continual maintenance and are on call for troubleshooting problems that may arise during class time.

Wireless technology: In December 2003, a task force was convened to address the desirability of making SDSM&T a wireless campus. This group met with vendors, interviewed students and faculty, and visited other campuses with wireless capability. In its May 2004 report to the Vice President for Academic Affairs, the task force recommended putting a robust wireless network into place and planning for conversion to a student laptop program within two years. Since that time, the wireless network is fully operational; every building on campus has been equipped with access points. A piloting of the network was done in fall 2004 in GES 115—Professionalism in Engineering and Science. A 30-node laptop station was purchased for use in the classroom scheduled for GES sections. The cart held 30 wireless laptops, allowing the classroom to become a computer lab (RR137).

Tablet PC program: With the wireless network fully operational, SDSM&T is now piloting a tablet PC program and plans to fully implement it in fall 2006. This program is described in more detail under Core Component 3c, above.

Videoconferencing: The Digital Dakota Network (DDN) and the Governor’s Electronic Classroom (GEC), located in the Classroom Building, link all six regents’ universities, as well as all SD K-12 school districts, and many state agencies with interactive videoconferencing capabilities. The GEC also includes a tightly coupled desktop computing environment. All videoconferencing sites are fully interactive; the videoconferencing equipment automatically switches to the site where someone is speaking. Other videoconferencing rooms around campus include CB 106 which is a 40 seat student classroom; Surbeck, Hardrock and Door conference rooms which hold around 12 -20 people; and a portable unit that can be placed anywhere on campus. All rooms permit videoconferencing via Internet2 (H.323 standard) network connections as well as connecting to any 11 site.
3rd item of evidence in support of Core Component D

The institution provides support for the diverse needs of students through tutoring, ADA assistance, and professional counseling and peer advising.

**Tutoring and the Tech Learning Center:**  For students experiencing difficulties in their coursework, one of the “help” options available on campus is the Tech Learning Center (TLC). Located in the basement of the Library, the TLC provides free tutorial services to SDSM&T students in all the core subjects of math, chemistry, physics, computer science, English, and more. Staffed by peer tutors (i.e., academically qualified upper-level students who have “been there”), the TLC is open seven days a week during the academic year and on a more limited basis during summer sessions. In addition, many of the academic departments, honor societies and Greek organizations provide limited tutoring services on a regular basis.

Starting in summer 2004, we piloted tested the offering of tutoring services online via SMARTTHINKING® which provides assistance in chemistry, math, business, and writing. We granted students in math and English courses ten free hours of SMARTTHINKING® tutoring per academic year. The service is available 24/7 and seemed to be most useful for adult, commuter and/or distance-learning students. Use of SMARTTHINKING® was required by students in some sections of college algebra, trigonometry, and calculus I (its use counting somewhat in the course grade) and its use was encouraged in other mathematics courses. Surveys of students indicated mixed feelings about the service. Those who didn’t care for this online assistance generally pointed to its impersonal nature, delays in response, computer-related problems, and even occasional errors by the tutors at “the other end.” Other students really liked this resource and, overall, feelings about the service tended to be quite polarized.

**Assistive technologies:**  In 2001 SDSM&T implemented an assistive technologies lab for students with ADA-certified disabilities such as visual or auditory impairments, dyslexia, ambulatory impairments, etc. Funded through a Department of Education Title III Strengthening Institutions Development grant, this lab is equipped with state-of-the-art computers, scanners, and software to facilitate learning for these students.

**Student counseling/ADA assistance:**  The Counseling and Student ADA Service offers SDSM&T students free, confidential professional counseling for individuals, groups and couples. Focus of counseling can be personal issues such as relationships or depression, academic problems, substance abuse issues, or career questions. Staff also coordinates certification, accommodation and counseling for disabled students under the ADA guidelines. Wellness programming includes sponsoring speakers (such as those on sexual assault, suicide prevention and binge drinking), events (such as the annual Health and Wellness Expo with 40 information and activity booths and health screenings) and consultation with faculty and staff. The Director of Counseling and Student ADA Services is a member of the Student Affairs Team and coordinates closely with other Student Affairs Departments, and works with the Retention Coordinator for early identification and intervention with students in danger of dropping out.

**Peer advising and residence hall assistants:**  Student Peer Advisors are upper-class students selected by the Director of Retention and Testing and the academic departments to assist other students with advising and registration activities, including university policies and procedures, and making referrals to other university services. Since fall 2003, two to three
peer advisors have been assigned to each mentor, assisting with summer registration sessions and the University Mentoring course, which is held weekly on Thursdays during the fall semester.

Living/Learning Community Assistants (LCAs) provide immediate assistance to 1st-year students in the FIRST program — helping with academic needs through coordinating study groups and providing peer tutoring. Additionally, LCAs meet monthly with FIRST participants to focus on specific areas of possible concern.

Resident Assistants are upper-class students employed by Residence Life to live in the dorms and work with students to ensure the residence hall communities are environments conducive to academic success.

Questions that arose from the self-study process relative to Criterion 3

1. Although significant gains have been made in developing curricular transformation, there is still something of a disconnection between faculty initiatives and administrative resources. What is the appropriate structure for managing curriculum, particularly in regards to the first year experience and other campus wide initiatives?

2. Although there is a substantial body of research that supports a need for curricular transformation, faculty in general place little value on that research or place differing values on different pedagogies. How does a university effectively manage curricular transformation so that the research knowledge base is not lost in transformation; e.g., so that the transformation tasks are being directed by those with the appropriate expertise?

3. Transformation curriculum requires a research knowledge base. How can we best support faculty members who are truly engaged in the scholarship of teaching or in educational research?

4. How do we develop an integrated and coherent process for systematic assessment and improvement of campus initiatives and complementary curriculum?

Most Significant Actions taken

1. The campus has developed a large variety of different assessment activities. Most programs have clearly-defined assessment and improvement processes.

2. Considerable emphasis has been placed on curricular transformation. Significant investments have been made in the first year. GES 115 is now required of all engineering programs and some science programs. The start of a learning community has been initiated through FIRST. A new program, the FIRST in the Classroom Faculty Cohort (FC2), has been funded to increase scholarly teaching in the first year curriculum.

3. Since the last HLC accreditation visit, greater numbers of faculty are engaged in scholarly teaching and in the scholarship of teaching. A few faculty members are actively engaged in educational research. More faculty members are publishing in educational journals and submitting grant proposals. This past year alone, over four
million in grant proposals have been submitted for education and transformational curriculum. Two faculty members were invited to participate in the Rigorous Research in Engineering Education workshop and have initiated a number of multi-institutional research projects in developmental theory and undergraduate design centers. The campus now hosts the list serve for the Steps for Better Thinking research group.

**Recommendations for moving forward**

1. The campus needs to develop an integrated and coherent assessment plan for systemic campus initiatives. While most programs have assessment processes in place, there is limited commonality between programs. Systemic plans are currently being developed or implemented in the first year experience program, in CAMP, and in multi-cultural assessment. We need to continue developing and improving these plans as well as developing similar approaches across other disciplines.

2. The campus needs to have a discussion about the appropriate balance between teaching and research. There is also a critical need for a campus workload model.

3. Although significant progress has been made in curricular initiatives, these initiatives are, in general, not universally supported and faculty members engaged in the scholarship of teaching often have to limit these initiatives to smaller areas over which they have control. The campus needs to come to understand and value the differences between teaching, scholarly teaching, the scholarship of teaching, educational research, and discipline research.

4. A true team oriented approach needs to be developed for both assessment processes as well academic initiatives.

5. The campus needs to articulate key academic areas for curricular transformation and improvement.
Chapter 8:
Criterion Four: Acquisition, Discovery, and Application of Knowledge

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Core Component B ........p. 156
Core Component C........p. 164
Core Component D........p. 172
Chapter 8: Criterion Four, Acquisition, Discovery, and Application of Knowledge

The organization promotes a life of learning for its faculty, administration, staff, and students by fostering and supporting inquiry, creativity, practice, and social responsibility in ways consistent with its mission.

Core Component 4a. The organization demonstrates, through the actions of its board, administrators, students, faculty, and staff, that it values a life of learning

Evaluative statement for all of Component 4a

SDSM&T has a strong record in this area but functions under considerable constraints. We cannot assert a strong performance in this area for all programs and areas, and definitions of what constitutes scholarship also vary. Workload and resources are persistent challenges; however, they also make the many successes we can point to all the more notable.

Evidence cited:

1. SDSM&T effectively allocates the available resources to support and promote a life of learning for its students, faculty, and staff.
2. Undergraduate research, scholarship, and applied design are fundamental components of our academic program.
3. SDSMT’s faculty, staff and graduate students value the creation and application of knowledge through basic and applied research.

1st item of evidence in support of Core Component A

SDSM&T effectively allocates the available resources to support and promote a life of learning for its students, faculty, and staff.

Evaluative statement for 1st example of evidence

Resources and workload are particular challenges at SDSM&T. Teaching workloads are unusually high at South Dakota universities, and state and federal resources for basic support and external funding have been declining. While we have strong faculty and staff development resources, resources to support research are notably lacking in some areas.

Discussion of 1st example of evidence

SDSM&T has enjoyed greater than average support for faculty development and assessment over the last three to seven years. Since 1998, two 3-year, $300,000 faculty development grants (1999-2002 and 2002-2005) from the Bush Foundation have supported faculty, staff, and students in their efforts to integrate research into the curriculum and to create new learning environments (RR271 and RR272). Staff members are supported through these funds, and the Human Resources Department also offers a regular schedule of short
courses in leadership and technical skills that any employee may take. In addition, institutional funding for professional development and assessment has been approximately $50,000 per year since 2001. A Director of Academic Initiatives was hired in 2001 to promote faculty-designed assessment and curriculum-development projects.

Each year from 1998 to 2004, a competitive grant fund of about $1.5 million has been offered by the governor’s office to the six institutions in the regents’ system. Funding is given to faculty members with the best ideas for course and curriculum development, with an emphasis on integrating technology into teaching and course redesign. Since 1998, SDSM&T faculty members have won 44 of these “Governor’s Awards,” and have brought an additional $1,025,632 to campus to support work on teaching and learning (RR57). In summer 2005, the Governor revised his awards program to focus on research (RR302). Nearly $445,000 was awarded to 19 faculty members statewide as “seed grants” to spur their research work. Of the 19 grants awarded, 14 came from just 2 schools, and SDSM&T faculty members secured the following 5 awards:


As SDSM&T presses to increase research and improve teaching as part of its mission to become a premier engineering and science university, we recognize the Library requires attention to enable it to fully support our goals. In the past ten years, funding has not kept pace with increases in materials costs or with increased needs. More aggressive strategic planning and fundraising are under way to help the Library grow to meet its obligations. The major limiting factor is funding; however, several developments point to renewed hope. First, the Board of Regents has made Library resources throughout the system a key concern. Second, SDSM&T has moved to allocate 3% of indirect costs directly to the Library budget, so that resources will grow as research grows. Third, the Library is a key component of the SDSM&T Foundation fundraising efforts and capital campaign. These developments promise to help, but the Library must be poised to make effective use of these new resources.

At a campus-wide strategic planning meeting held February 3, 2005, the Library Committee gathered input from faculty, staff, and students on the role of the Library and the resources desired by these constituents (RR303). Key issues that emerged included upgrading the journal and book collections, enhancing availability of search engines, improving staffing, and giving faculty/staff greater input to the acquisition process and management of collections (RR67). During spring 2005, the Committee instigated a long-overdue review of the Library journal collection. Input from all responding departments was gathered to establish priorities for current holdings and new acquisitions based on current funding.

Further actions taken in fall 2005 lay the groundwork for improving the Library. The Library Committee is developing a strategic plan which will be presented to the University Cabinet in spring 2006. This plan will be available via the online Resource Room by March 1, 2006.
and will be available to the visiting team in hard copy as well. The plan will lay out specific goals and objectives and identify key benchmarks to monitor progress. In the long term, this Committee holds responsibility for monitoring progress on the strategic plan, identifying next actions, and enlisting the support of the faculty and administration in implementing the plan to achieve a Library that fully supports the mission of SDSM&T.

Support for research has recently been improving in some areas. In summer 2004 a Vice President for Research was hired and charged with increasing our capacity for basic and applied research. At the Board of Regents level, a Vice President for Research was added to the executive staff to increase collaborations between the six regents’ institutions. Governor Rounds, who was elected in 2004, has launched a very strong “2010 Initiative” to increase research in the state university system as a means of stimulating economic development. Governor Round’s priorities have resulted in funding for a new Ph.D. program for SDSM&T and funding of a statewide competitive grant fund (described above) for the support of new research initiatives.

Teaching and research labs on campus do not have an adequate and reliable base of funding for upgrades. Steps are being taken to address this issue. An increase in student fees over three years (from $23.30 to $50) was approved in spring 2005 for all laboratory courses. The Vice President for Research collects and disseminates to all faculty and staff members all relevant Federal calls for proposals on a weekly basis. The Research Affairs office is staffed by very dedicated personnel who are examining methods to streamline paperwork to decrease the time required to submit proposals. Workshops are being planned to assist faculty in grant writing.

2nd item of evidence in support of Core Component A

Undergraduate research, scholarship, and applied design are fundamental components of our academic program.

Evaluative statement for 2nd example of evidence

An institutional strength in this area is that all students complete design or research projects in all the B.S. degree programs. In addition, we have strong programs, such as CAMP, NSF-funded REUs (Research Experience for Undergraduates), and the yearly Design Fair that provide our students with engaging models for the life-long application of learning.

Discussion of 2nd example of evidence

All engineering majors must complete a Senior Design project, and many are required to present at the yearly Design Fair (RR199). All members of campus are invited, and engineering faculty members use the campus-wide Design Fair Rubric (RR183) to assess the projects and the performance of the students presenting them (RR273). The Design Fair Rubric was used in spring 2005 in partial computation of the final grades for Mechanical Engineering students enrolled in ME 479 (second semester senior design). The Rubric results are collected and maintained by a designated Mechanical engineering faculty member. Many students combine their senior projects with their involvement on one of the CAMP (Center for Advanced Manufacturing and Production) enterprise teams. All non-engineering programs have senior theses or senior projects, which involve independent scholarship with final written and/or oral presentations. For example:
• Physics majors complete a four-semester research project that is closely related to ongoing faculty research in the department and culminates in a research paper and presentation given to physics students and faculty.
• Math majors take a two-term sequence of Math 498 (Undergraduate Research/Scholarship) and Math 402 (Communicating Mathematics), which culminates in an oral presentation given at a departmental colloquium as well as a written paper submitted to the major advisor at the end of the term.
• Teams of computer science majors complete a Senior Design Project in which they implement the software project that they started in their CSC 470 Software Engineering course. Team members produce a written report and give an oral presentation.
• Interdisciplinary sciences seniors complete a Capstone Project over two semesters that involves all the stages of formal research and presentation or implementation.

It is becoming increasingly common for our students to travel with faculty members to professional conferences and also to present conference papers. Each year, 4 to 8 students and instructors in math have attended and presented at the regional meeting of the Mathematical Association of America. A group of computer science instructors and students regularly attends the Midwest Instruction and Computing Symposium (MICS) and give presentations. Chemistry majors have a strong record of presenting with faculty members, and SDSM&T students are always well represented at the yearly student research poster session in the state capitol.

One of the three categories in our current 3-year $300,000 faculty development grant is specifically devoted to collaborative research projects between students and faculty. Funding priority is given to travel grant proposals involving students traveling with faculty for the pursuit or presentation of research. International travel frequently involves teams of faculty and students. The geology program offers a yearly five-week field camp in Turkey, and applications for the 2005 field camp surpassed available spaces. Faculty and students have done engineering design projects in Latin America and Africa, and a project to develop an international design-team version of engineering Senior Design in East Africa is underway (RR189). The number of NSF-funded Research Experience for Undergraduates (REU) programs at SDSM&T has grown over the last five years. The chemical engineering program has been funded for two REUs, and an interdisciplinary group of faculty has just received funding for a five-year “Materials, Mechanics, and Manufacturing” REU site that targets regional American Indian students (RR173).

3rd item of evidence in support of Core Component A

SDSM&T’s faculty, staff and graduate students value the creation and application of knowledge through basic and applied research.

Evaluative statement for 3rd example of evidence

The steady increase in research and research funding is evidence of a strong culture of lifelong learning at SDSM&T. However, as greater emphasis is placed on increasing externally funded research, some faculty and staff members feel a need for greater clarity about expectations and the most desirable balance between teaching and research. Increased
research is also needed in teaching and learning areas, and, specifically in engineering pedagogy.

Discussion of 3rd example of evidence

Since 1996, external funding for research has quadrupled, from $3,210,000 to $11,922,000 in FY2004. More important is the doubling of external funding that occurred between FY2000 and FY2001. We are confident in the ability of our faculty members to attract increased external funding; however, growing the level of external funding to any significant degree will necessitate development of internal structures for supporting grant-productive faculty members. Externally funded research (non-State funding) since 1996 is shown in Figure 8.1 below.

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<tr>
<th>Year</th>
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<td>FY2001</td>
<td>11,639,000</td>
</tr>
<tr>
<td>FY2002</td>
<td>6,518,000</td>
</tr>
<tr>
<td>FY2003</td>
<td>12,744,000</td>
</tr>
<tr>
<td>FY2004</td>
<td>11,922,000</td>
</tr>
<tr>
<td>FY2005</td>
<td>12,703,000</td>
</tr>
</tbody>
</table>

Figure 8.1 Annual external (non-state) funding for research 1996 to 2005

A summary breakdown of all external funding (state, federal, and other) for the years 1996 to 2005 can be found in the Resource Room (RR182). Figure 8.2 below illustrates our strong reliance on Department of Defense and National Science Foundation funding.

Figure 8.2 External Sources of Fiscal Year 2004 Project Funding
As seen in Figure 8.3 below, SDSM&T performs well in attracting external funding as compared to the other regents’ institutions and is third overall in total external funding. SDSU is a large land-grant institution, and USD has a medical school, so this comparison reflects well on SDSM&T.

<table>
<thead>
<tr>
<th>FY</th>
<th>BHSU</th>
<th>DSU</th>
<th>NSU</th>
<th>SDSM&amp;T</th>
<th>SDSU</th>
<th>USD</th>
<th>System</th>
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</thead>
<tbody>
<tr>
<td>FY1998</td>
<td>$422,027</td>
<td>$364,772</td>
<td>$528,284</td>
<td>$4,155,675</td>
<td>$4,009,633</td>
<td>$8,462,428</td>
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<td>FY1999</td>
<td>$737,828</td>
<td>$671,332</td>
<td>$636,412</td>
<td>$3,979,289</td>
<td>$4,937,555</td>
<td>$9,972,118</td>
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<td>FY2000</td>
<td>$985,001</td>
<td>$973,285</td>
<td>$748,218</td>
<td>$4,445,784</td>
<td>$6,063,189</td>
<td>$11,369,025</td>
<td>24,584,502</td>
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<td>FY2001</td>
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<td>$1,365,381</td>
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<tr>
<td>FY2002</td>
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<td>$1,208,072</td>
<td>$2,706,134</td>
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<td>FY2003</td>
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<td>$1,648,284</td>
<td>$8,291,796</td>
<td>$8,180,848</td>
<td>$22,830,970</td>
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<td>FY2004</td>
<td>$2,335,052</td>
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<td>$9,065,898</td>
<td>$8,265,414</td>
<td>$24,884,782</td>
<td>47,402,130</td>
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Figure 8.3 External Funding within the South Dakota regents’ system

The following initiatives and research centers at SDSM&T illustrate the importance SDSM&T places on the pursuit of basic research and our pattern of success:

- The Institute for Atmospheric Sciences (IAS)
- The Advanced Materials Processing and Joining Laboratory (AMP)
- The Additive Manufacturing Laboratory (AML)
- Pursuit of the Homestake Deep Underground Science and Engineering Laboratory (H-DUSEL)
- The Center for Accelerated Applications at the Nanoscale (CAAN)
- The National Science Foundation Friction Stir Processing Industry/University Cooperative Research Center (I/UCRC)
- The Computational Mechanics Laboratory (CML)
- The Polymer Technology, Processing and Composites Laboratory (PTPCL), housed in the Tech Development Lab (TDL)

The Institute for Atmospheric Sciences (IAS) was founded in 1959 to study the physical, chemical, and biological processes that affect the composition and dynamics of the atmosphere (RR64). Since 1996, the IAS has built upon its strong foundation in physical meteorology to evolve into a research group that focuses on scientific issues that are regionally relevant, nationally important and of global concern. In 2004, a new Ph.D. program was created in atmospheric and environmental sciences (RR175).

The Advanced Materials Processing and Joining Laboratory (AMP) was created in 2001 under a grant from the Army Research Laboratory to develop state-of-the-art equipment in friction stir processing and in laser deposition. In 2004, separately administered laboratories were established for these two technologies. The Advanced Materials Processing and Joining Laboratory has become one of the world’s leading focal points for research and development in the emerging friction stir welding and processing technologies, and supports over 40 graduate and undergraduate students and 6 faculty members (RR139 and RR140). The Additive Manufacturing Laboratory (AML) performs applied research in the areas of direct write and laser powder deposition technologies. With the addition of direct write technologies during the summer of 2004, the AML became a unique organization focused on additive manufacturing techniques covering six orders of magnitude, from microns to meters. The AML has directly supported over 20 graduate and undergraduate students and 3 faculty
members and performs collaborative work with 9 different departments on the SDSM&T campus.

Since 2001, SDSM&T has been deeply involved in positioning itself and the state to secure federal funding for the creation of a national Deep Underground Science and Engineering Laboratory to be located in the former Homestake gold mine in Lead, South Dakota. An interim lab is currently being established, and we remain optimistic about being successful in the creation of a national underground lab. Faculty members working in geology, geological engineering, atmospheric sciences, biology, and mining engineering have submitted proposals to fund research initiatives in the interim lab. The successful creation of a national laboratory in nearby Lead, South Dakota would have a tremendously vitalizing impact on research at SDSM&T.

The CAAN was established in July, 2004 by a competitive state grant process. Research involves nanoparticles and associated nanosensors, with particular emphasis on South Dakota mineral development. In 2004, a new Ph.D. program was created in nanoscience and nanotechnology (RR76 and RR176).

In October 2004, SDSM&T and its partners (Brigham Young University, the University of South Carolina, the University of Missouri- Rolla and more than 18 industry partners) received NSF support to create the I/UCRC. This is the first NSF-funded national research center in the nation to focus on friction stir processing, and the first I/UCRC in the state. SDSM&T is the lead institution. The Center will address the needs of the aerospace, aeronautic, energy, military and commercial industries in developing the rapidly growing friction stir processing technology.

Also in October 2004, the Tech Development Lab (TDL) was opened. The TDL is a building that houses several cutting-edge research activities and projects, all designed to expand knowledge of science and engineering; to solve the problems of industry, the military and government; and to create economic development opportunities for South Dakota. These activities include the Center for Accelerated Applications at the Nanoscale (CAAN), the Direct Write Laboratory, the Nanofiber Laboratory, the Organic Synthesis Laboratory, and the Polymer Technology, Processing, and Composites Laboratory (PTPCL). The Nanofibers Laboratory is directed towards the leading edge research on the fabrications and applications of polymeric, ceramic, and carbon/graphite nanofibers. The PTPCL is a user facility housing state-of-the-art tooling, polymer and polymer composite processing, and finishing equipment. The current investment in the PTPCL over the last three years exceeds $1.6 M. The PTPCL is designed to provide research and development infrastructure and assistance to design and create new polymers and reinforcements, new processes, new applications for polymer composites, structural components, and systems. Ultimately the systems created are then tested in the field to assess robustness and proof of concept.

Other notable areas of research productivity at SDSM&T include physics research focused in condensed matter physics, such as experimental characterization and theoretical analysis of electronic materials. Research in the computer sciences includes database design; image and signal processing; pattern recognition, with applications to remote sensing; neural networks; distributed and parallel computing; and artificial intelligence. Research in math involves partial differential equations, statistics, numerical linear algebra, and pedagogy. Research in civil and environmental engineering includes analysis and design of structures and deep sea foundations, and assessment of water resources and groundwater quality.
Since 1997, the SDSM&T Magazine has provided a professionally produced tri-annual means of recognizing faculty, staff, and students who excel. It describes awards and grants received by faculty members and students, and feature articles present examples of faculty and/or student research. Abstracts of all major articles since 1997 have been compiled (RR174), and all issues are archived online http://www.hpcnet.org/sdsmtmagazine. Recognition is also given through award ceremonies for teaching, research and service. The Exemplary Award and Traditions of Excellence (TEA) are granted for our exempt and career services personnel. Each year, we select and celebrate “Outstanding Recent Graduates,” and honor distinguished alums at spring graduation. Honors Day is held each spring, and the university grants an annual Presidential Outstanding Professor Award, the Benard Ennenga Award for a teacher or faculty, the L. Richard Kitchen Memorial Award for non-faculty, and the Virginia Simpson Award for any faculty or staff member. Summa cum laude senior students are also recognized.

Research in the area of pedagogy is flourishing in a few areas of campus; however, we have a limited record of publications in this area in peer-reviewed journals. Faculty members present regularly at teaching and learning conferences sponsored by The Collaboration for the Advancement of College Teaching and Learning, a consortium of more than 100 Midwestern colleges and universities dedicated to faculty development and the scholarship of learning. Work on assessment, new methods for addressing diversity, and study on cognitive development in students have been the focus of most publications and presentations in this area.

Participation in the scholarship of teaching and learning varies considerably across the campus. Many detect a cultural bias on campus which ignores or minimizes areas of scholarship that don’t result in the influx of research funding. Many also perceive that research and teaching are not mutually supportive, and that emphasis on one constitutes a devaluation of the other. Additional efforts are needed to work on the cultural and institutional biases in order to ensure that all scholarship is valued and that participation in a life of learning is strong across all facets of the campus. Crucial steps have been taken; for instance, the promotion and tenure guidelines were changed in fall 2002 to include “innovations in curriculum” and “improving pedagogy” as evidence of “scholarly activity.” Efforts are now underway to create a renewed cross-campus understanding of how the guidelines are to be applied in promotion and tenure cases.

**Core Component 4b. The organization demonstrates that acquisition of a breadth of knowledge and skills and the exercise of intellectual inquiry are integral to its educational programs**

**Evaluative statement for all of Component 4b**

*The general education program at SDSM&T is strong, regularly reviewed, and well integrated into our science and engineering majors. Uniform general education policies, however, create restrictions that prevent us from optimizing the impact of the program. We review, refine, and create academic programs at a healthy pace, and, more recently, have a strong performance in this area. Our student activities are well focused on promoting a life of learning and emphasizing key skills, such as leadership and teaming.*
Evidence cited:

1. SDSM&T regularly reviews its general education program as part of a statewide system of general education and has taken steps to integrate general education learning into all science and engineering programs.
2. The creation of new academic programs and initiatives illustrates continual support of a broad-based education and the pursuit of knowledge.
3. Student activities and programs make a strong contribution to promoting a life of learning for students and faculty.

1st item of evidence in support of Core Component B

SDSM&T regularly reviews its general education program as part of a statewide system of general education and has taken steps to integrate general education learning into all science and engineering programs.

Evaluative statement for 1st example of evidence

Accountability and uniformity of effort in achieving general education objectives and outcomes are successfully ensured by the regent’s policy requiring the completion of 30 credits of general education courses in the first two years, identical objectives and outcomes statewide, and a carefully limited set of approved courses. The restrictive set of lower-level, high-enrollment general education courses mitigates our success, however, in that it reduces the number of upper level courses that our students can take. Engineering and science students, in particular, would benefit from the option to take more general education courses during their junior and senior years, and this is not currently allowed. The General Education Assessment Committee (GEAC) and the Engineering Assessment Committee (EAC) have successfully worked to diminish the impact of this separation between general education course work and course work in the majors. Steps have been taken at the system level to improve the integration of general education learning outcomes in each major on campus.

Discussion of 1st example of evidence

Since 1998, all six regents’ institutions have adhered to the same seven general education objectives and outcomes and associated policies. Institutions are able to add objectives and specific “graduation requirements”: however, 62% of the B.S. programs at SDSM&T are ABET accredited, and the rigor of this standard has made it unnecessary for us to add to either the 1998 or 2005 versions of the general education objectives (RR186 and RR187). The program was established in 1998 by a statewide process that included extensive professional development for two representatives from each institution. In 2003, a 5-year review of the program was initiated (again as a statewide process), and a refined set of core requirements was created and made effective beginning fall 2005. Complete documentation of all general education review activities and decisions is maintained at http://www.sdbor.edu/administration/academics/educationrequirementsreview2003-2004.htm. 2001, the GEAC began developing and implementing a campus plan for assessing general education. Documentation was completed in spring 2004 (RR52); however, the plan is being modified because of the decision to alter the core requirements.

The learning essential for engineering and science students is a well established topic of concern and action at SDSM&T. During AY 2000-2001, the Vice President for Academic
Affairs led a broad year-long effort (culminating in a 2-day retreat) by our Academic Advisory Board and campus groups to articulate the “Drivers for Science and Engineering Education at SDSM&T.” Their report to campus (RR138) laid out in detail the curricular implications of our need to inculcate technical excellence, cultural understanding, leadership, continuous learning, business/professional ethics, and enhancements in communication skills. The “drivers” cited in 2001 have been our focus in the five years since. For example, during spring 2002, the Vice President for Academic Affairs held a series of campus “Globalism” roundtables to develop specific outcomes and action items for achieving both general education- and ABET-defined learning in this area (RR177).

Oversight of academic assessment at SDSM&T is achieved collaboratively by the Engineering Assessment Committee (EAC) and the General Education Assessment Committee (GEAC). Communication skills, ethics and human values, global issues, an understanding of social issues, and strong mathematical skills are central concerns to the faculty representatives on both committees. The GEAC surveyed general education faculty to create an ABET / Gen Ed matrix to show how large-enrollment general education courses address the ABET “(a) through (k)” outcomes (RR55). In addition, since the formation of the committees, a careful record has been kept of their major initiatives and collaborative efforts (RR51).

The regents’ oversight of general education and the option of collaborating with peer institutions have had positive effects on the program at SDSM&T. All six institutions collaborated, for instance, in the development of a web-based information literacy assessment that was piloted in spring 2005, a pilot that SDSM&T could not have developed on its own. All six institutions use the CAAP exam as a general education assessment of math, writing, reading, and science reasoning skills, and this commonality provides comparison cohorts for our students. Use of the CAAP and Board leadership also create a statewide assessment community within which the campuses can share best practices and professional development. SDSM&T’s assessment director serves on a statewide assessment council and facilitates a regional assessment colloquium (comprised of representatives from 27 institutions) to which the assessment directors from five regents’ universities belong. The Board of Regents coordinates the following statewide “discipline councils”:

- Business
- Education
- Fine Arts
- Humanities
- Information Technology
- Math
- Science
- Social Science
- Health, Physical Education, and Recreation

Faculty members benefit from having a state-level professional community to serve as a broader frame of reference for curricular issues and developments. Lastly, the attention brought to general education by the regents has translated into a clear articulation in all syllabi of the specific general education outcomes a course meets, along with clear links to the assessments used to measure the outcomes. In 2004, hard copies of all syllabi used in all general education courses were collected and individually read by teams of academic administrators.

Our common general education program also creates restrictions that compromise the breadth of the learning imparted. Many on campus believe SDSM&T students would benefit from being freed entirely from the system-wide policy of completing general education within the first 64 credit hours. The six regents’ institutions also have common course numbering and
content for general education, and this can create disparities between the content our students need in key courses, such as calculus and trigonometry, and what is needed elsewhere in the state.

Six initiatives are worth noting as solid examples of how we are working to integrate general education learning into program curricula and to ensure that key learning outcomes are reinforced throughout a student’s undergraduate years.

1. The Engineering Assessment Committee (EAC) charged itself in 2003 with studying how to improve knowledge retention and transfer from general education courses to the engineering programs. The EAC solicited the learning outcomes for key lower-division courses in English, chemistry, math and physics and then sent these outcomes to all engineering faculty members. Each engineering program ranked the relative importance for engineering majors of the outcomes. The results were analyzed and the EAC decided to concentrate on learning in the math sequence first.

2. In 2004 the Math / Engineering Alignment Task Force was created by the VPAA, and the team studied the literature on math foundations for engineering curricula. The project continued over 2 years, and, in May 2005, the EAC reviewed a proposal to create a new sequence of courses in applied math (See http://www.hpcnet.org/math_engr_alignment and RR184 and RR185).

3. In 2003-2004, the GEAC oversaw the creation of an area within the Virtual Assessment Office (VAO) where a single set of course objectives and outcomes for each general education course could be viewed http://www.hpcnet.org/GEPcourses

4. In AY 2003-2004, a “closing the loop” initiative was undertaken by the GEAC in conjunction with the English faculty to review all assessment data collected since 1998 on communication skills and to identify specific actions to take in the subsequent year. The recommendations were presented at the May 2004 all-campus meeting (RR19). The English faculty furnished the GEAC a pedagogical hit list of the ten most common grammar errors found in student essays, and they are also planning a series of campus faculty writing workshops, which will begin in fall 2005.

5. In 2002, the Faculty Development Committee supported efforts to integrate key learning outcomes across disciplines by making one of the three funding themes “Integrating and linking curricular concepts and instructional approaches within and across disciplines to improve curricular continuity.” Nearly a dozen grant projects have been funded since then to target “ethical thinking,” teaming and leadership skills, and intercultural development outcomes.

6. Effective fall 2005, all programs include in their curricula a course at the 300-level or above that is “writing-intensive” (RR263) and one that is “globalization-intensive” (RR148). Course credit must be given for these added components, and the learning must be assessed in clearly linked measures. SDSM&T’s redesign plans and syllabi for courses meeting these requirements were reviewed and approved by the Board of Regents in spring 2005.

2nd item of evidence in support of Core Component B

The creation of new academic programs and initiatives illustrates continual support of a broad-based education and the pursuit of knowledge
Evaluative statement for 2\textsuperscript{nd} example of evidence

SDSM&T does a good job of monitoring changes in incoming students and pedagogy (on a broad scale) and adjusts the curriculum and co-curriculum accordingly. We also respond well to worldwide advances in technology that demand changes in science and engineering education. The primary limitations we work under are the high workloads of faculty and staff, a lack of resources, and limited involvement by some programs in pedagogical issues.

Discussion of 2\textsuperscript{nd} example of evidence

Since 1998, we have

• Created two new undergraduate programs
• Created a freshman engineering course
• Revised our largest undergraduate program
• Made considerable progress on creating an integrated 1\textsuperscript{st}-year experience
• Created two new Ph.D. programs
• Received regents’ approval for a new Ph.D. program

In 1998, an interdisciplinary environmental engineering B.S. degree program was created. Graduates work in chemical, civil, geological, materials, and mining engineering fields to solve existing, and prevent future, environmental problems. In 2004 the program applied for but did not receive accreditation under ABET. The chair of the Department of Civil and Environmental Engineering is working with the program’s faculty to prepare the program for an accreditation visit in fall 2007.

In 2004, the mining engineering and management B.S. program was created (RR236) to meet the changing needs of the mining industry. The curriculum includes management, financial analysis, human resources, and contract negotiations and will equip graduates with strong management skills to complement their mining engineering knowledge.

Creation and development of a freshman engineering course has been an important development since our last accreditation review (RR240). The faculty members involved in this course have been at the forefront of campus work on pedagogical reforms and the switch to active-learning and a student-centered curriculum. In 1997 and 2004, we experimented with linking the course with 100-level writing and humanities courses, but scheduling difficulties terminated that effort both times. In 2004, a specially designed classroom, EP 255, was created for the course, and the course was renamed GES 115 (General Engineering and Science) to reflect the inclusion of the course into the physics and interdisciplinary sciences programs. In 2005, participation by physics was discontinued; however, new gains were made as GES 115 was formally linked with the freshman mentoring course, which was renamed GES 115M.

In 2005 our largest single program, interdisciplinary sciences, was redefined into four rigorous “specializations” designed to help graduates adapt to ever-changing fields in science and technology and deal with people as well as technical problems. Current interdisciplinary sciences program enrollment stands at approximately 189 students, and the five-year goal is to maintain or slightly exceed this number. The specializations are

• Atmospheric Science: for careers in meteorology or graduate school.
• Pre-Professional Health Sciences: for pre-medical or dental school, and programs in health professions or medical technology.
• Business Applications in Science and Technology: for application of business administration or entrepreneurial studies to science and technology endeavors.
• Science, Technology, and Society: for careers in law, science and environmental policy, and public policy.

The IS program is in the process of developing an external advisory board. With the cooperation of the Foundation, we have identified a physician from the Black Hills Regional Eye Institute, who is interested in getting a number of local physicians together to support the Pre-Professional Health Sciences track.

In fall 2003, we began work on creating an integrated 1st-year experience (RR45 and RR275). A consultant was hired to inventory curricular and co-curricular activities, key faculty and staff, student support services, and retention as they related to the first year and measured up to the criteria of the "Foundations of Excellence in the First College Year" (RR307). The consultant worked with representatives from across campus to develop concepts for a comprehensive 1st-year experience. Using the consultant’s findings, a campus-wide working group created specific objectives and learning outcomes for the 1st-year experience (RR192). This working group was led by the Criterion 3 co-chairs and contained representatives from over 15 campus departments and programs. At our November 2004 all-campus planning meeting, options for an administrative structure for the 1st-year experience were presented and debated. A single-coordinator option was endorsed as the best means of integrating the curricular and co-curricular dimensions of a truly supportive 1st-year experience. In spring 2005, the regents approved the 1st-year experience as our “institutional priority” area for allocating a portion of 2005-2006 salary funds, and funding for a 1st-year coordinator position was approved.

The proposal “A developmental approach for improving student retention in STEM (Science, Technology, Engineering and Math)” was submitted to the NSF in February 2005, for additional funding for the 1st year experience (RR224). The proposal was not funded but will be resubmitted. Meanwhile, we are implementing the vision of the proposal in order to improve the linkages between various aspects of the first year, improve the support system to increase retention of underrepresented groups, and achieve measurable cognitive gains.

A series of campus-wide “conversations” about improving the 1st-year experience were held during spring 2005 (RR45). These interactive workshops examined recent survey data about the student’s 1st-year experience; discussed retention, learning outcomes, and the co-curriculum; and developed ideas for specific changes that will occur at SDSM&T in order for the 1st-year experience to improve.

In fall 2005 we initiated the 3rd Ph.D. program in the nation for nanoscience and nanotechnology, following the University of Washington and the University of Albany. This program capitalizes on the revolution in science and engineering research at the nanoscale and the economic development impacts it will have in technological areas, including information technology, materials, healthcare, energy, and the environment. The new Ph.D. in atmospheric and environmental sciences links expertise in atmospheric science, biogeochemistry, ecology, and hydrology to address issues of regional to global impacts between earth system components and land management practices in a way that benefits decision-making at regional and national levels. Recently, in December 2005, we received Board of Regents approval for an interdisciplinary M.S./Ph.D. biomedical engineering program was begun (RR279 and RR317). SDSM&T and the University of South Dakota developed the curriculum jointly.
3\textsuperscript{rd} item of evidence in support of Core Component B

Student activities and programs make a strong contribution to promoting a life of learning for students and faculty.

Evaluative statement for 3\textsuperscript{rd} example of evidence

Co-curricular activities promote a broad range of insight and skills. Examples of insights these activities help students and faculty learn include the following:

- on-the-job experience
- ethics and professional responsibility
- importance of lifelong learning
- how their career contributes to society
- applications of major field of study to real-world problems
- how organizations function
- how to influence people and issues
- how organizations function

Examples of skills that these activities help students and faculty develop include the following:

- leadership
- multidisciplinary teamwork
- problem solving skills
- project management
- communication (verbal and oral)
- practical job skills

The impact of student activities can be limited when faculty involvement is insufficient because of lack of interest or lack of time

Discussion of 3\textsuperscript{rd} example of evidence

Figure 8.4 below is a matrix that shows how student activities and programs provide opportunities for students to acquire the skills and insights listed above. The matrix does not measure how well we inculcate each insight or skill: rather, it simply illustrates the role of co-curricular activities in developing the attitudes and capacity for students and faculty to engage in a life of learning.
Matrix of insights and skills provided to students and faculty by student activities and programs

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<th>3</th>
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INSIGHTS that these activities help students & faculty learn

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<td>How to influence people and issues</td>
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</tbody>
</table>

SKILLS that these activities help students & faculty develop

| Leadership | X | X | X | X | X |
| Multidisciplinary teamwork | X | X | X | X | X |
| Problem solving skills | X | X | X | X | X | X | X |
| Project management | X | X | X |   |   |
| Communication (verbal and oral) | X | X | X | X | X | X |
| Practical job skills | X | X | X | X | X | X |

Figure 8.4 Insights and skills provided to students and faculty by student activities and programs
NOTE 1: The CAMP objective is to increase the quality of design and manufacturing education using a unique approach with enterprise teams that manage a design project for a specific industrial need or client. Students develop skills in project management, multidisciplinary teamwork, and presentations to sponsors. CAMP strives to cause personal and professional development of students through the process of design team projects.

NOTE 2: Service learning opportunities exist for students to volunteer on a service project that is related to a course assignment or concept.

NOTE 3: Professional societies are common to engineering programs, and most degree programs have a student chapter of a related professional society.

NOTE 4: The Classroom without Walls workshop is becoming a tradition at SDSM&T. Example topics of various workshops and learning activities include the following:
   (a) Learning behaviors of Native American Students (2004)
   (b) Project management and team development (2004)
   (c) Preparing today’s students for tomorrow’s world (2003)
   (d) Designing pivotal courses and curricula through CAMP (2002)
   (e) Student success in the classroom and beyond (2001)

NOTE 5: Field camps in the U.S. and abroad are offered yearly in geology and paleontology.

NOTE 6: The 80 student groups and organizations we have at SDSM&T represent a wide range of academic, social, and spiritual interests that students can participate in.

NOTE 7: The Leadership Development Team (LDT) sponsors the annual Leadership Development retreat, lectures, and workshops. The LDT members have attended two week-long curriculum-development workshops (RR276), and are preparing a major initiative for 2006 (RR288).

NOTE 8: Students are welcomed to serve on campus committees, and are commonly sought out for membership.

Core Component 4c. The organization assesses the usefulness of its curricula to students who will live and work in a global, diverse, and technological society

Evaluative statement for all of Component 4c

We have an effective system of external assessment that includes formal accreditation boards and external advisory boards. Surveys of students, alumni, and employers are also used to assess our programs for academics and student development. Assessment data has been used to improve our curriculum and co-curriculum in a variety of ways. Current improvements we are pursuing include the development of a multicultural affairs program for a more diverse campus environment, and development of external academic or industrial advisory boards for programs without formal external accreditation, such as interdisciplinary sciences. We struggle with limitations of human and financial resources that hinder efforts to stay current with new developments in science and technology. We are seeking to improve the recognition of research on teaching and learning.
Evidence cited:

1. A variety of external perspectives are incorporated into curricula development and assessment.
2. Learning goals and outcomes of academic programs and student activities are designed to give students the skills and knowledge needed for living and working in a diverse world.
3. Changes as a result of internal and external assessments illustrate our commitment to a relevant and dynamic curriculum.

1st item of evidence in support of Core Component C

A variety of external perspectives are incorporated into curricula development and assessment

Evaluative statement for 1st example of evidence

We are doing very well at getting external assessment through accreditation and academic advisory boards; using surveys of students, alumni and employers; and seeking special reviews and assessments from hired consultants. A few programs need and are actively pursuing improved external assessment. An opportunity exists to continue the recent increase in community and regional input on SDSM&T’s role in economic development and technology transfer. Potential drawbacks of external evaluation include the influx of conflicting opinions, pressure for rapid change, and the major and sometimes negative impact on curricular coherence and faculty workloads.

Discussion of 1st example of evidence

Seventy-five percent of our undergraduate programs are accredited by professional boards. All engineering programs and the computer sciences program are reviewed by ABET, Inc. every six years. The chemistry program is reviewed and accredited by the American Chemical Society. Four B.S. degree programs do not have a formal accreditation process. Our new environmental engineering program was the only one of the nine engineering programs that did not receive a full six-year accreditation. Deficiencies were cited in Criterion 8 (curriculum). The program’s faculty is preparing the program for an accreditation visit in fall 2007. External consultants were hired to comment on new curriculum development in degree programs of Mining Engineering and Management (B.S.), Environmental Engineering (B.S.), Nanoscience and Nanoengineering (Ph.D.), and Atmospheric and Environmental Sciences (Ph.D.).

The campus-level academic advisory board meets twice annually to evaluate campus-level academic issues. Seventy-five percent of our B.S. programs have external advisory boards, and another 13% are developing advisory boards. The external assessment and guidance such boards offer helps ensure the relevance of programs and curricula; however, the concerns of industry for the latest technology must be balanced with long-term pedagogical goals. Perspectives of some of the external constituents can also change very quickly or be contradictory.

The use of external advisory boards at the graduate program level is less formal; however, most M.S. and Ph.D. programs receive input from the same advisory boards used for their
B.S. programs. This input often addresses research, staffing, new initiatives and other issues that relate to graduate programs, but the graduate program curriculum is often not directly evaluated in isolation from its undergraduate counterparts.

In 2003, graduating seniors in engineering were surveyed on the impact of the EC2000 curriculum. Most engineering programs also independently survey graduating seniors, alums, and/or employers about how well the program’s curriculum achieves the learning cited in its program-level objectives and outcomes. Notable examples of high quality surveys include those developed by our electrical and computer engineering and industrial engineering programs (See RR255, RR254, RR296, and RR297).

Feedback from employers who interview our students is positive and clearly signals that our students, curriculum, and learning outcomes are valued. Career Planning surveys the company representatives following their campus interviews with graduating seniors (RR232). For example, the 2003-04 data show that over 100 employers recruited on campus; 92% of the 2003-04 graduates seeking work were employed in their career field within 12 months of graduation and are working for 114 different employers in 24 states; and 21% of 2003-04 graduates are in graduate school. Figure 8.5 below summarizes 2003-04 placement rates and average starting salary offers.

<table>
<thead>
<tr>
<th>Major</th>
<th># Grads</th>
<th>% Placed Overall</th>
<th>Working in SD</th>
<th>% Working Grads in SD</th>
<th>Avg. Offer-SDSM&amp;T</th>
<th>Ave. Offer-National</th>
<th>Avg. Offer-SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE</td>
<td>34</td>
<td>100%</td>
<td>7</td>
<td>28%</td>
<td>$41,915</td>
<td>$42,053</td>
<td>$37,427</td>
</tr>
<tr>
<td>CENG</td>
<td>17</td>
<td>100%</td>
<td>4</td>
<td>31%</td>
<td>$53,591</td>
<td>$51,572</td>
<td>$35,500**</td>
</tr>
<tr>
<td>CHE</td>
<td>12</td>
<td>92%</td>
<td>2</td>
<td>25%</td>
<td>$51,889</td>
<td>$52,819</td>
<td>$42,333**</td>
</tr>
<tr>
<td>CHEM</td>
<td>10</td>
<td>100%</td>
<td>3</td>
<td>75%</td>
<td>$34,750</td>
<td>$36,675</td>
<td>$34,750**</td>
</tr>
<tr>
<td>CSC</td>
<td>24</td>
<td>83%</td>
<td>9</td>
<td>60%</td>
<td>$53,077</td>
<td>$49,691</td>
<td>$42,846</td>
</tr>
<tr>
<td>EE</td>
<td>27</td>
<td>100%</td>
<td>5</td>
<td>28%</td>
<td>$51,409</td>
<td>$51,372</td>
<td>$31,000**</td>
</tr>
<tr>
<td>ENVE</td>
<td>2</td>
<td>100%</td>
<td>2</td>
<td>100%</td>
<td>$41,615**</td>
<td>$43,175</td>
<td>$41,230**</td>
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<td>$42,959</td>
<td>$35,880**</td>
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<td>GEOL</td>
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<td>0%</td>
<td>*</td>
<td>$39,167</td>
<td>*</td>
</tr>
<tr>
<td>IE</td>
<td>27</td>
<td>85%</td>
<td>10</td>
<td>48%</td>
<td>$45,315</td>
<td>$46,021</td>
<td>$35,600**</td>
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<tr>
<td>IS</td>
<td>32</td>
<td>92%</td>
<td>9</td>
<td>75%</td>
<td>*</td>
<td>N/A</td>
<td>*</td>
</tr>
<tr>
<td>MATH</td>
<td>3</td>
<td>100%</td>
<td>0</td>
<td>0%</td>
<td>*</td>
<td>$44,638</td>
<td>*</td>
</tr>
<tr>
<td>ME</td>
<td>36</td>
<td>92%</td>
<td>7</td>
<td>24%</td>
<td>$44,916</td>
<td>$48,864</td>
<td>$38,450**</td>
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<tr>
<td>METE</td>
<td>7</td>
<td>100%</td>
<td>0</td>
<td>0%</td>
<td>$46,100</td>
<td>$49,000</td>
<td>*</td>
</tr>
<tr>
<td>Major</td>
<td># Grads</td>
<td>% Placed Overall</td>
<td>Working in SD</td>
<td>Working Grads in SD</td>
<td>Avg. Offer-SDSM&amp;T</td>
<td>Ave. Offer-National</td>
<td>Avg. Offer-SD</td>
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</tr>
<tr>
<td>MINE</td>
<td>2</td>
<td>100%</td>
<td>0</td>
<td>0%</td>
<td>$46,267</td>
<td>$42,959</td>
<td>*</td>
</tr>
<tr>
<td>PHYS</td>
<td>0</td>
<td>N/A</td>
<td>0</td>
<td>N/A</td>
<td>*</td>
<td>$37,279</td>
<td>*</td>
</tr>
<tr>
<td>TOTAL</td>
<td>241</td>
<td>92%</td>
<td>61</td>
<td>38%</td>
<td>$47,061</td>
<td>$39,683</td>
<td></td>
</tr>
<tr>
<td>All Eng.</td>
<td>170</td>
<td>94%</td>
<td>40</td>
<td>32%</td>
<td>$46,266</td>
<td>$35,500**</td>
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<tr>
<td>All Science</td>
<td>71</td>
<td>88%</td>
<td>21</td>
<td>62%</td>
<td>$50,459</td>
<td>$41,077</td>
<td></td>
</tr>
</tbody>
</table>

% Placed Overall: (Working+Grad School+Military/Other)
% Working Grads in SD: Of graduates who have accepted jobs, % who are working in SD
* No Salary Reports or Attending Graduate School
** Avg. Based on less than 5 salary reports

Figure 8.5  2003-04 placement rates and average initial salary offers

2nd item of evidence in support of Core Component C

Learning goals and outcomes of academic programs and student activities are designed to give students the skills and knowledge needed for living and working in a diverse world.

Evaluative statement for 2nd example of evidence

Our students graduate with strong preparation in critical thinking, problem solving, the application of technology, teaming, communication, and project management. Our performance is adequate for fostering personal and professional development. Improvement is needed in the areas of cross-cultural and global awareness; value-system development; and understanding the social implications of the science and engineering professions. Although we are trying to increase the diversity of our student population, we must do more in this arena, as we remain a predominantly homogeneous, Midwestern institution. The establishment of a Multicultural Affairs Office in 2002 and other initiatives should help with the recruitment and retention of students from diverse populations.

Discussion of 2nd example of evidence

We have selected the following 12 examples of skills, knowledge, and attitudes that will help science and engineering graduates succeed in a global, diverse, and technological society:

1. critical thinking
2. problem solving
3. technology (effective use of current technology in one’s career)
4. teamwork
5. communication
6. project management
7. personal development
8. professional development
9. value system (understanding your own, and other’s, value systems)
10. cross culture (understanding your own, and how to relate to someone else’s)
11. global awareness (current and future trends in your field)
12. social awareness (impacts of your field on society)

As stated above, we are doing well at dimensions 1 through 6, have acceptable performance in dimensions at the middle tier and would like to improve the impact we have on our students in dimensions 9 through 12.

Please note that this example of evidence for 4c pertains to the usefulness of our education, and how it provides practical skills and knowledge for students to succeed. In the section on 4b, we discussed how student activities promote a life of learning.

**Discussion of 2nd example of evidence**

In 2003, the institution was invited by Penn State to participate in an ABET-commissioned survey on the impact of EC2000 (the revised engineering accreditation standards introduced in 2000). Graduating seniors in mechanical, civil, chemical, and electrical engineering (81 seniors in all) responded to a detailed survey of their learning relative to the ABET outcomes (a) through (k). Full results can be found at [http://www.hpcnet.org/EngrAssResources](http://www.hpcnet.org/EngrAssResources). The Vice President for Academic Affairs and the Engineering Assessment Committee formulated joint observations and action items based on the result, the key points of which are as follows:

**STRENGTHS**
- Curriculum helps students gain scientific, technical, communication, and analytical skills
- Curriculum strong on teaming instruction and practice
- Students generally have a good attitude about the University, its programs and faculty

**WEAKNESSES**
- Inadequate degree of active learning pedagogies used in the classroom
- Feedback from instructors (i.e., timing and amount) is inadequate (in aggregate)
- Sub-optimum degree and quality of interactions with faculty members outside of classroom
- Learning in the areas of “diversity” and self-reflection

**OPPORTUNITIES / OBSERVATIONS**
- Student expectations may outstrip current faculty capacity (a workload issue)
- We could think more creatively about how to design facilities and activities so that more active learning and student-student and student-faculty interactions occur without placing more demands on faculty time and effort
- We should explore expanding CAMP and CAMP-like engaged learning activities

Our comments on our success helping students learn in the 12 areas we single out are based, in part, upon the results of this fairly recent assessment. Figures 8.6 and 8.7 below illustrate how we offer curricular and co-curricular experiences designed to help students acquire these skills.
The following are details on each of the 12 learning areas cited in Figure 8.6 above. The results of our 2004 SWOT analysis of SDSM&T’s performance relative to Core Component 4c are incorporated into these comments.

**Senior projects and enterprise teams:** These are typically team projects extending over two semesters that require integration and application of 3 to 4 years of course material to a real-life project, problem, or activity.

**ABET accreditation of engineering programs:** ABET outcomes (a) through (k) are considered necessary for B.S. engineering graduates to succeed (i.e., they demonstrate the required technical, professional and personal skills and understanding).

**GES115 curriculum:** This freshman course helps science and engineering majors develop skills of teamwork, problem solving, written and oral communication, data analysis, design, and research (RR240).

**Redesign of the interdisciplinary sciences program:** The four updated specializations enhance student preparation for professional activity or graduate study and are described above in Core Component 4b. The IS outcomes include students’ ability (1) to integrate academic instruction with community and professional service, and (2) to contribute to their communities.

**General education global requirement:** Effective fall 2005, each B.S. degree program will contain a component of study on the impact of globalization.

**General education writing requirement:** Effective fall 2005, each B.S. degree program will contain a writing component which expands on professional writing skills in junior- and senior-level courses.
International Activities: Increased emphasis on international senior projects and study abroad programs offer options for any student on campus to build a for-credit international activity into their degree program. Pilot efforts to design an intense cross-cultural teaming experience in the context of a specific field of study promise to give students technical and personal development in all 12 dimensions.

Seminar series on global and societal impact of engineering: In 2004 and 2005 a seminar series brought experts on campus to discuss national- and international-level issues in technology. Examples of topics included Sustainability, Global Cooperation, Engineers Without Borders, Engineering and Public Policy, and Earthquakes.

Figure 8.7 below summarizes how these 12 dimensions of learning are addressed through the co-curriculum.

<table>
<thead>
<tr>
<th>Learned through the co-curriculum</th>
<th>First year program</th>
<th>Student Groups &amp; Professional Societies</th>
<th>Multicultural affairs</th>
<th>Student affairs: division, residence halls</th>
<th>Campus ministries</th>
<th>WISE</th>
<th>Career Planning, Program &amp; Internships</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>skills and knowledge</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical thinking</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem solving</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teamwork</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Project management</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal development</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Professional development</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Value system</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cross culture</td>
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<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Global awareness</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Social awareness</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Figure 8.7 Co-curricular experiences designed to help students acquire key learning outcomes

1st year experience: Planning and development of the past three years has produced a comprehensive 1st-year experience that is being piloted in 2006. Outcomes include academic and leadership skills, personal development, community responsibility, and appreciation of diversity.

Student Groups and Professional Societies: Performing arts, athletics, professional societies, campus ministries, service-learning, recreation, and other activities provide opportunities to apply academic and social talents in environments that complement the classroom setting, and promote the skills and knowledge required for success in a diverse world. These activities are voluntary however, and students who resist participating in co-curricular activities miss the personal and professional development.

Criterion Four 170
**Multicultural Affairs office:** Recruitment and retention of underrepresented students increases the diversity of the campus, which is important for the entire community. Additional funding is needed for scholarships and for developing liaisons with minority institutions and communities. In 2004, the Multicultural Committee began reporting directly to the SDSM&T president and was charged to “achieve and maintain national prominence for the recruitment, retention and graduation of American Indians seeking mathematics, science, and engineering degrees at the graduate and undergraduate levels while respecting their ethnic heritage” (RR207).

**The student affairs division, including the residence halls:** Multiple programs have been initiated, but foremost is the FIRST program (Freshman Introduction to Real Success at Tech). In AY 2004-05 101 freshman formed a living and learning community housed in our newly built Howard Peterson Hall dorm. The FIRST staff and residence hall advisors have developed programming to encourage students to engage in social activities. This special programming is needed because many of our students are so goal-driven and focused on career goals that they neglect aspects of their personal development.

**Women in Science and Engineering (WISE):** This program was established in 2005 and a director was hired. The program aims to increase funding for scholarships to recruit top minority and female students and will develop programming to attract, support, retain, and graduate women in science and engineering programs.

**Career Services:** Career services staff work with students in the development of their career goals and interviewing skills. They coordinate placement into cooperative-learning and intern programs that provide the personal and professional experience needed for a successful transition into professional practice.

**3rd item of evidence in support of Core component C**

Changes as a result of recent internal and external assessments illustrate our commitment to a relevant and dynamic curriculum.

**Evaluative statement of 3rd item of evidence**

*Because 62% of our programs are ABET accredited, our attention to the value of external assessments aimed at keeping curricula relevant, particularly in technical areas, is broadly assured. Internal assessments are also strong in the ABET-accredited programs and in general education as well. Our commitment to a “dynamic” curriculum, however, is still insufficiently matched by our assessment efforts. Starting in 2001, assessments pointed to the need to revise curricula to prepare students in the areas of diversity and global awareness. However, formal changes to all curricula in all programs will not be in place until fall 2005. Also needed to fulfill our commitment to dynamic curricula is a stronger, deeper, and broader base of faculty members attuned to and educated in current research on teaching and learning.*

**Discussion of 3rd item of evidence**

Many improvements have resulted from the 2004 ABET accreditation process. The following list provides some general examples:
• Changes in program curriculum, such as improved breadth, better balance of theory and practical knowledge, and incorporation of new advances of technology
• Implementation of coherent assessment plans in all engineering programs
• Increased emphasis on societal issues within degree programs
• Improved senior capstone design, including higher quality projects, interaction with real clients, and more synthesis of course material in capstone projects
• Co-teaching courses with professionals from state agencies
• A new guest speaker series exploring societal, ethical, and contemporary issues
• Increased emphasis on teaming and leadership
• Improved lab experiences, including more design-build-test activities
• Increased emphasis on communication, especially writing

In addition to the ABET-related reforms, external and internal assessments have led to changes in general education issues, new and revised degree programs, and potential revision of the content of math courses required in engineering degrees. General education assessment work on effective communication skills and the oral and written communication rubrics resulted in the closing the loop report (RR19) and in the inclusion of “improving communication skills” in our strategic initiatives. Input from external evaluators was used to revise or create several degree programs (Mining Engineering and Management B.S., Environmental Engineering B.S., Nanoscience and Nanoengineering Ph.D., and Atmospheric and Environmental Sciences Ph.D.). Other degree programs revised as a result of internal and external evaluations include the new specializations in the IS degree, a new Occupational Safety Minor, and a new Entrepreneurship Minor.

Evaluations by the Engineering Assessment Committee on Math/Engineering Alignment resulted in a request to the Math Department to "consider novel approaches, possibly renaming and re-defining the courses that constitute the 16 credits of mathematics instruction for engineering majors" (RR185).

Assessments have also identified several opportunities and areas for improvement. Extensive evaluation and re-design of the 1st-year experience will have a significant impact on students and faculty. Locating the new business incubator on campus will expose our faculty and curriculum to more state-of-the-art science and technology. The Engineering Assessment Committee hopes to repeat the math/engineering alignment process to assess the content of chemistry and physics courses for engineering majors. A revitalized WAC (Writing Across the Curriculum) program could be expanded to include more linkages between engineering and English courses. Threats that could limit our advancement in these areas include limited people and facility resources for keeping the science and technology curricula dynamic and contemporary, and a limited understanding of and appreciation for the value of engineering and science education research.

Core Component 4d. The organization provides support to ensure that faculty, students, and staff acquire, discover, and apply knowledge responsibly

Evaluative discussion for all of Component 4d

Faculty and staff handle knowledge responsibly, with few exceptions. Eight cases of academic integrity issues involving students in the 2004/2005 academic year were resolved through relatively informal approaches. More formal action is rarely needed for academic dishonesty of students. The existing system of administrators, policies, and procedures
adequately defines expectations for ethical research, instruction, and learning, and provides an effective system for resolving problems in these areas. Ethics is clearly promoted in classes, by student support programs, and through student activities. Our learning and scholarship activities contribute many benefits to society. Interest is increasing in service learning, international senior projects, and other examples of promoting social responsibility and service through our scholarship and learning activities. We handle knowledge responsibly despite expanding opportunities for ethical abuse of the internet and electronic devices such as cell phones by students.

Evidence cited:

1. Internal, or administrative, accountability promotes responsible use of knowledge
2. Ethical discovery and use of knowledge is promoted and practiced
3. The campus community honors its commitment to use knowledge for the benefit of society

1st item of evidence in support of Core component D

Internal, or administrative, accountability promotes responsible use of knowledge.

Discussion of 1st item of evidence:

An extensive system of policies exists that define expectations for responsible use of knowledge by faculty, staff and students, and stipulates procedures to follow when problems occur. The primary sources are as follows:

- The Faculty and staff handbook http://www.hpcnet.org/upload/sdsmt/hr/handbook_0304.pdf, gives guidance on Intellectual Property (page 31), and Disclosure of Conflict of Interest (page 30).
- The SDSM&T catalog (http://www.sdsmt.edu/services/upr/Catalog%2004_05.pdf), gives guidance on Intellectual Property (page 75), Grievances (page 73), Academic Dishonesty (page 74), and Plagiarism (page 74).

Interviews with 30 administrators, faculty and students, including the Vice Presidents, Directors and Deans who oversee these policies and procedures, and the Judicial Officer, and three department chairs, indicate the following:

1. The existing system of policies and procedures is sufficient and effective to define expectations.
2. In the few cases each year where the policies and procedures must be applied to resolve grievances or violations, the existing system is sufficient and effective. Specific details are considered confidential and are therefore not discussed in the HLC self study.
3. There are no major concerns with the existing system, and other than routine, ongoing review to update policies and procedures, there are no suggestions for improvement.

Board of Regents policy 3.4.2.B.1 clearly defines expectations for academic integrity and for the ethical values promoted on campus. Academic integrity standards are to be clarified by instructors in all course syllabi, and every general education course syllabus was reviewed during a two-day Academic Affairs retreat for all academic vice presidents in fall 2004 to ensure that an integrity policy was clearly stated in the text of each syllabus.

The SDSM&T academic integrity policy printed in the catalog was revised in fall 2003 to heighten awareness and effectiveness of academic integrity policies and enforcement procedures (see http://www.hpcnet.org/sdsmt/siteID=314427). A formal procedure now exists for determining consequences of academic integrity violations, which involves written documentation, a judicial officer who participates in informal hearings and maintains records, and a judicial committee that resolves more serious situations. Eight students had problems with academic integrity issues in the 2004/2005 academic year. Four cases were referred to the judicial officer and were resolved between the students and the judicial officer. Four other cases were reported by faculty to the Dean of Student Affairs using the new Academic Integrity Report form. These cases were resolved between the faculty and student involved. In all eight cases, the incidents were resolved at a relatively low level of intervention, and formal hearings before the judicial committee were not needed. We know that more incidents occurred than these eight that were reported; however, this has been the first year of the new policy and procedure, and some faculty may not be aware of the changes. Some faculty members are also probably not aware of some forms of academic dishonesty that occur, or do not wish to report violations. The system of policies defining expectations for academic integrity and the procedures for handling violations are working well.

Oversight of faculty and graduate student research and externally sponsored research is administered by the Office of Research Affairs (ORA). The ORA facilitates all intellectual-property issues and houses the Office of Sponsored Programs, which oversees and coordinates all pre- and post-award functions and compliance actions for externally funded programs. All integrity of all intellectual property, licensing, and patenting activities are overseen by the ORA.

A system-wide Intellectual Property (IP) policy was updated in 2004 and is being used as the basis for a revision and updating of our campus-specific IP policy (not updated since 1983). The IP policies of the system are, of course, a topic of mixed views; however, by most measures they generously ensure the rights of researchers. Graduate student researchers sign an agreement which places them under the governance of the system-wide policy (See RR203 and RR204).

Faculty members who serve as advisors for the senior design (capstone) course, the coordinators of our CAMP program, and faculty advisors of student groups provide oversight and ensure the ethical creation and application of knowledge. For instance, CAMP student leaders meet in a weekly seminar on topics such as professional ethics and social responsibility, project management, team building, and technical aspects of a project. Both humanities professors and engineering professors have presented and led discussions on these topics.
The vehicle competitions bring stressful situations in which students have the opportunity of making difficult choices and interpreting racing rules. Responsibility, integrity, and honesty are stressed throughout the design, development, and competition process. The environment and society are important issues in CAMP. Students have worked on several projects to assist the disabled and to improve the environment through the use of technology. Students seek to find a reasonable solution balancing potential benefits with safety and environmental impact.

The ethics committee met this year and decided to explore the possibility of developing a campus code of ethics that would be submitted to the administration, faculty, and students for consideration. In the summer of 2005 the committee members were tasked with researching the codes of ethics that currently are used at other universities, corporations, and professional organizations. The committee reviewed many example codes of ethics in its research. The committee is also considering an Academic Honor Code to which students would subscribe.

A student has drafted language that would be added to the “I Am Here” survey each semester where students would acknowledge acceptance of accountability for their own actions. To view the Code of Ethics the campus will consider at the February 2, 2006 all-campus session, see “Code of Ethics” at http://www.hpcnet.org/PresidentCampusPlanning.

In addition, the Ethics Committee may take up the following issues in AY 2005-06:

- Revised or new policies and procedures may be needed to promote and monitor responsible use of the internet, and to prevent cheating on exams through cell phones and other electronic devices.
- Researchers occasionally fail to deliver final project reports to their sponsors, as required by research contracts.

Details of the sources of this information are available in the reference room.

2nd item of evidence in support of Core component D

Ethical discovery and use of knowledge is promoted and practiced.

Discussion of 2nd item of evidence

The faculty is developing significant components of ethics in courses; the following are representative examples:

- Exploration of ethics often begins with the GES engineering and science curriculum for 1st-year students. Use of short, one-page ethical dilemmas has been tested in GES 115 but these ethics modules are not currently included in the course. The ethical dilemma modules were developed in AY 2003-04 by the coordinator of GES 115 in collaboration with GES 115 faculty members, and the results of this project have resulted in publications and national presentations.

- Ethics are a large part of the military science program (MSL 101, MSL 201, plus some 300- and 400-level content).

- The computer science program includes treatment of computer ethics, intellectual property rights, and copyright issues. In CSC 465, for instance, ethical issues related to globalization of this field are discussed, and an author in the field of computer ethics
offered a “Computer Ethics Across the Curriculum” all-faculty workshop in September 2005.

- All of the ABET/EAC accredited programs have developed and are assessing learning outcomes related to ABET criteria (f) Professional and Ethical Responsibility. Typical course content for a senior-level “professions” course is seen in CEE 463, Civil Engineering Profession (RR211), which has the following course description: “Lecture and discussion on current engineering topics with emphasis on professional, personal and ethical development. The course will cover ethics, societal impacts, contemporary issues, lifelong learning and communications.”

- In IENG 366, Management Processes, case studies and ethical dilemmas are used to improve students’ cognitive skills according to the Steps for Better Thinking model. Cases typically involve strategic planning and globalization issues that often include either human resource constraints or conflicting management goals that must be prioritized. Student responses are loaded to the campus Digital Archive Tool and later assessed by the industrial engineering faculty using a project rubric that includes a formal assessment of societal context and/or ethical considerations (RR277).

- An Introduction to Ethics (PHIL 220) was first offered in summer 2003 and is currently being taught in spring 2006 (RR307). A course on “Introduction to the Ethics of Nanotechnology” has been developed but not yet offered.

Responsible scholarship and use of knowledge is also promoted outside the curriculum. The office of Academic and Enrollment Services (AES) provides significant support for these values as part of student and faculty services for academic orientation, academic advising, mentoring, peer advisors, three student success publications, a Parent’s Guide, and the advisor/mentor handbook and training. AES also ensures that Federal, State, Board of Regents, and University policies and procedures are publicized and followed. The STUDENT Project, which created a single student information system and student database for all regents’ institutions, has prompted more uniformity of academic policy across the Board of Regents’ system and equal and uniform access to information by the administration at all of the campuses in the regents’ system.

Residence Life provides policies and regulations, oversight, coaching, and modeling of responsible use of knowledge and behavior. Students are generally required to live in the dorms for their first two years, so this communicates and reinforces these policies and expectations for a large portion of the student body. The director of Residence Life requires all resident assistants to undergo a thorough orientation and training process which includes discussion of and agreement with a 14-point statement of ethical standards (RR210); disciplining students; and the importance of holding students accountable for their behaviors and choices, especially those surrounding alcohol.

The Student Affairs division sponsors a variety of activities that promote ethical values and behavior. SDSM&T’s Leadership Development Team (LDT), which is a student-led organization, engages students in consideration of ethical issues. For example, at the Leadership Development retreat last fall, LDT members involved small groups with situations that involved ethical decision making. The groups were each given a situation and had one hour to create a skit that acted out the situation and how they would make an ethical decision. On March 21, 2005 the LDT sponsored a Leadership Lecture Panel that discussed leadership traits and characteristics. An Ethics Awareness campaign was conducted by
Student Affairs last year. A panel on “Ethics in Industry” featuring employers and alumni was attended in February 2004 by 156 students and faculty members. In September 2005, a nationally known figure in ethics education (Dr. Marion Ben-Jacob) came to campus to offer an “Integrating Computer Ethics Across the Curriculum” workshop. Two other examples involving professional aspects of ethics include the “Order of the Engineer” luncheon and ceremony during Engineers Week, and the positive feedback we receive from academic advisory boards and employers indicating that they see our organization and students handling knowledge responsibly.

The Midwest work ethic of our students is often cited by employers as one of the reasons for their continued campus recruiting relationship with SDSM&T. As an example, three years ago officials of a multinational corporation that produces building materials decided to try recruiting at SDSM&T because they weren’t having much success finding graduates at some of the “Big 10” schools who had the desired work ethic and willingness to do hands-on work. The main ethical dilemma observed by Career Planning and Placement staff involves students who change their mind on a job offer they have already accepted because a more desirable job offer is subsequently received. However, these situations only occur once or twice a year.

3rd item of evidence in support of Core component D

The campus community honors its commitment to use knowledge for the benefit of society.

Discussion of 3rd item of evidence

The institution demonstrates responsible discovery and use of knowledge by the commitment to service learning activities of faculty and students, and by the benefits to society of faculty and staff research, and professional service.

Many examples exist of increasing interest in service learning and other educational activities that promote social responsibility and service:

- Free choir and band concerts are presented to high schools, middle schools, rest homes, local business offices, and to the community at large.
- International senior projects provide design services to developing communities, and study abroad programs (although a small part of our institutional activity) impact both the sending and hosting institution.
- Art History students get credit for being docents at the Dahl Fine Arts Community Center.
- IS 380 (IS internship) provides credit for student internships working in community social services.
- “Praxis” opportunities (volunteer community activities offered by United Ministries of Higher Education) are extended to students in many classes for credit or in lieu of a traditional assignment, such as writing a paper or completing a lab assignment. These classes include Technical Communications II, Computers and Society, and the Psychology of Abnormal Behavior.
- Activities by campus ministries (e.g., Urban Plunge, mission trips during spring and summer breaks, and Habitat for Humanity).
• For the past two years SDSM&T has sponsored a United Way Day of Caring team in which students and staff have volunteered to rake leaves at Storybook Island, help with a landscaping project at a group home for Black Hills Workshop, and do yard work for elderly women who participate in the Meals on Wheels program.

• SDSM&T students support the public Christmas Lighting Program at Storybook Island in various ways. The campus chapter of Tau Beta Pi Engineering Honor Society designed and built an electronic Christmas tree for display at Storybook Island during the holiday season. Also, for the past several years students and staff have volunteered to decorate the Storybook Island sets with Christmas lights and have staffed the concession stands during the Rotary Club’s Christmas season fundraiser for the free children’s park in the summer.

• A survey of student organizations that Student Affairs conducted indicated that SDSM&T students volunteered more than 7,737 hours in community and campus service during the AY 2002-03. The students volunteered for a wide range of community organizations that include Black Hills Regional Food Bank, Big Brothers/Big Sisters, Soup Kitchen, Habitat for Humanity, Boys Club, Blood Drives, Red Ribbon Week and Girls Inc., Highway Clean-Up, and Halloween House—to name just a few.

• Service projects by fraternities and sororities.

Grant proposal requests sent to our Faculty Development Committee repeatedly identify “ethics” as a unifying theme for projects to integrate the curriculum. The following projects have been funded since 2001 to integrate the teaching of ethical reasoning into the curriculum:

<table>
<thead>
<tr>
<th>Year</th>
<th>Name(s)</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>Larry Simonson, ECE</td>
<td>Chicago workshop on &quot;Ethics across the Curriculum&quot;</td>
<td>$1,000</td>
</tr>
<tr>
<td>2003</td>
<td>Larry Simonson, ECE and Larry Stetler, Geology</td>
<td>Development of &quot;Ethical Dilemmas&quot; for use in GE 115</td>
<td>$1,500</td>
</tr>
<tr>
<td>2003</td>
<td>Fernand Marquis, MetE and Stan Howard, MetE</td>
<td>Using Foundation Coalition Module on Ethics in and Understanding the Impact of Engineering Solutions</td>
<td>$3,875</td>
</tr>
<tr>
<td>2003</td>
<td>Andrea Surovek, CEE</td>
<td>Workshops and lecture series: &quot;Global &amp; Societal Impact of Civil Engineering&quot;</td>
<td>$4,967</td>
</tr>
<tr>
<td>2004</td>
<td>Michael Langerman, ME</td>
<td>Exploring the impact of engineering solutions (guest lecture series) with Dale Skillman</td>
<td>$1,260</td>
</tr>
<tr>
<td>2004</td>
<td>M. R. Hansen, CEE</td>
<td>Impact of Professional Societies on Engineering Practices, guest lecture series</td>
<td>$1,315</td>
</tr>
<tr>
<td>2004</td>
<td>Andrea Surovek, CEE</td>
<td>Workshops and lecture series: &quot;Global &amp; Societal Impact of Civil Engineering&quot;</td>
<td>$4,820</td>
</tr>
<tr>
<td>2004</td>
<td>Larry Stetler, Geology , and Larry Simonson, ECE</td>
<td>Collaboration Conference presentation on Reasoning through Ethical Dilemmas</td>
<td>$2,000</td>
</tr>
<tr>
<td>2004</td>
<td>Abul Hasan, ECE, Mike Batchelder, ECE</td>
<td>Global &amp; Societal Impact of Electrical and Computer Engineering (in-class presenter series)</td>
<td>$2,000</td>
</tr>
<tr>
<td>2005</td>
<td>Manuel Penaloza CSC</td>
<td>Workshop &quot;Integrating Computer Ethics Across the Curriculum&quot; September 15, 2005 with Dr. Marion Ben-Jacob</td>
<td>$2,425</td>
</tr>
</tbody>
</table>
Like most other higher learning institutions, SDSM&T is positioned to pass on unique benefits of scholarship and learning to our local and national community. For example, The South Dakota Space Grant Consortium is based at SDSM&T and enhances faculty and student development through fellowships at the Earth Resources Observation Systems (EROS) Data Center (a unit of the U.S. Geological Survey). SDSM&T research with the Data Center improves models for water resource management and flood forecasting, which are extremely important issues in South Dakota.

Notable additional examples of SDSM&T serving our community in ways that enable us to model ethical judgment and the responsible application of knowledge for the betterment of society include the Science Fair, the West River Math Contest, the Museum of Geology, Engineers’ Week, National Chemistry Week, and the Children’s Science Center. Details are as follows:

**Science Fair:** The High Plains Regional Science and Engineering Fair is an Intel International Science and Engineering Fair (ISEF) affiliate with 400 to 500 middle- through high-school participants annually. Projects must apply the scientific method to explore and answer questions in some aspect of science, technology, engineering or math. Students must adhere to strict guidelines for reference documentation and attribution of contributors. All projects entered in the competition are screened by a SDSM&T Scientific Review Committee mandated by ISEF.

**West River Math Contest:** The West River Math contest annually gives approximately 500 middle and high school students a chance to compete in an exam in one of the following categories: Algebra I, Algebra II, Geometry, Advanced Math, or Master’s. The contest problems are carefully written and repeatedly reviewed to ensure that the questions are unambiguous, fair, and within the realm of knowledge that may reasonably be expected of students in each category. This was the 55th year that the math faculty hosted the one-day event, completed the grading, and identified the top contestants.

**The Museum of Geology:** The Museum of Geology has unique paleontological and mineralogical displays that attract tens of thousands of visitors, particularly school groups from the local area. Staff members provide workshops, provide outreach to local schools and public groups, serve as expert witnesses, and provide conservation services. The Museum has traveling displays and numerous professional research visitors. As the designated repository for all federal land-managing agencies in South Dakota, and some Native American tribes, the Museum has accumulated a library of fossil and mineral collections for research and education. Educational and research programs are national and international in scope, and many foreign collaborators are served by the institution. Academic service is provided through the paleontology program, the only paleontology degree in the United States, in which field education, classroom education, and sponsorship of the student paleontology club are fostered.

**Engineers Week:** Since 1977, seven days of campus and community programming make up our yearly “Engineers’ Week,” including national speakers sponsored by the South Dakota Engineering Society. The keynote presentation focuses on a contemporary issue in engineering and includes both the ethical dimension of engineering as well as its social impact. The topics for the last 5 years were as follows:

- (2005) “Engineers without Borders: Experiences and Projects of SDSM&T Faculty and Alums”
On occasion, attorneys present a full program on ethics in engineering, followed by a question and answer period. Each engineering program creates a different display or demonstrates an experiment that shows how engineering solutions contribute to society. For instance, industrial engineering stresses ergonomics, and materials and metallurgical engineering demonstrates “metal with a memory.” An annual highlight of Engineers Week is a luncheon for approximately 250 to 300 people to honor outstanding alumni and new inductees into the Order of the Engineer. All inductees stand and publicly recite an oath that defines ethical and professional standards for all engineers (RR208). Another highlight involving high school students is the Rube Goldberg machine contest in which the aim is to build the most inefficient machine possible. In 2004-05, two area high school teams earned a spot in the national finals. Attendance overall for Engineers’ Week regularly tops 1,000.

National Chemistry Week: National Chemistry Week is a community-based program of the American Chemical Society (ACS). This annual campus event unites ACS student affiliates chapters, businesses, SDSM&T, and individuals in communicating the importance of chemistry to our quality of life. The mission of National Chemistry Week is to reach the public, particularly elementary and secondary school children, with positive messages about chemistry. These positive messages are achieved via a combination of scientific presentations and community-service efforts. For instance, in 2005 a blood drive was held; in 2003 a raffle raised $825 for the city rescue mission; and, in 2002, a cake walk and a “hygiene drive” yielded several hundred pounds of products for a local food bank.

Faculty Professional Services: Service to a variety of academic and professional societies includes peer review of journals to ensure the validity of the research involved and its value to society, engineer licensing and professional agencies, development of codes of ethics, and advisory boards that serve governmental agencies and programs. For example, one of our materials and metallurgical engineering Faculty members has served as a writer and reviewer of Fundamentals of Engineering exam questions for six years. Our faculty members and one administrator serve as accreditation reviewers for ABET, and two administrators serve as accreditation reviewers for the Higher Learning Commission. Faculty members also provide service as expert witnesses and through a variety of consulting activities.

Questions that arose from the self-study process relative to Criterion 4

Fundamentally SDSM&T exhibits a strong commitment to a life of learning and research that pervades the campus at all levels and provides a strong environment for academic growth and technological development. As we seek to maintain and improve this environment, several questions emerge as critical issues for discussion and resolution as we move ahead.

1. What is the appropriate balance between teaching and research for this institution? What is the appropriate balance across campus units as well as for individual faculty? What range of variation should be encouraged? How can the two be integrated for mutual benefit?
2. Can we improve our ability to mitigate the deleterious effects on our programs caused by workload issues and funding constraints? Are we making the best possible use of what we have? Is there more we can do to identify priorities and allocate tasks to better meet our responsibilities?

3. How can we most effectively grow our resources? Are there unconsidered sources available that we should be exploiting? How do we improve our ability to generate additional funds?

**Most Significant Actions taken**

The campus has made significant progress in the last few years to meet challenges to its learning and research environment. Chief among these are the following:

1. A strategic-planning process linked to the self-study task has been put in place, with new committees, regular campus meetings, and renewed attention to self-evaluation and goal-setting. This has simultaneously achieved wider input to the planning process and clearer articulation of goals and benchmarks.

2. Decisions have been made to reaffirm our institutional focus on science and engineering and promote strategic research areas. This step aids the effective pooling of resources and provides clearer goals and strategies for growth. New academic and research programs generated in these areas are breathing new life into the campus learning environment.

3. Improvement of library governance and collections has emerged as a major focus and is garnering attention and action at the level of the state legislature, governor, the Board of Regents, and the University. New and more effective ways to manage and grow the Library resources are being developed.

4. Changes in college structure and organization have positioned the university to better respond to perceived constraints and threats.

**Recommendations for moving forward**

1. Following a number of significant changes in structure, governance, and the strategic planning process, the period ahead is our time to fully implement the improvements we have crafted and to fine-tune the new systems. The strategic planning committees must continue to identify key action items and strategies, particularly to the questions raised above.
Chapter 9:
Criterion Five: Engagement and Service

(For Educational Development)
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Core Component B ........p. 190
Core Component C........p. 193
Core Component D........p. 195

(For Economic Development)
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Chapter 9: Criterion Five, Engagement and Service

As called for by its mission, the organization identifies its constituencies and serves them in ways both value.

Our Constituents as defined by our mission

SDSM&T, in concert with Black Hills State University (BHSU), National American University (NAU), Western Dakota Tech (WDT), and Oglala Lakota College (OLC) serves the full range of constituents who turn to higher educational institutions for educational, economic, and cultural development and support. Creation of the Higher Education Center – West River comprised of SDSM&T, BHSU, South Dakota State University, University of South Dakota and Dakota State University makes clear our intent to serve the Black Hills region by collaborating with other institutions.

SDSM&T, BHSU, NAU, WDT, and OLC each excel at serving specific constituents. BHSU, for instance, is known for its high quality teacher-education program. BHSU serves the teacher training and staffing needs of the region. NAU provides associate and baccalaureate programs in the business and health care fields. SDSM&T is known as a center of research and development and is becoming a force in economic development. SDSM&T also serves select aspects of the tourism industry, for instance, through its special paleontology collections and museum. WDT serves those in the region who seek a post-secondary education combined with preparation for employment in the trades. OLC is a tribally controlled institution that offers bachelors and masters degrees.

A focus on science and engineering enables SDSM&T to cover distinct regional needs in the areas of educational development and economic development.

In other areas that might normally be considered within the realm of a university, we may choose to exclude ourselves, unless specifically tied to one of these two focus areas. Only in special instances, for example, would we serve general interest community service organizations, (e.g. service clubs, community fund drives, entertainment venues) or underserved individuals or the groups supporting them, who are concerned with basic life needs of food, shelter and clothing. Nor do we generally fill the training needs of small businesses, tourism, and service industries. However, we can’t eliminate any particular entity in the area of outreach and service because extraordinary circumstances sometimes arise, as happened during the forest fires in the summer of 2002. In that instance, we opened the dorms and food service to house and feed people displaced by the fires. Additionally, individual students and faculty contribute through engagement and service apart from campus focused activities.

In our self study and strategic planning process, we considered our activities within these two areas of educational development and economic development as the foci of our outreach and service to constituencies external to the university. We formed working groups to help us study, coordinate and plan our outreach activities in each of these areas. Each working group gathered and analyzed data on and conducted a Strengths, Weaknesses, Opportunities, and
Threats (SWOT) analysis and prepared this chapter through a collaborative effort of writers in each working group.

Organization of this chapter

This chapter addresses each of the Core Components twice, once from the perspective of our educational development constituents, and a second time as relates to our economic development constituents.

EDUCATIONAL DEVELOPMENT

Engaging and serving our educational development constituents

Although the SDSM&T serves its constituents in numerous ways that universities traditionally serve their constituents, our focus is to provide educational development through activities and programs related to the advancement of engineering and science to:

- K – 12 teachers and their students involved in teaching and learning math and science
- Math and science teachers and students at junior, community and tribal colleges
- Prospective students, applicants and their families

SDSM&T serves specific “secondary” constituents in this area. They are deemed “secondary” only because of the occasional or seasonal nature of these demands and include the following:

- Organizations delivering educational programs or professional conferences through the conferencing and outreach function of the University
- Engineers and scientists desiring continuing education at the professional level
- Individuals served by our courses who are pursuing academic programs in fields other than mathematics, engineering and science
- Individuals desiring to broaden their science and engineering educational backgrounds

Connecting our mission with these constituent groups

Our mission is “to provide a well-rounded education that prepares students for leadership roles in engineering and science.” The educational community is specifically mentioned in our commitment “to benefit the state, region, and nation through collaborative efforts in education and economic development.”

SWOT analysis of our performance in the area of educational development

The Educational Development working group for the self-study under Criterion 5 conducted a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis in fall 2004 and noted the following:

Strengths: SDSM&T is in close proximity to the second largest and most diverse school district in South Dakota. We have an excellent, nationally recognized faculty. Excitement
about science and technology is building among K-6 students. We have a small, intimate campus.

**Weaknesses:** Faculty and staff are overburdened at SDSM&T and in the K–14 system. SDSM&T does not market itself well; there is a lack of media exposure and community awareness. Our outreach is not focused and lacks coordination and funding. Students and faculty are involved in outreach, but it isn’t a campus focus.

**Opportunities:** External funding is available for math/science K–14 projects. We have the opportunity to team with K–12 personnel to present at regional conferences, such as the Technology in Education conference, which brings together educators, administrators, and technology experts. Given all our planning activities, we could identify three to four things we do well and then support and market the identified activities. SDSM&T has an opportunity to provide leadership in K–14 Mathematics and Science education.

**Threats:** The number of students graduating from high school in the next 12 years in our state and region will decline. Additionally there is inadequate funding at both the K–14 and university levels. Faculty and staff are overworked. The leadership on campus or at the state level can change quickly, with negative consequences.

**Overview of our activities in educational service and engagement:**

Constituents are attracted to campus by numerous educational programs and activities. Below is a listing of our major activities. Greater detail is presented on most of these in the discussion of the core components, as indicated below.

**Core Component A**
- Bridges to Success program
- Research Experiences for Undergraduates (REU)
- Scientific Knowledge for Indian Learning and Leadership (SKILL)
- Space Grant Consortium
- West River Math Contest

**Core Component B**
- Cultural Expo
- Engineers Week (E-Week) Girls
- Kids Block Contest
- Star of the West Speakers Series

**Core Component C**
- Advanced Placement (AP) Institutes
- Black Hills Science Teaching project (BLAHST) teacher-training workshops
- Technology for Teaching and Learning program (TTL)

**Core Component D**
- Engineers Week
- High Plains Regional Science Fair
- Museum of Geology
- Youth Engineering Adventure (YEA)
The following activities are not further discussed below but should be noted:

- Athletic staff members conduct camps and clinics for K-12 coaches and athletes. Student athletes also give presentations at service clubs.
- Articulation Agreements with Oglala Lakota College and Sinte Gleska University are being reviewed, updated and extended.
- Center of Excellence for Advanced Manufacturing and Production (CAMP) sponsored a year long collaboration with Dakota Middle School (RR15, RR16, RR168, and RR169).
- National Science Foundation Keystone Species Project determines post-fire succession influence on cavity user communities in the Black Hills of South Dakota. The study addresses the potential keystone function of different woodpecker species in various post-fire successional pine forests in the Black Hills.
- SKILL National Aeronautics and Space Administration (NASA) Honors Program aimed to increase the secondary school retention and college entrance rate of American Indian students. The four-week residential summer experience included skill building and research in science and mathematics.

**Core Component 5a. (for educational development): The organization learns from the constituencies it serves and analyzes its capacity to serve their needs and expectations.**

**Evaluative statement for all of Component 5a**

*SDSM&T has a strong record of interaction with K-14 math and science teachers, but our efforts to learn from them about how to serve their needs have not been systematic. In a small community such as this, we have relied primarily on contact with SDSM&T-sponsored events and the personal involvement of many faculty and staff with the K-14 community. Formal assessments, such as surveys of participants and a means of tracking the academic history of student participants would help. Creation of a K-14 advisory board or a formal network of K-14 teachers, counselors and administrators would also be desirable. Our efforts to learn from and serve the Native American population have been more systematic and well organized.*

**Evidence cited:**

1. Programs designed specifically for Native Americans interested in math, science, and engineering
2. Programs designed to boost high school graduation among Native American students
3. Programs designed to provide Native American students with support in completing their undergraduate degrees at SDSM&T
4. Programs designed to encourage interest in science and engineering

**1st item of evidence in support of Core Component A**

Programs designed specifically for Native Americans interested in math, science, and engineering
Evaluative statement for 1st example of evidence

Since 1989, SDSM&T has established a fairly good record of encouraging Native American participation in its academic life in the areas of science and engineering.

Discussion of 1st example of evidence

The Native American population, which is by far the largest minority population in the state, as well as the indigenous people, forms an important constituency. In South Dakota, American Indians represented 8.3% of the population according to the 2000 census data. Native Americans are typically underrepresented in science, technology, engineering, and math (STEM) areas. In spring 2003, there were only 315 American Indian graduates nationwide who were awarded B.S. degrees in engineering. We have made efforts to reach out to Native American communities in K-14, attempted to bring to campus more of those Native American students who have a passion and aptitude for science and engineering and once here, helped them succeed. Below is a brief history of our efforts since the late 1980s:

1989: The American Indian Science and Engineering Society (AISES) established at SDSM&T. The program started with 8 Native American students, and two years later had 32.

1990-2001: K-14 programming (summer-residential and after-school programs) created through the Scientific Knowledge for Indian Learning and Leadership (SKILL) program. Dramatic improvement in Native American retention at the secondary level; the high school graduation rate of participants was 100% compared to 47% for non-participants. Since 2001, SDSM&T has hosted the summer residential program which is operated by Oglala Lakota College and the Oceti Sakowin Education Consortium.

1991: The Minority Study Center established to promote and preserve American Indian culture on campus and to provide space for students to study and learn.

2001: The State assumes funding for the Director of Multicultural Affairs and operating costs. The Minority Affairs Advisory Committee and the Minority Student Program Policy established to study a renewed approach to Native American issues.

Spring 2003: SDSM&T graduated the largest number of Native Americans with a B.S. in engineering from a single institution, but these number only 7 out of 315 nationwide who have earned a B.S. in engineering.

Fall 2003: SDSM&T has a record number of first-time American Indian students (22) and the highest enrollment ever of American Indian students (total of 65 or 2.6% of the student population).

2004: Multicultural Activities office established.

2004: In fall semester, 70 Native American students were enrolled, whereas 44 Native American students were enrolled in fall 1998.

2004-present: The Multicultural Committee (MCC) begins reporting directly to the SDSM&T president and is charged to “achieve and maintain national prominence for the recruitment, retention and graduation of American Indians seeking mathematics, science, and
engineering at the graduate and undergraduate levels while respecting their ethnic heritage.”

2005: In spring 2005, Timothy “Bull” Bennett is the first SDSM&T American Indian Ph.D. recipient.

2005: In fall 2005, a newly hired full-time Director of Multicultural Affairs begins to work with the MCC to review and strengthen campus initiatives.

Since 1990, aggressive K-14 programming has been conducted through the Scientific Knowledge for Indian Learning and Leadership (SKILL) program, through summer residential programs (1991-2001), and through after school programs. The SKILL residential program offered reservation children exposure to a non-reservation environment and was a huge success for retention of students at the secondary level. High school graduation rate of participants was 100% compared to 47% for non-participants.

The South Dakota Space Grant Consortium (SDSGC), established by NASA, has played and continues to play a major role in connecting with the K-14 community. SDSGC and SDSM&T have tribal college affiliations with several schools in the state. Another NASA affiliated activity is American Indian Space Days—a joint effort by SDSM&T, tribal colleges, and elementary, middle and secondary tribal schools, which was held in collaboration with the 2005 Black Hills Pow Wow (RR133).

SDSM&T has been selected for two National Science Foundation sponsored sites for Research Experiences for Undergraduates (REU). The REU program supports active research participation by undergraduate students in any of the areas of research funded by the National Science Foundation. REU projects involve students in meaningful ways in ongoing research programs or in research projects specially designed for the purpose. Typically these programs are ten week summer programs involving local students and those from other institutions. The Materials, Mechanics, and Manufacturing REU site, first offered in summer 2005, had as one of its three objectives “to increase minority student exposure to cutting-edge research.” One of the targeted populations for this REU is students at Oglala Lakota College, and it is expected that many participants will be first-generation Native American college students (RR173).

2nd item of evidence in support of Core Component A

Programs designed to boost high school graduation among Native American students

Discussion of 2nd example of evidence

Scientific Knowledge for Indian Learning and Leadership (SKILL) was a summer residential program (1991-2001) which offered reservation students exposure to a non-reservation environment, and was run in collaboration with Oglala Lakota College (OLC). This pre-college program had a mission of improving the college-readiness of American Indian Students in math and science. SKILL provides a wide range of activities for elementary through high school students, including research opportunities, tutorial assistance and academic summer programs. High school graduation rate of participants was 100% compared to 47% for non-participants.
In 1994 the SKILL program at SDSM&T commissioned Lakota artist Don Montileaux to paint a work entitled Looking Beyond One’s Self. This print depicts three American Indians looking beyond the immediate horizon and toward a vision for the future. It symbolizes SKILL's desire for young American Indians to reach beyond themselves . . . toward the stars and their visions. The original painting flew on board the March 1995 STS-67 NASA mission of the space shuttle Endeavor. On December 2, 1996 print number 2/400 was presented to President William Clinton on behalf of the SKILL Program at SDSM&T.

3rd item of evidence in support of Core Component A

Programs designed to provide Native American students with support in completing their undergraduate degrees at SDSM&T

Discussion of 3rd example of evidence

Office of Multicultural Affairs: The Mission Statement of the Office of Multicultural Affairs commits SDSM&T to “achieving and maintaining national prominence for the recruitment, retention and graduation of American Indians seeking mathematics, science, and engineering at the graduate and undergraduate levels while respecting their ethnic heritage. An appreciation of the culture and the contributions of American Indians will be promoted wherever possible such as the classroom and extra-curricular experiences.”

A Minority Study Center was established in 1991 to promote and preserve American Indian culture on campus and to provide space for students to study and learn. The grant funded SKILL Director position was reorganized and state funding was allocated for the Director of Multicultural Affairs in the summer of 2001. State funding also provides for a support staff person and operating expenses. The Minority Affairs Advisory Committee was re-chartered in 2004 and the Minority Student Program Policy, established in 1991, was reviewed. Our newly remodeled Surbeck Student Center opened a new Office for Multicultural Affairs next to the Ivanhoe International Center in fall 2004.

The Office of Multicultural Affairs has the following listed among its services:
- Provide supplemental tutoring, and workshops for time management, test taking, study skills, communications and stress management
- Administer scholarship programs and identify other sources of financial assistance for students
- Provide assistance for students in coop/internship placements and full-time employment
- Provide a student study lounge where students can interact
- Serve as the advisor to the American Indian Science and Engineering Society (AISES)

Bridges to Success Program: This joint program between SDSM&T and Oglala Lakota College (OLC) is funded by the National Science Foundation regionally through a grant from Salish Kootenai College, the National Science Foundation, and the All Nations Louis Stokes Alliance for Minority Participation (ANLSAMP) Program. The “Bridges” program provides an undergraduate research opportunity with SDSM&T faculty for primarily American Indian students who are mid-way through their science, technology, engineering or mathematics (STEM) college curriculum. The research experience, in conjunction with a series of professional development workshops, helps to give students practical experience in their chosen major as well as needed financial support. Most of the students are either STEM
students at OLC with a desire to pursue a degree at SDSM&T, or are enrolled SDSM&T students.

The purpose of the program is not only to increase enrollment and retention of American Indian students but also to increase the number graduating with four-year degrees in STEM areas. The program just received its third consecutive year of funding and has supported 44 students thus far.

4th item of evidence in support of Core Component A

Programs designed to encourage interest in science and engineering

Discussion of 4th example of evidence

The West River Math Contest provides an opportunity for 8th-12th grade students from the surrounding region to engage in an academic competition, by taking tests in various subject areas, including algebra and geometry. This event, in place since 1950, currently attracts between four and five hundred students annually, representing 20-25 schools. Each year, during the contest, SDSM&T faculty meet with the teachers who have accompanied the contestants. At these informal meetings, valuable information is shared, not just about the contest, but also about common interests and concerns in mathematics education. As a direct result of these discussions, in 1999 the contest moved from Saturday to a weekday, in order to allow more students to attend. The number of participants increased fifty percent that year. The math teachers who attend are very supportive of the event, and are grateful that their students can be recognized for academic accomplishments.

The High Plains Regional Science and Engineering Fair (also cited in Core Component 5d) encourages middle school and high school students to apply the scientific method to explore questions and come up with answers to virtually any aspect of science, technology, engineering, and mathematics. Science fair participants are expected to follow the rules and regulations of ethical and moral investigation that have been outlined by the Intel ISEF (International Science and Engineering Fair) Scientific Review Committee. The High Plains Regional Science and Engineering Fair has its own Scientific Review Committee although SDSM&T faculty and staff volunteer to serve as judges for this annual on-campus event.

Core Component 5b. (for educational development): The organization has the capacity and the commitment to engage with its identified constituencies and communities.

Evaluative statement for all of Component 5b

We are becoming increasingly successful at attracting a large number of return participants from schools across the state for campus-hosted events. In 2003, with encouragement and financial support of the Board of Regents, we began the renovation process to turn our student center into an attractive modern conference center. To ensure the successful utilization of the facility, we created, in 2003, two new, full-time positions: “Director, Educational Programs and Professional Conferences” and an “Information Specialist” to assist in the promotion of campus events. Our new marketing initiative is comprehensive in terms of staffing and its goals, and it is designed to build the prospect pool for both students and utilization groups. We are doing well in this area and are working hard to do even better.
Evidence cited:

1. Renovations of Surbeck Student Center and construction of an adjacent residence hall
2. Star of the West speaker series
3. Events designed to interest youth in science, math, engineering, and the international atmosphere of SDSM&T

1st item of evidence in support of Core Component B

Renovations of Surbeck Center, our student union and construction of an adjacent residence hall

Discussion of 1st example of evidence

SDSM&T has made significant improvements to its conference and meeting facilities. The campus central chiller project has increased our capacity to fully utilize spaces during the summer months. Additionally, Surbeck Center has added meeting room space and refurbished existing space to provide better atmosphere and state of the art presentation equipment. Meeting rooms in Surbeck Center will accommodate groups ranging from 10 – 400; several lecture halls on campus continue to be used by off-campus groups on weekends and during the summer months. Summer conferencing capabilities were expanded with the completion of Peterson Hall, an adjoining 297-bed residence hall with individual temperature-controlled rooms. We reorganized our scheduling, event services and conferencing services staff to provide more efficient handling of reservation requests for equipment, facilities, and food services. Summer 2005 was the first full summer of operation with the improved facilities; preliminary numbers indicate a substantial increase in utilization of meeting and lodging rooms by off-campus constituents. Several national conferences are scheduled to be held at SDSM&T during the next two summers.

2nd item of evidence in support of Core Component B

Star of the West speaker series

Discussion of 2nd example of evidence

The Star of the West Speaker Series is an annual event that provides a venue for leading experts in technical fields to make broad-overview presentations to a broad range of constituencies that include the general public, students in grades six and up, as well as faculty, staff, and our enrolled students.

The Star of the West Speakers Series was an outgrowth of the McGillycuddy Speaker Series. Both series were possible because of a generous donation from Ray Graham. Mr. Graham funded the series through an endowment in order to give students, faculty, staff, and the community access to experts at the national level who can challenge attendees to consider new ways of thinking about important issues.
Speakers have included the following:

- George McGovern, former U.S. Senator and presidential candidate
- Drs. Frank and Deborah Popper, Rutgers University and City University of New York’s College of Staten Island, developers of the Buffalo Commons concept
- Jodi Rave, reporter on Native issues for Lee Newspapers, a Midwest newspaper chain with a circulation of 1.1 million
- Dr. Donald R. Baer, a laboratory fellow at the William R. Wiley Environmental Molecular Sciences Laboratory, located at Pacific Northwest National Laboratory in Richland, Washington.
- James Von Ehr I, founder, chairman and chief executive officer of Zyvex Corporation, based in Richardson, Texas
- Dr. Davis Baird, a professor in the Department of Philosophy at the University of South Carolina
- Dr. Jeffrey Henderson, President and CEO, Black Hills Center for American Indian Health

**3rd item of evidence in support of Core Component B**

Events designed to interest youth in science, math, engineering, and the international atmosphere of SDSM&T

**Discussion of 3rd example of evidence**

Interest in science and engineering must be encouraged at an early age to ensure that students have the appropriate academic preparation to enter one of these fields when they reach college age. SDSM&T sponsors various activities to promote this interest and to expose students to the global culture at the University. Four examples of these efforts are the Cultural Expo, E-week GIRLS, the Children’s Science Center, and the Kid’s Block Contest.

**Cultural Expo**: Local and regional school children and community cultural groups are invited to join a celebration of our cultural and international diversity. The intent is to promote friendship and cultural exchange between people of different countries and cultures. Cultural displays, native foods and entertainment including dancing and singing are featured.

**E-week GIRLS (Girls into Real Learning Succeed)**: This is a day outreach program that brings over 150 middle school and high school girls to campus each spring. Girls not only learn about science and engineering careers but they also participate in hands-on examples of those occupations.

**The Children’s Science Center**: The Children’s Science Center was operated by SDSM&T between 1998 and 2004 at a City of Rapid City facility. The Center provided interactive educational exhibits and education programs for children in the Black Hills area. Thousands of individuals were served each year in an effort to increase the science and technology literacy of area youth. Programming was also offered to families and teachers. Numerous corporate, educational, and private individuals served as a sponsors and partners for the range of programs offered at the Center. During the 2004-05 year the science exhibits were transitioned to the Rapid City YMCA.

**Kids’ Block Contest**: Children in first through sixth grades compete at engineering a specified building project, using their imaginations and interlocking building blocks.
Core Component 5c. (for educational development): The organization demonstrates its responsiveness to those constituencies that depend on it for service.

Evaluative statement for all of Component 5c

SDSM&T is well known by its K-14 constituents in the community and state as a respected university. We find we have two categories of constituents: 1) those with whom we have a collaborative history and who view us as highly approachable, and 2) those who are potential constituents but have not contacted us due to the perception that we are ivory tower, over their heads, and otherwise not approachable.

We have a strong and successful history of serving our Category 1 constituents (i.e., those K-14 teachers and students that have been involved with the various educational opportunities we offer). We have the community reputation as being “the” technical content experts in the fields of STEM areas (Science, Technology, Engineering, and Math). Thus, certain members of our K-14 constituents often request services in the form of teacher training opportunities, and SDSM&T does a good job of responding by providing the requested services.

However, there remains a significant potential for serving Category 2 constituents (i.e., constituents that are either undefined, not aware of our services or, as yet, have not contacted us due to the perception that we are unapproachable). There is need in the community for visiting scientists from SDSM&T to do outreach in K-14 classrooms and for on-campus workshops for the local community. Many K-14 teachers do not know that there are certain people on campus that conduct classroom outreach. Those teachers that do know about this service make numerous requests for classroom visitors and campus tours.

As an institution, SDSM&T needs to decide if we are truly going to make ourselves available to the full range of the K-14 community, and if so, must provide the necessary time and resources to individual faculty and staff members to do it. Those faculty and staff that are not interested in K-14 outreach services should not be expected to engage. By targeting the many campus employees who are enthusiastic and energetic about outreach, we could improve recruitment and offer greater educational value to our constituents. Such efforts must differentiate between services provided during the academic year and the summer.

Evidence cited:

1. Summer Technology for Teaching and Learning (TTL) program
2. Summer Advanced Placement (AP) Institutes
3. Black Hills Science Teaching Project to Prepare K-8 teachers for the New Millennium (BLAHST)

1st item of evidence in support of Core Component C

Summer Technology for Teaching and Learning (TTL) program
Discussion of 1st example of evidence

The Technology for Teaching and Learning (TTL) program was instituted by the State in response to a critical shortage of system administrators in the K-14 system. Training was difficult to acquire, particularly in the more rural school districts; however, the expertise was available at SDSM&T and has been offered through the TTL between 1999 and 2004. Approximately 460 teachers were trained. The program had generally high quality instruction but the success of the training was influenced by the background of the participants. Students who had some system administration experience prior to training were able to acquire advanced skills very quickly. Those people returned to their school districts and made significant contributions; others returned to repeat the program in order to achieve needed competencies. TTL training was recently moved to Mitchell Technical Institute in order to serve the eastern portion of the State; however, SDSM&T continues to assist with this program.

2nd item of evidence in support of Core Component C

Summer AP Institutes

Discussion of 2nd example of evidence

SDSM&T has offered 13 Advanced Placement (AP) Institutes for 175 high school teachers since 1998. These five-day intensive sessions, led by an AP consultant trained by The College Board and assisted by an SDSM&T faculty member, are designed to help prepare high school teachers to teach advanced placement courses in their schools. SDSM&T has held AP Institutes in English Composition and Language, English Composition and Literature, English Vertical Teams, Calculus, Math Vertical Teams, and Environmental Science. Evaluations by participants have indicated a high degree of satisfaction with the instruction.

In addition to the AP Institutes funded by SDSM&T, we have led Math Vertical Team projects with the Rapid City School District and the Todd County School District on the Rosebud Reservation, funded through an Eisenhower Grant and a No Child Left Behind Grant. In summer 2003, 20 teachers participated in the Institute and in professional development throughout the academic year, with the goal of increasing the readiness and calculus proficiency required by many STEM higher education institutions. The project found that math teachers were very interested in developing and incorporating technology in their classrooms and that it was imperative to align math curriculums at the K-14 level, as well as provide instruction that highlights applied math. The grant project was funded for one year. As a result, the Rapid City School District has a math vertical team comprising middle and high school math teachers that continues to work to align the math curriculum so that students are prepared for AP level work when they become seniors.

A valuable outcome of this 2003 project was a better understanding of the differences and similarities of teaching strategies at a tribal school district and a large urban public school. In summer 2004, our Director of Multicultural Affairs received funding from the No Child Left Behind State Grant Project to continue the project with Rapid City area schools. Twelve teachers participated with the goal of continued training in AP Calculus and vertical alignment of the math curriculum (RR161, RR162, and RR166).
The AP Institutes offered thus far and the number of participants are as follows:

- 1998 – English Literature and Composition – 14
- 1999 – English Literature and Composition – 23
- 2000 – English Vertical Teams – 12; Math Vertical Teams – 7; Environmental Science – 3
- 2001 – Calculus – 11; Math Vertical Teams – 14
- 2003 – Calculus, Rapid City – 11
- 2004 – English Language and Composition – 15

3rd item of evidence in support of Core Component C

Black Hills Science Teaching Project to Prepare K-8 teachers for the New Millennium (BLAHST) [http://www.camse.org/blahst/index.htm](http://www.camse.org/blahst/index.htm)

Discussion of 3rd example of evidence

The goal of this project is to help teachers in 10 school districts improve their capability in teaching science and, thereby, to increase scientific literacy among students and the general public. The project is based at the Center for the Advancement of Math and Science Education (CAMSE), Black Hills State University, Spearfish, South Dakota, and is in its 5th year of a six year term. It serves 430 K-8 teachers and approximately 10,000 students. Under subcontract, SDSM&T provides university faculty consultants to educate the teachers in science content in the areas of geology, paleontology, ecology, and physics. This professional development is achieved through multi-day workshops during the academic year and summers. The Black Hills Science Teaching Project has provided 43,000 hours of professional development in the form of workshops, in-services, on-line classes, etc. since its inception in 1999. The objective of having all K-8 teachers reach 100 hours of professional development has been met or exceeded in the case of over half of the teachers. Workshops are consistently rated high by the teachers who find the workshops to be of benefit in content, pedagogy, and interactions with peers from other districts. External assessments of the project are conducted to judge program success (RR167).

Core Component 5d. (for educational development): Internal and External Constituencies value the services the organization provides.

Evaluative statement for all of Component 5d

Our K – 14 constituencies clearly value the educational opportunities we provide. Value is demonstrated by constituent groups returning year after year. With the exception of the YEA (Youth Engineering Adventure) program, assessment is primarily anecdotal for K–14 student involvements and, therefore, formalized assessment needs to be incorporated into more of the programs. Since many outreach programs have already been described above, only four programs of particularly long standing are offered as evidence below.

Evidence cited:

1. High Plains Regional Science Fair
2. Engineers Week
3. Youth Engineering Adventure
4. Museum of Geology

1\textsuperscript{st} item of evidence in support of Core Component D

High Plains Regional Science Fair

Discussion of 1\textsuperscript{st} example of evidence

The High Plains Regional Science Fair yearly attracts hundreds of participants ranging from grades 6 through 12 and has been doing so for 50 years. Interview teams of judges comprised of faculty, students and area science professionals instill in participants positive attitudes towards what they have been able to accomplish, a better understanding of science and/or engineering, and innovative ideas to advance their work. Feedback and suggestions are solicited from campus and community participants; overwhelmingly, responses to this annual event are positive.

The Science Fair Committee has been disappointed that more high school students have not been participating in recent years; most participants are elementary and middle school students. It has been determined that in large part the reason for this lack of participation is the paper work that must be completed by students and teachers who are carrying a heavy work load. This paper work and documentation assures compliance with International Science and Engineering Fair (ISEF) rules governing, among other things, the acceptable use of vertebrate animals, human subjects, and hazardous substances or devices. Further information can be found at [http://www.sciserv.org/isef/primer/rules_regulations.asp](http://www.sciserv.org/isef/primer/rules_regulations.asp).

To address this issue the committee has identified parents and plans to approach student organizations for volunteers willing to help high school teachers and students. These volunteers will spend time at the high schools assisting students and teachers plan and prepare projects and document adherence to ISEF rules.

2\textsuperscript{nd} item of evidence in support of Core Component D

Engineers Week

Discussion of 2\textsuperscript{nd} example of evidence

Engineers Week was founded in the United States in 1951 by the National Society of Professional Engineers. SDSM&T initiated its first Engineers Week in 1978. The program is dedicated to raising public awareness of engineers’ positive contributions to the quality of life. At the public-school level the event is intended to show students that science, math and engineering are fun and exciting professions. Each year, over 1200 K-12 students participate in the week of events that includes the Kid’s Block Contest, MathCounts, Hot Chemistry – Cool Show, and the Computer Programming Contest. Representative comments from teachers and participants include:

- “Thank you for having our students on last Friday. The students really enjoyed seeing the different exhibits and the chemistry show. The students really liked the marksmanship and the hot air popcorn demonstration as well as the satellite pictures on the computers. There were some demonstrations that seemed unprepared for example, some in the
civil/mechanical building. Overall, the students and faculty enjoyed the experience. I definitely would like to come back next year.”

- “We had two great days. Thank you. My students were there for the chemistry show, the tours and for E-Week Girls. Chemistry Show--The chemistry show should continue showing the ‘magic’ first, and then a second display with the explanation. It was also informative and fun when the ‘magicians’ asked questions while explaining the chemistry.”

- “Tours--Keeping the group of 35 students together worked well. Also during lunch my students picked the areas they wanted to go to. . . . The students like the hands on activities.”

- “E-Week Girls--The hands on activities were a hit.”

- "This was the best school day I've ever had." "We got to eat popcorn." "I liked the chocolate kisses." "Can we have the space camp person come to Dakota [Middle School]?”

3rd item of evidence in support of Core Component D

Youth Engineering Adventure

Discussion of 3rd example of evidence

An example of a newer program, founded in 2001, is Youth Engineering Adventure (YEA), a one-week, on-campus program designed for high school students interested in math and science. Participants have an opportunity to learn about career opportunities through a variety of hands-on projects associated with many of the engineering departments. They also tour engineering firms in the Rapid City area. Total participation for the five completed years is 141. Of the 141 past attendees, 92 have graduated from high school and 24 are currently attending the SDSM&T. Several of the students have indicated that they would not be at the School of Mines had it not been for YEA. YEA has proven to be a very worthwhile program and promises to become another yearly SDSM&T tradition. Assessment to improve program effectiveness is done each year. Ninety-eight percent of the participants report a better understanding of what engineering is all about after attending YEA.

4th item of evidence in support of Core Component D

Museum of Geology

Discussion of 4th example of evidence

The Museum of Geology is part of SDSM&T and is charged by the State statutes to collect, conserve, and interpret the minerals, rocks, fossils and geology of South Dakota. The museum conserves a collection of approximately 250,000 geological artifacts consisting of minerals, rocks, and invertebrate and vertebrate fossils. These collections form the basis of scientific research by staff and undergraduate and graduate students in our paleontology programs and for qualified visiting scientists. The Museum exhibit hall features approximately 2300 specimens housed in a world-class mineral exhibit, a rock exhibit, and invertebrate and vertebrate fossil exhibits featuring swimming Cretaceous reptiles and Cretaceous dinosaurs, a collection of reptiles and mammals from the Big Badlands, and Pleistocene mammals. The Museum hosts 30,000 visitors per year, including approximately
4,000 school children. Research efforts of the Museum includes numerous federal contracts, studies by 15 master’s students and 20 undergraduates, and a professional staff of three.

**Questions that arose from the self study relative to Educational Development**

1. The question “who, precisely, are our constituencies?” arose very early in the self-study process. Time was taken by the working group to answer the question in the form of a whitepaper. Input was sought from across campus, via emails and focus groups, and the final version was reviewed and approved by the President, Executive Council, and University Cabinet. The content of the white paper has been incorporated into the introductory sections of this chapter that introduce the topics of educational and economic development.

2. While this question was technically “answered” in the course of self-study, much work remains in communicating this definition to campus and processing the implications of the definition.

3. What should be the scope of our participation with regional K-14 constituencies? And are we devoting the resources necessary to be full partners in selected activities? Limited resources dictate that we cannot be all things to all people. The scope of our involvement with engagement and service continues to be a topic of considerable discussion.

**Actions taken relative to Educational Development**

1. We defined our constituencies and shared this definition with the campus community and the Executive Council for reaction and input. The definition was subsequently amended based on the input received.

3. We clearly stated that the primary focus and concentration of our involvement with engagement and service would be in the areas of educational development and economic development.

4. We further clarified our role as a provider of higher education in conjunction and collaboration with other educational providers in the region. We therefore have more precisely and narrowly defined our areas of concentration for fulfilling our service and engagement responsibilities.

**Recommendations relative to Educational Development**

1. Establish or clearly assign administrative responsibility for K-14 outreach efforts.

2. Establish a formalized system to seek external input on our engagement and service efforts. Analyze the input and utilize the input for the improvement of the process.

3. Establish a K-14 advisory board or a formal network of K-14 teachers, counselors and administrators to ensure that we are meeting their needs.
4. Continue the conversation regarding the scope of our K-14 involvement. If we continue to serve a wide range of constituencies we must be willing to commit the resources, both staff and financial, in order to participate fully.

5. Improve our marketing efforts related to engagement and service in an attempt to become more visible to a broader range of constituencies.

**ECONOMIC DEVELOPMENT**

**Engaging and serving our economic development constituents**

In the area of **economic development**, SDSM&T embraces its responsibility to serve the following constituents:

- Entrepreneurial faculty, staff, students, and community members
- Manufacturing, and high tech service businesses
- Start-up businesses using technology developed at SDSM&T
- Venture Capitalists
- South Dakota State Government and City of Rapid City
- South Dakota Board of Regents
- Sponsors of economic development oriented research and development
- Western South Dakota economic development entities, e.g. Black Hills Vision, Rapid City Area Economic Development, and others
- SDSM&T alumni interested in participating in South Dakota economic development
- Tourism businesses that benefit from, or utilize, the scientific expertise of the University

**Connecting our mission of with this constituent group**

Our institutional mission includes a commitment “to benefit the state, region and nation through collaborative efforts in . . . economic development.” Furthermore, economic development is related to our mission “to advance the state of knowledge and application of this knowledge through research and scholarship.”

**SWOT analysis of our performance in the area of economic development**

In fall 2004, the Economic Development “Working Group” for the self-study under Criterion 5 conducted a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis. This group included regional leaders in economic development. A second SWOT was conducted by the University’s Academic Advisory Board. In both cases, the Criterion 5 co-chairs led a structured brain-storming exercise designed to produce a list in each of the four SWOT dimensions. A structured voting process was used to identify the most significant items in each category. The merged observations of the two groups are as follows:

**Strengths:** The programs: Small Business Innovation Research (SBIR), Tech Ventures and Small Business Technology Transfer Programs (STTR); the friction stir welder; groundbreaking on the new business incubator building.
Weaknesses: Pursuing economic development opportunities in multiple areas and the subsequent lack of focus on a few areas. We have projects with possible economic development ramifications in nanoscience and nanoengineering, friction stir welding, and in our new Ph.D. program in atmospheric and environmental science. If we attempt to do too much, through too many separate projects, we could fail.

Opportunities: The Vice President for Research has created an Intellectual Property Committee and has hired consultants and tasked committee members to create an Intellectual Property Policy that empowers our creative faculty, favors local business development, and creates specific practices to evaluate disclosures and respond to inventors in a timely way. Once in place, this policy in and of itself will spawn disclosures.

Threats: Our intellectual property and workload policies are set through a negotiation process that involves the Board of Regents, their university presidents and vice-presidents, and the Council on Higher Education (COHE), which is the bargaining unit for the faculty within the Board of Regents system. Around the time of conducting our SWOT analyses, the Board of Regents proposed new policies during the contract negotiation process with COHE that some faculty members identified as a threat to our focus on economic development. One proposed policy would have required those faculty members who do consulting to remit a percentage of their consulting income to the university; another proposed policy could have had the effect of reducing the salary of a faculty member who had a low teaching load due to the cancellation of a scheduled class because of low enrollments. Both of these policies were proposed and then withdrawn as part of the negotiation process. COHE and the Board of Regents negotiated a new policy on intellectual property, which is described in more detail in the section below on Core Component A.

Overview of our activities in economic development service and engagement:

We are involved in a variety of ways that serve our economic development constituencies. Below is a listing of our major activities. Greater detail is presented on most of these in the discussion of the core components, as indicated below.

Core Component A
- Intellectual Property policies were revised by our Board of Regents to provide more incentive for faculty members to pursue research with the potential for commercial profitability.
- Ph.D. program in Atmospheric and Environmental Sciences was established.
- Rapid City 2012 funding program provided funding for partnership initiatives.
- Tech Ventures LLC was established by the SDSM&T Foundation.

Core Component B
- The Center for Accelerated Applications at the Nanoscale (CAAN) was created.
- Homestake Deep Underground Science and Engineering Laboratory (H-DUSEL) was proposed for the now closed Homestake Mine in Lead, South Dakota.
- Military-sponsored research programs were designed to lead to economic development opportunities: These projects have enabled us to secure additional infrastructure in the form of the Tech Development Laboratory, an off-campus building devoted to these research programs.
- Ph.D. program in nanoscience and nanoengineering was created.
- Rapid City Area Economic Development Partnership is collaborating with us to locate a business incubator building on our campus.
- South Dakota’s 2010 Initiative has produced collaborations with the University.
- Tech Development Laboratory

Core Component C
- Black Hills Business Development Center
- Center of Excellence for Advanced Manufacturing and Production (CAMP)

Core Component D
- Advanced Materials Processing and Joining Laboratory for research on friction-stir welding and laser-additive manufacturing
- Small Business Innovation Research (SBIR) and the Small Business Technology Transfer (STTR) programs
- Zyvex nanotechnology testing service

The following activities are not further discussed below but should be noted:

- Black Hills Vision collaborates with us in promoting a technology corridor along the eastern edge of the Black Hills.
- Entrepreneurial Studies Minor: Created by our Board of Regents to provide educational opportunities available to all baccalaureate students in regents’ institutions for the purpose of preparing more college graduates to establish and operate small businesses.
- Senior design projects that involve local businesses and industries.

Core Component 5a. (for economic development): The organization learns from the constituencies it serves and analyzes its capacity to serve their needs and expectations.

Evaluative statement for Component 5a

We engage in direct contact with our constituencies in order to continually update our capacity to serve them. We have created mechanisms that give faculty members opportunities and incentives to pursue their entrepreneurial ideas. We have created new academic programs oriented toward practical research that will lead to economic development, and we are engaged with our city government to find mutually beneficial endeavors. We are committed to engage in this learning and analysis as called for in our mission. The evidence demonstrates that we are making significant progress toward doing this with respect to our economic development constituencies.

Evidence cited:

1. Revised Intellectual Property policies
2. Tech Ventures LLC
3. New Ph.D. programs
4. Rapid City 2012 Funding
1st item of evidence in support of Core Component A

Revised Intellectual Property policies

Discussion of 1st example of evidence

The institution’s policies on Intellectual Property (IP) are currently midway through a process of review and revision. The need for such revision became particularly apparent when the institution received research funding from the Army Research Laboratory and the Air Force Research Laboratory; a potential outcome of the funded research was the development of products that would be produced by the private sector. In working with these research sponsors, it became apparent that our IP policies needed to be expanded with more detailed procedures for moving ideas from the lab bench to the commercial sector. The Vice President for Research and the Research and Intellectual Property Council are working with leaders of the Offices of Technology Transfer from Georgia Tech and Virginia Tech to revise SDSM&T’s policies.

Additionally, entrepreneurial faculty had been saying for years that the IP policies in South Dakota were not as generous to authors and inventors as those policies are in other states. Our faculty bargaining unit, COHE, worked with the Board of Regents to negotiate a revised IP policy in January of 2004 (RR95). This policy superseded our former institutional policy last revised in 1991. The 2004 revisions to the regents’ IP policy expands the range of scholarly and artistic works for which ownership will be held by the individual who created them, and establishes a distribution-of-income schedule that is more generous to the individual who creates the work than allowed in the former policy. The new policy’s 50%/50% split of royalties between inventor and institution, having no sliding scale or cap on the return to the inventor, is within the top 5% of equitable IP profit sharing policies in the nation. In 2005, our Vice President for Research created an institutional Research and Intellectual Property Council. This council will review the latest regents’ policy and will develop a new institutional IP policy that will be a revision of current SDSM&T policies in light of the latest regents’ policy. The SDSM&T policy will conform to the regents’ policy and describe the detailed procedural steps for implementing the policy at our institution.

2nd item of evidence for Core Component A

Tech Ventures LLC

Discussion of 2nd example of evidence

In 2004, the institution obtained an enhancement for economic development activities when the SDSM&T Foundation formed Tech Ventures Inc., a for-profit corporation wholly owned by the SDSM&T Foundation. Its purpose is to support commercialization of research projects linked to SDSM&T faculty researchers. Tech Ventures assists in all aspects from start up, to seeking venture capital, to operating a new company. Through these partnerships, Tech Ventures will generate unrestricted revenues used to support the institution. Tech Ventures operates by assisting in the formation of separate limited liability corporations (LLC) for each economic development project and benefits by taking a small ownership share in each LLC. The first project of Tech Ventures was the formation of Control Systems Technology, formed to commercialize a system for the robotic processing of jewelry manufacturing invented by a professor of mechanical engineering at SDSM&T. The
university and the Foundation worked with the professor, the Army Research Laboratory, and the Boeing Corporation in obtaining an additional $400,000 grant to adapt the robotics process to the assembly of subcomponents for aircraft. A second LLC formed was SisMed, a firm for manufacturing specialty surgical instruments that was developed by a local alumnus of the institution. Tech Ventures is currently pursuing three patent applications for clients.

Tech Ventures provides a mechanism for the commercialization of ideas generated through research and development efforts on our campus. Our goal is to become a generator of new companies based on the constant flow of ideas that will be coming from our university. The evidence of what is being accomplished through Tech Ventures illustrates that we are working in cooperation with our constituencies to identify opportunities and to adapt to new opportunities.

3rd item of evidence for Core Component A

New Ph.D. programs

Discussion of 3rd item of evidence

In 2005 we proposed and were successful in establishing new and revised Ph.D. programs. Our Atmospheric, Environmental and Water Resources Ph.D. program was reestablished as a degree in atmospheric and environmental sciences (RR175). The revised curriculum emphasizes basic and applied research but has been tailored to foster work that supports South Dakota economic development in tourism, ecology, forestry, and agriculture. The program was specifically designed to promote research as a means to economic development and to address areas supported by funding agencies such as the National Aeronautic and Space Administration (NASA), the Environmental Protection Agency (EPA), the Department of Energy (DOE) and the National Science Foundation (NSF). Input from our constituencies of the State of South Dakota and the national governmental funding agencies was used in creating this revised academic program.

A new Ph.D. program in nanoscience and nanoengineering was also approved in 2005 (RR176), and the State funded the Center for Accelerated Applications at the Nanoscale (CAAN). The degree and the center will impact economic development and are described in detail in the section on Core Component B.

In December 2005, the Board of Regents approved an interdisciplinary M.S./Ph.D. Biomedical Engineering (BME) program that will be offered by SDSM&T in collaboration with the University of South Dakota (RR279 and RR317). The foci of the BME program will be 1) materials in bio and biomedical engineering, including nanoscience and nanoengineering; 2) computational biomechanics, including visualization; and 3) assistive technology, including sensor systems, neural systems, and controls.

4th item of evidence for Core Component A

Rapid City 2012 Funding
Discussion of 4th item of evidence

We are actively involved with the City of Rapid City as it prepares for the future of the city and region. In 2005, we submitted three proposals to the city 2012 committee that recommends funding for community projects from a special ½ cent sales tax. These have now been funded by the City Council. Two of the proposals will assist us in upgrading our track and stadium seating which will help us attract football and track events to our facilities. The third project involves the city building a connector street across an undeveloped section of our campus that will connect our main campus on Saint Joseph Street to Saint Patrick Street. The connector street is needed infrastructure for economic development because the new business incubator building, the Black Hills Business Development Center, is being built along the connector road on the edge of our current campus. The connector road will also provide an easier on-campus route to our Tech Development Laboratory located on Saint Patrick Street. The incubator building and the Tech Development Laboratory are described in more detail in the sections on core components D and B, respectively.

Core Component 5b. (for economic development) The organization has the capacity and the commitment to engage with its identified constituencies and communities.

Evaluative statement for Component 5b

Our activities provide strong evidence of our capacity and our commitment to engage with constituencies in pursuing opportunities for economic development. We have obtained additional facilities, added academic programs, created an organizational structure, and formed many new alliances with research sponsors and economic development entities.

Evidence cited:

1. 2010 Initiative
2. New Ph.D. programs
3. Tech Development Laboratory and Tech Ventures Inc.
4. Our relationship with research and development funding agencies and with regional economic development entities

1st item of evidence in support of Core Component B

2010 Initiative

Discussion of 1st item of evidence

The governor of South Dakota initiated the 2010 Initiative, (http://www.2010initiative.com) which outlines a series of specific goals and objectives for improving South Dakota’s economic growth. Within the initiative, Goal 3 is to “Become a Recognized Leader in Research and Technology Development by 2010.” The objectives within the governor’s Goal 3 include the following:

- Securing the Homestake Mine for use as an underground science laboratory
- Improving the ranking of the state of South Dakota for NSF funding
- Developing the research and technology infrastructure at our universities
Securing the Homestake Mine for use as an underground science laboratory: our institution helped initiate the discussions that have led to what is now called the Homestake-Deep Underground Science and Engineering Laboratory project (H-DUSEL). When the Homestake underground gold mine, which is located in the Black Hills town of Lead, closed in 2001, we participated with scientists involved in studying the sub-atomic neutrino particles in a decades-long experiment within the mine to propose the development of a deep underground national laboratory for scientific studies. These studies require ultra-low background with respect to cosmic radiation; therefore the deep underground workings of the facility should be ideal for these types of studies. Congress approved $10 million in Federal funds in November 2001 for start up efforts to convert the mine into an underground science laboratory.

In May of 2003 a National Science Foundation committee named Homestake as its preferred site for a national laboratory. In July, 2003, South Dakota Governor Rounds created the Homestake Laboratory Conversion Project to facilitate the development of the process to transfer the mine for conversion to the Laboratory. On February 11, 2004, Governor Rounds implemented the action of the Legislature to form the South Dakota Science and Technology Authority to complete the Agreement in Principle with the Barrick Gold Company to transfer the ownership of the mine to the Authority when NSF funds the conversion. The state legislature also provided $14.3 million in funding to implement the transfer. As the project developed, we became partners with the Lawrence Livermore National Laboratory and the University of California, which took on the leadership of the project.

In July, 2005, the National Science Foundation announced that Homestake was one of two finalists for the location of the Deep Underground Science and Engineering Laboratory. In a parallel effort, South Dakota appropriated an additional $19.9 million in October, 2005, to establish an interim laboratory for physics, geosciences, geomicrobiology, and engineering at a depth of 4850 ft in the mine. An SDSM& T professor is Co-PI for the NSF project; however, this is a large multi-agency effort. The following online information should be consulted for background and history relating to this effort:

- NSF DUSEL (a general site dealing with the DUSEL development process)  
  http://www.dusel.org
- South Dakota Science and Technology Authority (a relatively small site dealing with the South Dakota efforts to maintain the Homestake Facility)  
  http://www.state.sd.us/homestake
- Homestake Lab Information (an SDSMT site devoted to background material – primarily geologic – regarding Homestake)  
  http://homestake.sdsmt.edu/Resources.htm
- Homestake Lab Reference Book (background material on physical facilities at Homestake)  
  http://neutrino.lbl.gov/Homestake/HRB
- Homestake/AGU Meeting Website and Registration (this is the registration page for a series of workshops to be held at the end of 2005 and beginning of 2006 in conjunction with the S-2 project work)  
  http://neutrino.lbl.gov/AGU
- Request for Letters of Interest to use the Homestake 4850 FT. Level (Interim Laboratory and the longer-term Homestake DUSEL facilities for experiments)  
  http://neutrino.lbl.gov/Homestake/LOI/
Improving the ranking of the state of South Dakota for NSF funding: While the National Science Foundation remains an important source of our external funding, the percentage of our total external funding that comes from NSF has decreased in recent years from 40% in the late 1990’s to approximately 20% in 2004; total external funding has increased significantly during this same period as we have received more funding from other federal agencies, particularly the Department of Defense. We expect our renewed emphasis on basic and applied research coupled with economic development opportunities will lead to increased NSF funding.

Developing the research and technology infrastructure at our university: the institution continues to expand our capability in research leading to economic development by focusing our energies in particular areas and by building meaningful relationships with our constituencies. The institution received $585,000 as part of South Dakota’s 2010 Initiative to create the Center for Accelerated Applications at the Nanoscale (CAAN). CAAN research will focus on the areas of nano-particles and associated nano-sensors, with particular emphasis on South Dakota mineral development. CAAN is one of four university-based research centers funded through nearly $2.8 million in 2010 funds, and has involved the formation of a four-state “Northcentral States Nanosystems Consortium” to lead nanoscience and nanoengineering research in the region. (See http://nsnc.sdsmt.edu)

2nd item of evidence in support of Core Component B

New Ph.D. programs

Discussion of 2nd item of evidence

Our capacity and commitment to engage and serve our constituencies in economic development is evident in our activities to create and develop new knowledge through research and its application. As our mission states, we recognize our place as South Dakota’s technological university. Our new and emerging Ph.D. programs are evidence of our activities that place us at the forefront of advancing knowledge. In addition to the new AES degree described under Core Component A, we established a new Ph.D. program in nanoscience and nanoengineering in fall 2005. This new program’s objectives include the preparation of “graduate students who can support economic growth in this area” and the intent to “capitalize on the revolution in science and engineering research at the nanoscale and the economic development impacts it will have in technological areas, including information technology, materials, healthcare, energy, and the environment” (RR176).

Our Ph.D. program in biomedical engineering was presented to the regents in June 2005 (RR279), and the proposal was approved in December 2005 (RR317). Currently, we are exploring the possibility of addressing the professional needs of our students, alumni, and region through the development of a Masters of Engineering program. Such a program would offer an M.S. in engineering as a terminal degree for many engineering fields and, we believe, open new career paths for our students. The Dean of Graduate Studies is overseeing these discussions.

3rd item of evidence in support of Core Component B

Tech Development Laboratory and Tech Ventures Inc.
Discussion of 3rd item of evidence

The Tech Development Laboratory (TDL) is a building situated on East Saint Patrick Street, adjacent to the campus’ southern border. The structure was purchased by the SDSM&T Foundation as a means of alleviating the shortage of quality research space on campus. The 14,600 square feet of space was renovated in 2004-05 from its former commercial printing use to a state-of-the-art research laboratory. The TDL contains office, classroom, laboratory, and processing areas for several funded projects.

Tech Ventures, a for-profit corporation owned by the SDSM&T Foundation was described in the section on Core Component A. The combination of the TDL and Tech Ventures provides both the physical facilities for high quality research as well as an organizational structure that provides support for fledging businesses to develop. The first three projects to have assigned space in the building are being pursued by faculty members in chemical and mechanical engineering and chemistry and involve highly engineered polymers and polymer composites for use in defense applications.

4th item of evidence in support of Core Component B

Our relationship with research and development funding agencies and with regional economic development entities

Discussion of 4th item of evidence

We are proud of the relationships we have developed with the sponsors of economic-development oriented research and development and our local economic development agencies. Our support from agencies of the Federal government comprises over 85% of our total external funding for research, which has grown significantly over the past nine years as shown in Figure 9.1 below (source RR182). We have worked with our congressional delegation to expand our capabilities and to serve our constituencies. We have obtained support from Federal agencies, such as the Army and Air Force Research Laboratories, the National Science Foundation and other Federal constituencies. For example, we were awarded Department of Defense EPSCoR funding in 2005 to develop new optically clear polycarbonate plastics for use in protective armor and new explosive materials using nanoparticles.
Faculty and student research at SDSM&T primarily falls into one of five core technical areas:

1. Materials science and engineering
2. Nanosciences and nanoengineering
3. Atmospheric and environmental sciences
4. Geosciences and geological engineering
5. Biochemical process science and engineering

Strategic hiring is underway in these focus areas. For instance, we hired a director of the Center for Accelerated Applications at the Nanoscale (CAAN) in 2004 and have recently hired faculty members with expertise in biomedical engineering, composites, nanoscience, and nanoengineering.

State support has resulted in the establishment of a new focused research center in nanosciences. CAAN focuses on research in the areas of nanoparticles and associated nanosensors, with particular emphasis on South Dakota mineral development. When completed, Center staffing will include eleven new FTEs, three at South Dakota State University and eight at SDSM&T. These will be the new Center Director, four Ph.D. students, two technicians, three postdoctoral students and a center administrative assistant. The Center complements the new nanoscience and nanoengineering Ph.D. degree program that began in fall of 2005.

In addition to pursuing the nanosciences Ph.D. program, SDSM&T will partner with the University of South Dakota to establish M.S. and Ph.D. programs in biomedical engineering next year.
Industrial and economic development partnerships are also critical to developing and strengthening current and future research programs at SDSM&T by teaming the State of South Dakota, local economic development authorities, and private-sector partners to bring unique, state-of-the-art research capabilities to the university. A successful example of this engagement is the partnership between CAAN and the Zyvex Corporation. In March 2005, South Dakota Governor Mike Rounds announced a cooperative agreement involving Zyvex Corp. of Richardson, Texas, the state of South Dakota, and Rapid City economic development efforts to designate SDSM&T as the exclusive provider of integrated circuit (IC) failure analysis services to the semi-conductor industry. Under the agreement, Zyvex will outsource all of its testing services to CAAN. The agreement between SDSM&T and Zyvex requires the purchase of highly specialized equipment from Zyvex. The equipment measures structures smaller than 100 nanometers. SDSM&T will be the first university to have this type of fully integrated system installed and operational. The probing system will allow the university to utilize the most advanced integrated system developed for IC probing and nanomanipulation. Governor Rounds announced that the state has provided a $250,000 grant to help SDSM&T and CAAN acquire the equipment. Additional funds were provided through a loan from the Rapid Fund, a local economic development revolving loan fund.

By virtue of its location in South Dakota, SDSM&T also has specific research resources available, such as the competition for EPSCoR funding (available only in 27 states) from NSF, DOE, DOD, NASA, and NIH. The university has also successfully competed for support for nationally recognized centers of excellence. For example, SDSM&T and its partners announced the National Science Foundation Friction Stir Processing Industry/University Cooperative Research Center (I/UCRC) on 6 October, 2004. SDSM&T has joined with Brigham Young University, the University of South Carolina, the University of Missouri- Rolla and more than 18 industry partners to create the first NSF I/UCRC and national research center to focus on friction stir processing. This is the first such NSF center headquartered in South Dakota. The Center will address the needs of the aerospace, aeronautic, energy, military, and commercial industries in developing the rapidly growing friction stir processing technology. Industry partners will bring projects to the participating universities, where researchers, students, and other experts will work to solve the problems and advance the technology. The technologies developed under the I/UCRC will be integrated into the academic curriculum at each participating institution. SDSM&T is the lead institution for the Center. USC and BYU are the two participating site universities, while Missouri-Rolla is expected to become a full member next year.

**Core Component 5c. (for economic development) The organization demonstrates its responsiveness to those constituencies that depend on it for service.**

**Evaluative statement for Component 5c**

*We are learning to be responsive to the needs of our constituencies in economic development. We cite examples that demonstrate how we have partnered with other entities to collaborate with our constituents in creating opportunities for economic development. The rate of formation of such partnerships has increased in the past two years as we have begun to focus our energies on those partnerships that lead to economic development.*
Evidence cited:

1. The CAMP Program (Center for Advanced Manufacturing and Production)
2. Tech Ventures Inc.
3. The new Black Hills Business Development Center

We are developing an entrepreneurial culture on our campus. Each of the initiatives cited as evidence above focuses on a particular group of constituents although all constituents benefit in some way from each of the activities cited.

The Center of Excellence for Advanced Manufacturing and Production (CAMP) focuses on our student constituents by affording experiential learning opportunities through multidisciplinary project teams. The Tech Ventures Program focuses on the entrepreneurial faculty by affording them the opportunity to form their own commercial business. The new business incubator is focused on supporting entrepreneurs from the local community and campus alike. Combined, these three programs address the entrepreneurial/economic development needs of our constituents.

1st item of evidence in support of Core Component C

The CAMP Program (Center of Excellence for Advanced Manufacturing and Production)

Discussion of 1st item of evidence

As mentioned under Criterion 1, the CAMP program was established in 1996 as our institutional “Center for Excellence.” Currently, there are 10 multidisciplinary teams involving approximately 200 students in design and performance competitions on a local, regional, and national basis. All of these teams are involved in engineering challenges such as robotics, aircraft, concrete canoes, helicopters, racecars, off-road vehicles, and industrial design projects. Through CAMP we serve our economic development constituents by preparing our graduates for the demanding realities of engineering design and project management. Strong evidence that we prepare our students well in this regard are our repeated successes in national and international competitions.

The SAE Aero team offers a good example of the caliber of performance these team projects brings out in our students. The SAE Aero team placed 17th in the Design West International competition in 2004 (its 1st year of competition) but won the rating of “Best Team Overall.” This same team returned the next year and took 1st place through a remarkable display of character and persistence. At the end of day one of the competition, the SDSM&T Aero team was in 4th place, behind the University of Akron, National University of Australia, and Ohio State. One of the team’s two planes was smashed to bits. On the second day, they placed their full confidence in their design and loaded it heavily with 19 pounds of payload. On the second of two tries, the landing was perfect, and, when the heavy payload was announced, all teams knew that SDSM&T had taken first place. Figure 9.2 below offers a sense of how well SDSM&T student teams have fared in national competitions.
<table>
<thead>
<tr>
<th>Team</th>
<th>Competition</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mini-Baja - senior team</strong></td>
<td>West Regional</td>
<td>9th (out of 75)</td>
<td>30th (out of 70)</td>
<td>53rd (out of 100/87)</td>
<td>6th (out of 127)</td>
<td>22nd (out of 100)</td>
<td>22nd (out of 100)</td>
<td>8th (out of 94)</td>
<td>76th (out of 131)</td>
<td></td>
</tr>
<tr>
<td><strong>Mini-Baja - junior team</strong></td>
<td>West Regional</td>
<td>73rd (out of 100/87)</td>
<td>13th (out of 127)</td>
<td>30th (out of 100)</td>
<td>83rd (out of 100+)</td>
<td>NA</td>
<td>NA</td>
<td>115th (out of 131)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mini-Indy</strong></td>
<td>International</td>
<td>24th (out of 77)</td>
<td>53rd (out of 94)</td>
<td>42nd (out of 104)</td>
<td>41st (out of 104)</td>
<td>59th (out of 125)</td>
<td>42nd (out of 126)</td>
<td>49th (out of 125)</td>
<td>74th (out of 134)</td>
<td>84th (out of 123)</td>
</tr>
<tr>
<td><strong>Solar Car</strong></td>
<td>International</td>
<td>Sunrayce 29th</td>
<td>NA</td>
<td>Sunrayce 25th</td>
<td>Formula Sun 8th</td>
<td>NA</td>
<td>Formula Sun 2nd Grand Prix Stock Class</td>
<td>NA</td>
<td>Formula Sun 4th Grand Prix Stock Class</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Concrete Canoe</strong></td>
<td>National</td>
<td>7th</td>
<td>7th</td>
<td>5th (out of 200) top 2.5%</td>
<td>11th</td>
<td>5th (out of 200) top 2.5%</td>
<td>7th</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Concrete Canoe</strong></td>
<td>Regional</td>
<td>1st</td>
<td>1st</td>
<td>1st</td>
<td>1st</td>
<td>1st</td>
<td>1st or 2nd</td>
<td>2nd</td>
<td>2nd (out of 12)</td>
<td></td>
</tr>
<tr>
<td><strong>Human Powered Vehicle -</strong></td>
<td>National</td>
<td>7th (out of 40) top 18%</td>
<td>12th</td>
<td>3rd (out of 40) top 8%</td>
<td>5th Overall 2/4th Single Rider Utility</td>
<td>6th Overall (out of 25)+4th Single Rider Utility</td>
<td>16th (out of 25)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SAE Aero</strong></td>
<td>National</td>
<td>NA - First competition in 2001</td>
<td>12th (out of 37)</td>
<td>14th (out of 30)</td>
<td>12th (out of 39)</td>
<td>17th (out of 37)</td>
<td>1st (out of 39)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IEEE Robotics - team 1</strong></td>
<td>Regional</td>
<td>3rd (out of 16)</td>
<td>3rd (out of 19)</td>
<td>2nd (out of 33)</td>
<td>1st (out of 37/33)</td>
<td>3rd (out of 40)</td>
<td>2nd (out of 26)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Steel Bridge</strong></td>
<td>Regional</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>4th (out of 10)</td>
<td>DQ</td>
<td></td>
</tr>
<tr>
<td><strong>UAV</strong></td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td><strong>ChemE Car</strong></td>
<td>Regional</td>
<td>1st Car, 3rd Poster</td>
<td>1st</td>
<td>5th</td>
<td>1st Car</td>
<td>4th Car, 2nd poster</td>
<td>1st poster</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ChemE Car</strong></td>
<td>National</td>
<td>4th Car</td>
<td>4th Car</td>
<td>4th Car</td>
<td>4th Car</td>
<td>4th Car</td>
<td>4th Car</td>
<td>4th Car</td>
<td>4th Car</td>
<td></td>
</tr>
</tbody>
</table>

*C: Concrete canoe # of entrants in nationals is comprised of the first place team from each region, generally between 18 and 25. Each region usually has between 15 and 20 competitors.

** Only the first three places in Steel Bridge advance to national competition.

Figure 9.2 CAMP Team Competition Results 1997-2005

The array of projects has expanded over the past several years, and work is now underway to establish international CAMP projects. We regard this as an important development.
Our economic constituents among our donors clearly recognize the valuable service CAMP offers, and, in 2000, Caterpillar Inc. funded the creation of a specialized lab for our student project teams and since 1998 has provided approximately $25,000 a year for undergraduate scholarships.

Other important economic development constituents, our own entrepreneurial faculty, staff and students, gain valuable experience within CAMP by addressing open-ended problems where economic considerations are part of the analysis. Projects may be introduced by faculty members or students who have a viable idea; they then have the opportunity to develop the idea to the point of commercialization.

Ideas that are developed as projects within CAMP provide opportunities for undergraduate students to engage in real-life practical projects. The project originators or sponsors benefit by engaging undergraduate students who have been educated in a formal, team-based, interdisciplinary environment on their projects. Employers of our graduates benefit by hiring students who have had this real-world experience of developing projects in such an environment.

The South Dakota Board of Regents and state government are served by the enhanced quality of experiential learning experience afforded by CAMP programs. Some students spawn their own entrepreneurial businesses as a result of this experience as illustrated by the examples in the following Figure 9.3.

<table>
<thead>
<tr>
<th>Student Name</th>
<th>CAMP program</th>
<th>Degree/Yr</th>
<th>Business created</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robert Toms</td>
<td>Mini Baja</td>
<td>B.S. ME/ 1995</td>
<td>Design Advantage (electrical and mechanical product development)</td>
</tr>
<tr>
<td>Anthony Merkel</td>
<td>Formula SAE</td>
<td>B.S. ME/ 1997</td>
<td>Started his own sound and electronics company</td>
</tr>
<tr>
<td>Jason Nelson</td>
<td>Mini Baja</td>
<td>B.S. ME/ 2003</td>
<td>Rusher Racing (business was terminated after student graduated)</td>
</tr>
<tr>
<td>Ryan Rusher</td>
<td>Formula SAE</td>
<td>B.S. ME/ 2005</td>
<td>Risher Racing (business was terminated after student graduated)</td>
</tr>
</tbody>
</table>

Figure 9.3  CAMP-spawned entrepreneurial businesses.

The local community is well served by the CAMP program in that some of the projects accomplished every year are framed by entrepreneurs in the community. Once a community / business-based project is identified, the CAMP leadership facilitates the formation of an interdisciplinary student team and conducts oversight and mentoring throughout the project. A final project report by a student team often guides a local business in making decisions about commercialization of a product. One of our best examples of this type is our collaborations with Legend Air Suspensions, a local Rapid City company owned by Mr. Jesse Jurrens. The company produces after-market suspension systems for Harley Davidson motorcycles. In a first project for Mr. Jurrens, CAMP students helped test prototype parts for durability and performance. Then, in 2003-04, a CAMP senior design team designed a test
system for the company to build so that future testing of prototypes of new products can be done within the company.

CAMP is assessed in several ways including team success in placing in national project competitions; student success in job placement and starting salaries; student success in passing the Graduate Record Examination; successful commercialization of community-based projects, and faculty and student feedback. Please see the CAMP History (RR168) and the 2002 CAMP report to the Board of Regents (RR16) for additional assessment information.

Historically, the majority of CAMP projects have involved national student competitions. Over time, it is a CAMP goal to have more student teams working on more local engineering problems and to expand projects to include international humanitarian projects.

2nd item of evidence in support of Core Component C

Tech Ventures Inc.

Discussion of 2nd item of evidence

As described under Core Component A, Tech Ventures is a for-profit business entity owned in total by the SDSM&T Foundation. Tech Ventures demonstrates our responsiveness through its capacity for bringing together multiple constituencies under the leadership of the SDSM&T Foundation. The dimensions of expertise Tech Ventures offers include those of the creative author or inventor, the business manager, business service personnel, venture capitalists, and project managers. As limited liability corporations (LLC) are spun off from Tech Ventures, we will assess the success of the initiative by tracking the number of LLCs formed, the sustainability of the LLCs formed, and the SDSM&T Foundation’s return on investment. Success of this visionary venture will contribute greatly to the overall establishment of an entrepreneurial culture on the SDSM&T campus. As of mid 2005, two LLCs have been created and three patent applications are being pursued.

3rd item of evidence in support of Core Component C

The new Black Hills Business Development Center

Discussion of 3rd item of evidence

The Governor’s Office of Economic Development in concert with the Rapid City Economic Development Foundation has funded the creation of a business incubator building which will be named the Black Hills Business Development Center (RR141). SDSM&T has volunteered a site on the campus for location of the incubator and the foundation was excavated in June 2005.

The 30,000 to 40,000 square-foot space will undoubtedly facilitate the University’s economic development activities through collaboration with various community leaders. Collaboration currently exists with the West River Business Service Center, Western Research Alliance, SDSM&T, Black Hills State University, Black Hills Community Development, Black Hills Business Council and the Rapid City Economic Development Advocacy Committee (RR141). The construction funding sources are as follows: $750,000 EDA Grant, $450,000
HUD-EDI; $500,000 State of South Dakota, and $400,000 Rapid City Economic Development Foundation. The Rapid City Economic Development Foundation will assume all costs of building ownership, maintenance and operation. They will also be responsible for the day-to-day functions of the center and will provide oversight of the startup and expanding businesses that will locate in the facility.

Our economic development constituents will be served by the presence of this incubator facility on the campus since the facility will house many of the local entities that provide business development services to the community. Laboratory and office space will be made available at a reasonable rate to new businesses being incubated. Additionally, some of the traditional indirect overhead office activities will be shared from a central pool in the incubator.

Prior to 2003, the Rapid City Area Economic Development partnership was looking at off-campus locations for the facility. In 2003, our university president intervened and convinced the Black Hills Business Development Center (BHBDC) to locate the business incubator on the SDSM&T campus (RR141). This successful intervention demonstrates a new responsiveness on the part of SDSM&T as well as the value our constituents place on our involvement.

A part of the incubator function will be to provide entrepreneurial training for all individuals using the incubator service. The risk of starting a new business enterprise will be mitigated by better training and coaching for the entrepreneur. The presence of a business incubator will contribute greatly to the creation of a culture of entrepreneurship on the SDSM&T campus and within the local community.

The efficacy of the business incubator will be determined in terms of clients served, sustainable businesses started, occupancy, and jobs created. Discussions on campus have focused on the fact that the business incubator will be successful to the extent that it affords our constituents coordinated access to all of the support for business creation and planning available within our state, i.e. Small Business Development Center, Small Business Innovation Research, Readi-Fund, Rapid Fund, the Governor’s Office of Economic Development, West River Foundation, and the Genesis of Innovation/Equity.

**Core Component 5d. (for economic development): Internal and External Constituencies value the services the organization provides.**

**Evalutative statement for Component 5d**

*We cite strong evidence that the institution is valued for its role in collaborating with other entities in furthering economic development. The nature of the evidence is the significant monetary resources provided to the university in exchange for the service the university provides in conducting research and development leading to tangible results. The evidence shows a successful record of acquiring instrumentation and infrastructure for research and economic development-oriented projects; it also shows that we have established a number of partnerships with other entities in order to improve our ability to engage in meaningful economic development activities.*
Evidence cited:

1. The Advanced Materials Processing and Joining Laboratory (AMP-J) and the Additive Manufacturing Laboratory (AML)
2. The Small Business Innovation Research (SBIR) and the Small Business Technology Transfer (STTR) programs
3. Acquisition of Zyvex nanotechnology testing equipment and exclusive license

1st item of evidence in support of Core Component D

The Advanced Materials Processing and Joining Laboratory (AMP-J) and the Additive Manufacturing Laboratory (AML)

Discussion of 1st item of evidence

In 2001, the Advanced Materials Processing Center was established with a grant from the Army Research Laboratory and in 2004 was reorganized into the Advanced Materials Processing and Joining Laboratory (AMP-J) and the Additive Manufacture Laboratory (AML) (RR140). Under this grant, the latest in the state-of-the-art in friction stir welding was designed and procured by SDSM&T. AMP-J has an extensive government base of support and serves more than a dozen governmental and private research organizations with its unique research capabilities. During the past four years, the center has secured nearly $10 million (RR139) for research conducted at the regional, national, and international levels. Internationally, AMP-J is working with German and Japanese companies (RR139). Over the past three years, the center has supported over 40 graduate and undergraduate students and six faculty members in their research activities. In addition, the center has served 19 national and international industrial partners, 6 university partners and 6 governmental partners in carrying out research activities on their behalf (RR139). A major achievement during the first three years has been the establishment of the region’s first National Science Foundation Industry/University Cooperative Research for Friction Stir Processing. The center has an advisory board that oversees its research activities.

In spring 2004, the Additive Manufacturing Laboratory (AML) was established to perform applied research in the area of Direct Write and Laser Powder Deposition (LPD). The Direct Write Laboratory was established in the Tech Development Lab in summer 2004, and the AML became a unique organization focused on additive manufacturing techniques covering six orders of magnitude from microns to meters. The AML has directly supported over 20 graduate and undergraduate students and three faculty members and performs collaborative work with nine different departments on the SDSM&T campus. Current funding secured by the AML amounts to over $6 million in research equipment and project funds. Locally, the AML participates with RPM Associates of Rapid City on LPD developments and established a Direct Write program with the South Dakota Heart Research Foundation. Regionally the AML is working with TORO (Minneapolis, MN) on a cladding** project that could prevent work from going off shore. Nationally, the AML is a partner in a $3.5 million, 3-year program sponsored by the U.S. Department of Energy and performs research for the Army Research Laboratory and the Air Force Research Laboratory, along with a number of businesses with interests in additive manufacturing.

NOTE: ** cladding: an old jewelry art, now employed on an industrial scale to add the desirable surface properties of an expensive metal to a low-cost or strong base metal
2nd item of evidence in support of Core Component D

The Small Business Innovation Research and the Small Business Technology Transfer programs.

Discussion of 2nd item of evidence

The Small Business Innovation Research (SBIR) and the Small Business Technology Transfer (STTR) programs were created by Congress in 1982. In 2004, a total of over $2.5 billion dollars were made available by 12 federal funding agencies for SBIR and STTR programs. This amounts to 2.5% of each agency’s external research budget.

Recently, several companies in this area which involve SDSM&T faculty and graduates have been successful in obtaining funding from SBIR/STTR proposals, including Hydro Tech; Realtronic; Cynetics; Rapid Medical Systems; Edgecom; Lloyd’s, Inc.; Memsense; CHT Engineered Systems; Dakota Alpha; ReSpec; and others (RR155 and RR156). Thus far five SDSM&T faculty and staff members have been involved in successful SBIR grant projects. Beginning in the fall of 2004, we have a SBIR representative on campus to help organizations and individuals prepare and submit proposals for SBIR funding. This program stimulates practical research leading to commercialization of processes. The success of this program can be partially judged based on the number of proposals and awards produced by the faculty of this campus.

3rd item of evidence in support of Core Component D

Acquisition of Zyvex nanotechnology testing equipment and exclusive license

Discussion of 3rd item of evidence

In March 2005, SDSM&T formalized an agreement with the Zyvex Corporation of Richardson, Texas that designates our institution as Zyvex’s exclusive provider of integrated circuit failure analysis services to the semiconductor industry. The $250,000 purchase of Zyvex testing equipment was made possible by a grant from the Governor’s 2010 initiative, described under Core Component B, and a loan from the Rapid Fund, a local economic development revolving loan fund. The exclusive license as well as the grant and loan are indicative of the value our constituents place on the institution and its ability to participate in economic development by providing high-tech services to the private sector with the equipment procured (RR228).

Questions that arose from the self study relative to Economic Development

1. As described above in the concluding section on Educational Development, the question “who, precisely, are our constituencies?” arose very early in the self-study process and was answered via a whitepaper.
Actions taken relative to Economic Development

1. As noted throughout this chapter, the self-study was conducted within a framework of strategic planning and strategic actions. Particularly within this section on economic development, it is true to say that many of the specific examples of evidence cited are actions taken as a direct result of this strategic planning process. We are very much involved in the process of creating our future as a key player in economic development in Western South Dakota.

Recommendations relative to Economic Development

1. Continue the campus discussion of identifying our constituencies in economic development in order to develop a strong and common understanding of who we serve.

2. Form the Research and Intellectual Property Council, referred to in Core Component A, for the purpose of continually improving the policies and procedures that will encourage and facilitate the creation of intellectual property with the potential for economic development.
Chapter 9: Criterion Five, Engagement and Service

As called for by its mission, the organization identifies its constituencies and serves them in ways both value.

Our Constituents as defined by our mission

SDSM&T, in concert with Black Hills State University (BHSU), National American University (NAU), Western Dakota Tech (WDT), and Oglala Lakota College (OLC) serves the full range of constituents who turn to higher educational institutions for educational, economic, and cultural development and support. Creation of the Higher Education Center – West River comprised of SDSM&T, BHSU, South Dakota State University, University of South Dakota and Dakota State University makes clear our intent to serve the Black Hills region by collaborating with other institutions.

SDSM&T, Black Hills State University (BHSU), National American University (NAU), Western Dakota Tech (WDT), and Oglala Lakota College (OLC) each excel at serving specific constituents. BHSU, for instance, is known for its high quality teacher-education program. BHSU serves the teacher training and staffing needs of the region. NAU provides associate and baccalaureate programs in the business and health care fields. SDSM&T is known as a center of research and development and is becoming a force in economic development. SDSM&T also serves select aspects of the tourism industry, for instance, through its special paleontology collections and museum. WDT serves those in the region who seek a post-secondary education combined with preparation for employment in the trades. OLC is a tribally controlled institution that offers bachelors and masters degrees.

A focus on science and engineering enables SDSM&T to cover distinct regional needs in the areas of education development and economic development.

In other areas that might normally be considered within the realm of a university, we may choose to exclude ourselves, unless specifically tied to one of these two focus areas. Only in special instances, for example, would we serve general interest community service organizations, (e.g. service clubs, community fund drives, entertainment venues) or underserved individuals or the groups supporting them, who are concerned with basic life needs of food, shelter and clothing. Nor do we generally fill the training needs of small businesses, tourism, and service industries. However, we can’t eliminate any particular entity in the area of outreach and service because extraordinary circumstances sometimes arise, as happened during the forest fires in the summer of 2002. In that instance, we opened the dorms and food service to house and feed people displaced by the fires. Additionally, individual students and faculty contribute through engagement and service apart from campus focused activities.

In our self study and strategic planning process, we considered our activities within these two areas of educational development and economic development as the foci of our outreach and service to constituencies external to the university. We formed working groups to help us study, coordinate and plan our outreach activities in each of these areas. Each working group gathered and analyzed data on and conducted a Strengths, Weaknesses, Opportunities, and...
Organization of this chapter

This chapter addresses each of the Core Components twice, once from the perspective of our educational development constituents, and a second time as relates to our economic development constituents.

EDUCATIONAL DEVELOPMENT

Engaging and serving our educational development constituents

Although the SDSM&T serves its constituents in numerous ways that universities traditionally serve their constituents, our focus is to provide educational development through activities and programs related to the advancement of engineering and science to:
  - K – 12 teachers and their students involved in teaching and learning math and science
  - Math and science teachers and students at junior, community and tribal colleges
  - Prospective students, applicants and their families

SDSM&T serves specific “secondary” constituents in this area. They are deemed “secondary” only because of the occasional or seasonal nature of these demands and include the following:
  - Organizations delivering educational programs or professional conferences through the conferencing and outreach function of the University
  - Engineers and scientists desiring continuing education at the professional level
  - Individuals served by our courses who are pursuing academic programs in fields other than mathematics, engineering and science
  - Individuals desiring to broaden their science and engineering educational backgrounds

Connecting our mission with these constituent groups

Our mission is “to provide a well-rounded education that prepares students for leadership roles in engineering and science.” The educational community is specifically mentioned in our commitment “to benefit the state, region, and nation through collaborative efforts in education and economic development.”

SWOT analysis of our performance in the area of educational development

The Educational Development working group for the self-study under Criterion 5 conducted a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis in fall 2004 and noted the following:

Strengths: SDSM&T is in close proximity to the second largest and most diverse school district in South Dakota. We have an excellent, nationally recognized faculty. Excitement
about science and technology is building among K-6 students. We have a small, intimate campus.

**Weaknesses:** Faculty and staff are overburdened at SDSM&T and in the K–14 system. SDSM&T does not market itself well; there is a lack of media exposure and community awareness. Our outreach is not focused and lacks coordination and funding. Students and faculty are involved in outreach, but it isn’t a campus focus.

**Opportunities:** External funding is available for math/science K–14 projects. We have the opportunity to team with K–12 personnel to present at regional conferences, such as the Technology in Education conference, which brings together educators, administrators, and technology experts. Given all our planning activities, we could identify three to four things we do well and then support and market the identified activities. SDSM&T has an opportunity to provide leadership in K–14 Mathematics and Science education.

**Threats:** The number of students graduating from high school in the next 12 years in our state and region will decline. Additionally there is inadequate funding at both the K–14 and university levels. Faculty and staff are overworked. The leadership on campus or at the state level can change quickly, with negative consequences.

**Overview of our activities in educational service and engagement:**

Constituents are attracted to campus by numerous educational programs and activities. Below is a listing of our major activities. Greater detail is presented on most of these in the discussion of the core components, as indicated below.

**Core Component A**
- Bridges to Success program
- Research Experiences for Undergraduates (REU)
- Scientific Knowledge for Indian Learning and Leadership (SKILL)
- Space Grant Consortium
- West River Math Contest

**Core Component B**
- Cultural Expo
- Engineers Week (E-Week) Girls
- Kids Block Contest
- Star of the West Speakers Series

**Core Component C**
- Advanced Placement (AP) Institutes
- Black Hills Science Teaching project (BLAHST) teacher-training workshops
- Technology for Teaching and Learning program (TTL)

**Core Component D**
- Engineers Week
- High Plains Regional Science Fair
- Museum of Geology
- Youth Engineering Adventure (YEA)
The following activities are not further discussed below but should be noted:

- Athletic staff members conduct camps and clinics for K-12 coaches and athletes. Student athletes also give presentations at service clubs.
- Articulation Agreements with Oglala Lakota College and Sinte Gleska University are being reviewed, updated and extended.
- Center of Excellence for Advanced Manufacturing and Production (CAMP) sponsored a year long collaboration with Dakota Middle School (**RR15**, **RR16**, **RR168**, and **RR169**).
- National Science Foundation Keystone Species Project determines post-fire succession influence on cavity user communities in the Black Hills of South Dakota. The study addresses the potential keystone function of different woodpecker species in various post-fire successional pine forests in the Black Hills.
- SKILL National Aeronautics and Space Administration (NASA) Honors Program aimed to increase the secondary school retention and college entrance rate of American Indian students. The four-week residential summer experience included skill building and research in science and mathematics.

Core Component 5a. (for educational development): The organization learns from the constituencies it serves and analyzes its capacity to serve their needs and expectations.

Evaluative statement for all of Component 5a

SDSM&T has a strong record of interaction with K-14 math and science teachers, but our efforts to learn from them about how to serve their needs have not been systematic. In a small community such as this, we have relied primarily on contact with SDSM&T-sponsored events and the personal involvement of many faculty and staff with the K-14 community. Formal assessments, such as surveys of participants and a means of tracking the academic history of student participants would help. Creation of a K-14 advisory board or a formal network of K-14 teachers, counselors and administrators would also be desirable. Our efforts to learn from and serve the Native American population have been more systematic and well organized.

Evidence cited:

1. Programs designed specifically for Native Americans interested in math, science, and engineering
2. Programs designed to boost high school graduation among Native American students
3. Programs designed to provide Native American students with support in completing their undergraduate degrees at SDSM&T
4. Programs designed to encourage interest in science and engineering

1st item of evidence in support of Core Component A

Programs designed specifically for Native Americans interested in math, science, and engineering
Evaluative statement for 1st example of evidence

Since 1989, SDSM&T has established a fairly good record of encouraging Native American participation in its academic life in the areas of science and engineering.

Discussion of 1st example of evidence

The Native American population, which is by far the largest minority population in the state, as well as the indigenous people, forms an important constituency. In South Dakota, American Indians represented 8.3% of the population according to the 2000 census data. Native Americans are typically underrepresented in science, technology, engineering, and math (STEM) areas. In spring 2003, there were only 315 American Indian graduates nationwide who were awarded B.S. degrees in engineering. We have made efforts to reach out to Native American communities in K-14, attempted to bring to campus more of those Native American students who have a passion and aptitude for science and engineering and once here, helped them succeed. Below is a brief history of our efforts since the late 1980s:

1989: The American Indian Science and Engineering Society (AISES) established at SDSM&T. The program started with 8 Native American students, and two years later had 32.

1990-2001: K-14 programming (summer-residential and after-school programs) created through the Scientific Knowledge for Indian Learning and Leadership (SKILL) program. Dramatic improvement in Native American retention at the secondary level; the high school graduation rate of participants was 100% compared to 47% for non-participants. Since 2001, SDSM&T has hosted the summer residential program which is operated by Oglala Lakota College and the Oceti Sakowin Education Consortium.

1991: The Minority Study Center established to promote and preserve American Indian culture on campus and to provide space for students to study and learn.

2001: The State assumes funding for the Director of Multicultural Affairs and operating costs. The Minority Affairs Advisory Committee and the Minority Student Program Policy established to study a renewed approach to Native American issues.

Spring 2003: SDSM&T graduated the largest number of Native Americans with a B.S. in engineering from a single institution, but these number only 7 out of 315 nationwide who have earned a B.S. in engineering.

Fall 2003: SDSM&T has a record number of first-time American Indian students (22) and the highest enrollment ever of American Indian students (total of 65 or 2.6% of the student population).

2004: Multicultural Activities office established.

2004: In fall semester, 70 Native American students were enrolled, whereas 44 Native American students were enrolled in fall 1998.

2004-present: The Multicultural Committee (MCC) begins reporting directly to the SDSM&T president and is charged to “achieve and maintain national prominence for the recruitment, retention and graduation of American Indians seeking mathematics, science, and
engineering at the graduate and undergraduate levels while respecting their ethnic heritage.”

2005: In spring 2005, Timothy “Bull” Bennett is the first SDSM&T American Indian Ph.D. recipient.

2005: In fall 2005, a newly hired full-time Director of Multicultural Affairs begins to work with the MCC to review and strengthen campus initiatives.

Since 1990, aggressive K-14 programming has been conducted through the Scientific Knowledge for Indian Learning and Leadership (SKILL) program, through summer residential programs (1991-2001), and through after school programs. The SKILL residential program offered reservation children exposure to a non-reservation environment and was a huge success for retention of students at the secondary level. High school graduation rate of participants was 100% compared to 47% for non-participants.

The South Dakota Space Grant Consortium (SDSGC), established by NASA, has played and continues to play a major role in connecting with the K-14 community. SDSGC and SDSM&T have tribal college affiliations with several schools in the state. Another NASA affiliated activity is American Indian Space Days--a joint effort by SDSM&T, tribal colleges, and elementary, middle and secondary tribal schools, which was held in collaboration with the 2005 Black Hills Pow Wow (RR133).

SDSM&T has been selected for two National Science Foundation sponsored sites for Research Experiences for Undergraduates (REU). The REU program supports active research participation by undergraduate students in any of the areas of research funded by the National Science Foundation. REU projects involve students in meaningful ways in ongoing research programs or in research projects specially designed for the purpose. Typically these programs are ten week summer programs involving local students and those from other institutions. The Materials, Mechanics, and Manufacturing REU site, first offered in summer 2005, had as one of its three objectives “to increase minority student exposure to cutting-edge research.” One of the targeted populations for this REU is students at Oglala Lakota College, and it is expected that many participants will be first-generation Native American college students (RR173).

2nd item of evidence in support of Core Component A

Programs designed to boost high school graduation among Native American students

Discussion of 2nd example of evidence

Scientific Knowledge for Indian Learning and Leadership (SKILL) was a summer residential program (1991-2001) which offered reservation students exposure to a non-reservation environment, and was run in collaboration with Oglala Lakota College (OLC). This pre-college program had a mission of improving the college-readiness of American Indian Students in math and science. SKILL provides a wide range of activities for elementary through high school students, including research opportunities, tutorial assistance and academic summer programs. High school graduation rate of participants was 100% compared to 47% for non-participants.
In 1994 the SKILL program at SDSM&T commissioned Lakota artist Don Montileaux to paint a work entitled Looking Beyond One’s Self. This print depicts three American Indians looking beyond the immediate horizon and toward a vision for the future. It symbolizes SKILL's desire for young American Indians to reach beyond themselves...toward the stars and their visions. The original painting flew on board the March 1995 STS-67 NASA mission of the space shuttle Endeavor. On December 2, 1996 print number 2/400 was presented to President William Clinton on behalf of the SKILL Program at SDSM&T.

3rd item of evidence in support of Core Component A

Programs designed to provide Native American students with support in completing their undergraduate degrees at SDSM&T

Discussion of 3rd example of evidence

Office of Multicultural Affairs: The Mission Statement of the Office of Multicultural Affairs commits SDSM&T to “achiev[ing] and maintain[ing] national prominence for the recruitment, retention and graduation of American Indians seeking mathematics, science, and engineering at the graduate and undergraduate levels while respecting their ethnic heritage. An appreciation of the culture and the contributions of American Indians will be promoted wherever possible such as the classroom and extra-curricular experiences.”

A Minority Study Center was established in 1991 to promote and preserve American Indian culture on campus and to provide space for students to study and learn. The grant funded SKILL Director position was reorganized and state funding was allocated for the Director of Multicultural Affairs in the summer of 2001. State funding also provides for a support staff person and operating expenses. The Minority Affairs Advisory Committee was re-chartered in 2004 and the Minority Student Program Policy, established in 1991, was reviewed. Our newly remodeled Surbeck Student Center opened a new Office for Multicultural Affairs next to the Ivanhoe International Center in fall 2004.

The Office of Multicultural Affairs has the following listed among its services:

- Provide supplemental tutoring, and workshops for time management, test taking, study skills, communications and stress management
- Administer scholarship programs and identify other sources of financial assistance for students
- Provide assistance for students in coop/internship placements and full-time employment
- Provide a student study lounge where students can interact
- Serve as the advisor to the American Indian Science and Engineering Society (AISES)

Bridges to Success Program: This joint program between SDSM&T and Oglala Lakota College (OLC) is funded by the National Science Foundation regionally through a grant from Salish Kootenai College, the National Science Foundation, and the All Nations Louis Stokes Alliance for Minority Participation (ANLSAMP) Program. The “Bridges” program provides an undergraduate research opportunity with SDSM&T faculty for primarily American Indian students who are mid-way through their science, technology, engineering or mathematics (STEM) college curriculum. The research experience, in conjunction with a series of professional development workshops, helps to give students practical experience in their chosen major as well as needed financial support. Most of the students are either STEM
students at OLC with a desire to pursue a degree at SDSM&T, or are enrolled SDSM&T students. The purpose of the program is not only to increase enrollment and retention of American Indian students but also to increase the number graduating with four-year degrees in STEM areas. The program just received its third consecutive year of funding and has supported 44 students thus far.

4th item of evidence in support of Core Component A

Programs designed to encourage interest in science and engineering

Discussion of 4th example of evidence

The West River Math Contest provides an opportunity for 8th-12th grade students from the surrounding region to engage in an academic competition, by taking tests in various subject areas, including algebra and geometry. This event, in place since 1950, currently attracts between four and five hundred students annually, representing 20-25 schools. Each year, during the contest, SDSM&T faculty meet with the teachers who have accompanied the contestants. At these informal meetings, valuable information is shared, not just about the contest, but also about common interests and concerns in mathematics education. As a direct result of these discussions, in 1999 the contest moved from Saturday to a weekday, in order to allow more students to attend. The number of participants increased fifty percent that year. The math teachers who attend are very supportive of the event, and are grateful that their students can be recognized for academic accomplishments.

The High Plains Regional Science and Engineering Fair (also cited in Core Component 5d) encourages middle school and high school students to apply the scientific method to explore questions and come up with answers to virtually any aspect of science, technology, engineering, and mathematics. Science fair participants are expected to follow the rules and regulations of ethical and moral investigation that have been outlined by the Intel ISEF (International Science and Engineering Fair) Scientific Review Committee. The High Plains Regional Science and Engineering Fair has its own Scientific Review Committee although SDSM&T faculty and staff volunteer to serve as judges for this annual on-campus event.

Core Component 5b. (for educational development): The organization has the capacity and the commitment to engage with its identified constituencies and communities.

Evaluative statement for all of Component 5b

We are becoming increasingly successful at attracting a large number of return participants from schools across the state for campus-hosted events. In 2003, with encouragement and financial support of the Board of Regents, we began the renovation process to turn our student center into an attractive modern conference center. To ensure the successful utilization of the facility, we created, in 2003, two new, full-time positions: “Director, Educational Programs and Professional Conferences” and an “Information Specialist” to assist in the promotion of campus events. Our new marketing initiative is comprehensive in terms of staffing and its goals, and it is designed to build the prospect pool for both students and utilization groups. We are doing well in this area and are working hard to do even better.
Evidence cited:

1. Renovations of Surbeck Student Center and construction of an adjacent residence hall
2. Star of the West speaker series
3. Events designed to interest youth in science, math, engineering, and the international atmosphere of SDSM&T

1st item of evidence in support of Core Component B

Renovations of Surbeck Center, our student union and construction of an adjacent residence hall

Discussion of 1st example of evidence

SDSM&T has made significant improvements to its conference and meeting facilities. The campus central chiller project has increased our capacity to fully utilize spaces during the summer months. Additionally, Surbeck Center has added meeting room space and refurbished existing space to provide better atmosphere and state of the art presentation equipment. Meeting rooms in Surbeck Center will accommodate groups ranging from 10 – 400; several lecture halls on campus continue to be used by off-campus groups on weekends and during the summer months. Summer conferencing capabilities were expanded with the completion of Peterson Hall, an adjoining 297-bed residence hall with individual temperature-controlled rooms. We reorganized our scheduling, event services and conferencing services staff to provide more efficient handling of reservation requests for equipment, facilities, and food services. Summer 2005 was the first full summer of operation with the improved facilities; preliminary numbers indicate a substantial increase in utilization of meeting and lodging rooms by off-campus constituents. Several national conferences are scheduled to be held at SDSM&T during the next two summers.

2nd item of evidence in support of Core Component B

Star of the West speaker series

Discussion of 2nd example of evidence

The Star of the West Speaker Series is an annual event that provides a venue for leading experts in technical fields to make broad-overview presentations to a broad range of constituencies that include the general public, students in grades six and up, as well as faculty, staff, and our enrolled students.

The Star of the West Speakers Series was an outgrowth of the McGillycuddy Speaker Series. Both series were possible because of a generous donation from Ray Graham. Mr. Graham funded the series through an endowment in order to give students, faculty, staff, and the community access to experts at the national level who can challenge attendees to consider new ways of thinking about important issues.
Speakers have included the following:

- George McGovern, former U.S. Senator and presidential candidate
- Drs. Frank and Deborah Popper, Rutgers University and City University of New York’s College of Staten Island, developers of the Buffalo Commons concept
- Jodi Rave, reporter on Native issues for Lee Newspapers, a Midwest newspaper chain with a circulation of 1.1 million
- Dr. Donald R. Baer, a laboratory fellow at the William R. Wiley Environmental Molecular Sciences Laboratory, located at Pacific Northwest National Laboratory in Richland, Washington.
- James Von Ehr I, founder, chairman and chief executive officer of Zyvex Corporation, based in Richardson, Texas
- Dr. Davis Baird, a professor in the Department of Philosophy at the University of South Carolina
- Dr. Jeffrey Henderson, President and CEO, Black Hills Center for American Indian Health

3rd item of evidence in support of Core Component B

Events designed to interest youth in science, math, engineering, and the international atmosphere of SDSM&T

Discussion of 3rd example of evidence

Interest in science and engineering must be encouraged at an early age to ensure that students have the appropriate academic preparation to enter one of these fields when they reach college age. SDSM&T sponsors various activities to promote this interest and to expose students to the global culture at the University. Four examples of these efforts are the Cultural Expo, E-week GIRLS, the Children’s Science Center, and the Kid’s Block Contest.

Cultural Expo: Local and regional school children and community cultural groups are invited to join a celebration of our cultural and international diversity. The intent is to promote friendship and cultural exchange between people of different countries and cultures. Cultural displays, native foods and entertainment including dancing and singing are featured.

E-week GIRLS (Girls into Real Learning Succeed): This is a day outreach program that brings over 150 middle school and high school girls to campus each spring. Girls not only learn about science and engineering careers but they also participate in hands-on examples of those occupations.

The Children’s Science Center: The Children’s Science Center was operated by SDSM&T between 1998 and 2004 at a City of Rapid City facility. The Center provided interactive educational exhibits and education programs for children in the Black Hills area. Thousands of individuals were served each year in an effort to increase the science and technology literacy of area youth. Programming was also offered to families and teachers. Numerous corporate, educational, and private individuals served as a sponsors and partners for the range of programs offered at the Center. During the 2004-05 year the science exhibits were transitioned to the Rapid City YMCA.

Kids’ Block Contest: Children in first through sixth grades compete at engineering a specified building project, using their imaginations and interlocking building blocks.
Core Component 5c. (for educational development): The organization demonstrates its responsiveness to those constituencies that depend on it for service.

Evaluative statement for all of Component 5c

SDSM&T is well known by its K-14 constituents in the community and state as a respected university. We find we have two categories of constituents: 1) those with whom we have a collaborative history and who view us as highly approachable, and 2) those who are potential constituents but have not contacted us due to the perception that we are ivory tower, over their heads, and otherwise not approachable.

We have a strong and successful history of serving our Category 1 constituents (i.e., those K-14 teachers and students that have been involved with the various educational opportunities we offer). We have the community reputation as being “the” technical content experts in the fields of STEM areas (Science, Technology, Engineering, and Math). Thus, certain members of our K-14 constituents often request services in the form of teacher training opportunities, and SDSM&T does a good job of responding by providing the requested services.

However, there remains a significant potential for serving Category 2 constituents (i.e., constituents that are either undefined, not aware of our services or, as yet, have not contacted us due to the perception that we are unapproachable). There is need in the community for visiting scientists from SDSM&T to do outreach in K-14 classrooms and for on-campus workshops for the local community. Many K-14 teachers do not know that there are certain people on campus that conduct classroom outreach. Those teachers that do know about this service make numerous requests for classroom visitors and campus tours.

As an institution, SDSM&T needs to decide if we are truly going to make ourselves available to the full range of the K-14 community, and if so, must provide the necessary time and resources to individual faculty and staff members to do it. Those faculty and staff that are not interested in K-14 outreach services should not be expected to engage. By targeting the many campus employees who are enthusiastic and energetic about outreach, we could improve recruitment and offer greater educational value to our constituents. Such efforts must differentiate between services provided during the academic year and the summer.

Evidence cited:

1. Summer Technology for Teaching and Learning (TTL) program
2. Summer Advanced Placement (AP) Institutes
3. Black Hills Science Teaching Project to Prepare K-8 teachers for the New Millennium (BLAHST)

1st item of evidence in support of Core Component C

Summer Technology for Teaching and Learning (TTL) program
Discussion of 1st example of evidence

The Technology for Teaching and Learning (TTL) program was instituted by the State in response to a critical shortage of system administrators in the K-14 system. Training was difficult to acquire, particularly in the more rural school districts; however, the expertise was available at SDSM&T and has been offered through the TTL between 1999 and 2004. Approximately 460 teachers were trained. The program had generally high quality instruction but the success of the training was influenced by the background of the participants. Students who had some system administration experience prior to training were able to acquire advanced skills very quickly. Those people returned to their school districts and made significant contributions; others returned to repeat the program in order to achieve needed competencies. TTL training was recently moved to Mitchell Technical Institute in order to serve the eastern portion of the State; however, SDSM&T continues to assist with this program.

2nd item of evidence in support of Core Component C

Summer AP Institutes

Discussion of 2nd example of evidence

SDSM&T has offered 13 Advanced Placement (AP) Institutes for 175 high school teachers since 1998. These five-day intensive sessions, led by an AP consultant trained by The College Board and assisted by an SDSM&T faculty member, are designed to help prepare high school teachers to teach advanced placement courses in their schools. SDSM&T has held AP Institutes in English Composition and Language, English Composition and Literature, English Vertical Teams, Calculus, Math Vertical Teams, and Environmental Science. Evaluations by participants have indicated a high degree of satisfaction with the instruction.

In addition to the AP Institutes funded by SDSM&T, we have led Math Vertical Team projects with the Rapid City School District and the Todd County School District on the Rosebud Reservation, funded through an Eisenhower Grant and a No Child Left Behind Grant. In summer 2003, 20 teachers participated in the Institute and in professional development throughout the academic year, with the goal of increasing the readiness and calculus proficiency required by many STEM higher education institutions. The project found that math teachers were very interested in developing and incorporating technology in their classrooms and that it was imperative to align math curriculums at the K-14 level, as well as provide instruction that highlights applied math. The grant project was funded for one year. As a result, the Rapid City School District has a math vertical team comprising middle and high school math teachers that continues to work to align the math curriculum so that students are prepared for AP level work when they become seniors.

A valuable outcome of this 2003 project was a better understanding of the differences and similarities of teaching strategies at a tribal school district and a large urban public school. In summer 2004, our Director of Multicultural Affairs received funding from the No Child Left Behind State Grant Project to continue the project with Rapid City area schools. Twelve teachers participated with the goal of continued training in AP Calculus and vertical alignment of the math curriculum (RR161, RR162, and RR166).
The AP Institutes offered thus far and the number of participants are as follows:
1998 – English Literature and Composition –14
1999 – English Literature and Composition –23
2000 – English Vertical Teams –12; Math Vertical Teams –7; Environmental Science –3
2001 – Calculus –11; Math Vertical Teams –14
2002 – Math Vertical Teams, Rosebud –15; Math Vertical Teams, Rapid City –11
2003 – Calculus, Rapid City –11
2004 – English Language and Composition –15

3rd item of evidence in support of Core Component C

Black Hills Science Teaching Project to Prepare K-8 teachers for the New Millennium (BLAHST) [http://www.camse.org/blahst/index.htm](http://www.camse.org/blahst/index.htm)

Discussion of 3rd example of evidence

The goal of this project is to help teachers in 10 school districts improve their capability in teaching science and, thereby, to increase scientific literacy among students and the general public. The project is based at the Center for the Advancement of Math and Science Education (CAMSE), Black Hills State University, Spearfish, South Dakota, and is in its 5th year of a six year term. It serves 430 K-8 teachers and approximately 10,000 students. Under subcontract, SDSM&T provides university faculty consultants to educate the teachers in science content in the areas of geology, paleontology, ecology, and physics. This professional development is achieved though multi-day workshops during the academic year and summers. The Black Hills Science Teaching Project has provided 43,000 hours of professional development in the form of workshops, in-services, on-line classes, etc. since its inception in 1999. The objective of having all K-8 teachers reach 100 hours of professional development has been met or exceeded in the case of over half of the teachers. Workshops are consistently rated high by the teachers who find the workshops to be of benefit in content, pedagogy, and interactions with peers from other districts. External assessments of the project are conducted to judge program success (RR167).

Core Component 5d. (for educational development): Internal and External Constituencies value the services the organization provides.

Evaluative statement for all of Component 5d

Our K–14 constituencies clearly value the educational opportunities we provide. Value is demonstrated by constituent groups returning year after year. With the exception of the YEA (Youth Engineering Adventure) program, assessment is primarily anecdotal for K–14 student involvements and, therefore, formalized assessment needs to be incorporated into more of the programs. Since many outreach programs have already been described above, only four programs of particularly long standing are offered as evidence below.

Evidence cited:

1. High Plains Regional Science Fair
2. Engineers Week
3. Youth Engineering Adventure
4. Museum of Geology

1st item of evidence in support of Core Component D

High Plains Regional Science Fair

Discussion of 1st example of evidence

The High Plains Regional Science Fair yearly attracts hundreds of participants ranging from grades 6 through 12 and has been doing so for 50 years. Interview teams of judges comprised of faculty, students and area science professionals instill in participants positive attitudes towards what they have been able to accomplish, a better understanding of science and/or engineering, and innovative ideas to advance their work. Feedback and suggestions are solicited from campus and community participants; overwhelmingly, responses to this annual event are positive.

The Science Fair Committee has been disappointed that more high school students have not been participating in recent years; most participants are elementary and middle school students. It has been determined that in large part the reason for this lack of participation is the paper work that must be completed by students and teachers who are carrying a heavy work load. This paper work and documentation assures compliance with International Science and Engineering Fair (ISEF) rules governing, among other things, the acceptable use of vertebrate animals, human subjects, and hazardous substances or devices. Further information can be found at http://www.sciserv.org/isef/primer/rules_regulations.asp.

To address this issue the committee has identified parents and plans to approach student organizations for volunteers willing to help high school teachers and students. These volunteers will spend time at the high schools assisting students and teachers plan and prepare projects and document adherence to ISEF rules.

2nd item of evidence in support of Core Component D

Engineers Week

Discussion of 2nd example of evidence

Engineers Week was founded in the United States in 1951 by the National Society of Professional Engineers. SDSM&T initiated its first Engineers Week in 1978. The program is dedicated to raising public awareness of engineers’ positive contributions to the quality of life. At the public-school level the event is intended to show students that science, math and engineering are fun and exciting professions. Each year, over 1200 K -12 students participate in the week of events that includes the Kid’s Block Contest, MathCounts, Hot Chemistry – Cool Show, and the Computer Programming Contest. Representative comments from teachers and participants include:

- “Thank you for having our students on last Friday. The students really enjoyed seeing the different exhibits and the chemistry show. The students really liked the marksmanship and the hot air popcorn demonstration as well as the satellite pictures on the computers. There were some demonstrations that seemed unprepared for example, some in the
civil/mechanical building. Overall, the students and faculty enjoyed the experience. I definitely would like to come back next year.”

- “We had two great days. Thank you. My students were there for the chemistry show, the tours and for E-Week Girls. Chemistry Show--The chemistry show should continue showing the ‘magic’ first, and then a second display with the explanation. It was also informative and fun when the ‘magicians’ asked questions while explaining the chemistry.”
- “Tours--Keeping the group of 35 students together worked well. Also during lunch my students picked the areas they wanted to go to. . . . The students like the hands on activities.”
- “E-Week Girls--The hands on activities were a hit.”
- "This was the best school day I've ever had." "We got to eat popcorn." "I liked the chocolate kisses." "Can we have the space camp person come to Dakota [Middle School]?”

3rd item of evidence in support of Core Component D

Youth Engineering Adventure

Discussion of 3rd example of evidence

An example of a newer program, founded in 2001, is Youth Engineering Adventure (YEA), a one-week, on-campus program designed for high school students interested in math and science. Participants have an opportunity to learn about career opportunities through a variety of hands-on projects associated with many of the engineering departments. They also tour engineering firms in the Rapid City area. Total participation for the five completed years is 141. Of the 141 past attendees, 92 have graduated from high school and 24 are currently attending the SDSM&T. Several of the students have indicated that they would not be at the School of Mines had it not been for YEA. YEA has proven to be a very worthwhile program and promises to become another yearly SDSM&T tradition. Assessment to improve program effectiveness is done each year. Ninety-eight percent of the participants report a better understanding of what engineering is all about after attending YEA.

4th item of evidence in support of Core Component D

Museum of Geology

Discussion of 4th example of evidence

The Museum of Geology is part of SDSM&T and is charged by the State statutes to collect, conserve, and interpret the minerals, rocks, fossils and geology of South Dakota. The museum conserves a collection of approximately 250,000 geological artifacts consisting of minerals, rocks, and invertebrate and vertebrate fossils. These collections form the basis of scientific research by staff and undergraduate and graduate students in our paleontology programs and for qualified visiting scientists. The Museum exhibit hall features approximately 2300 specimens housed in a world-class mineral exhibit, a rock exhibit, and invertebrate and vertebrate fossil exhibits featuring swimming Cretaceous reptiles and Cretaceous dinosaurs, a collection of reptiles and mammals from the Big Badlands, and Pleistocene mammals. The Museum hosts 30,000 visitors per year, including approximately
4,000 school children. Research efforts of the Museum includes numerous federal contracts, studies by 15 master’s students and 20 undergraduates, and a professional staff of three.

**Questions that arose from the self study relative to Educational Development**

1. The question “who, precisely, are our constituencies?” arose very early in the self-study process. Time was taken by the working group to answer the question in the form of a whitepaper. Input was sought from across campus, via emails and focus groups, and the final version was reviewed and approved by the President, Executive Council, and University Cabinet. The content of the white paper has been incorporated into the introductory sections of this chapter that introduce the topics of educational and economic development.

2. While this question was technically “answered” in the course of self-study, much work remains in communicating this definition to campus and processing the implications of the definition.

3. What should be the scope of our participation with regional K-14 constituencies? And are we devoting the resources necessary to be full partners in selected activities? Limited resources dictate that we cannot be all things to all people. The scope of our involvement with engagement and service continues to be a topic of considerable discussion.

**Actions taken relative to Educational Development**

1. We defined our constituencies and shared this definition with the campus community and the Executive Council for reaction and input. The definition was subsequently amended based on the input received.

3. We clearly stated that the primary focus and concentration of our involvement with engagement and service would be in the areas of educational development and economic development.

4. We further clarified our role as a provider of higher education in conjunction and collaboration with other educational providers in the region. We therefore have more precisely and narrowly defined our areas of concentration for fulfilling our service and engagement responsibilities.

**Recommendations relative to Educational Development**

1. Establish or clearly assign administrative responsibility for K-14 outreach efforts.

2. Establish a formalized system to seek external input on our engagement and service efforts. Analyze the input and utilize the input for the improvement of the process.

3. Establish a K-14 advisory board or a formal network of K-14 teachers, counselors and administrators to ensure that we are meeting their needs.
4. Continue the conversation regarding the scope of our K-14 involvement. If we continue to serve a wide range of constituencies we must be willing to commit the resources, both staff and financial, in order to participate fully.

5. Improve our marketing efforts related to engagement and service in an attempt to become more visible to a broader range of constituencies.

ECONOMIC DEVELOPMENT

Engaging and serving our economic development constituents

In the area of economic development, SDSM&T embraces its responsibility to serve the following constituents:
- Entrepreneurial faculty, staff, students, and community members
- Manufacturing, and high tech service businesses
- Start-up businesses using technology developed at SDSM&T
- Venture Capitalists
- South Dakota State Government and City of Rapid City
- South Dakota Board of Regents
- Sponsors of economic development oriented research and development
- Western South Dakota economic development entities, e.g. Black Hills Vision, Rapid City Area Economic Development, and others
- SDSM&T alumni interested in participating in South Dakota economic development
- Tourism businesses that benefit from, or utilize, the scientific expertise of the University

Connecting our mission of with this constituent group

Our institutional mission includes a commitment “to benefit the state, region and nation through collaborative efforts in . . . economic development.” Furthermore, economic development is related to our mission “to advance the state of knowledge and application of this knowledge through research and scholarship.”

SWOT analysis of our performance in the area of economic development

In fall 2004, the Economic Development “Working Group” for the self-study under Criterion 5 conducted a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis. This group included regional leaders in economic development. A second SWOT was conducted by the University’s Academic Advisory Board. In both cases, the Criterion 5 co-chairs led a structured brain-storming exercise designed to produce a list in each of the four SWOT dimensions. A structured voting process was used to identify the most significant items in each category. The merged observations of the two groups are as follows:

Strengths: The programs: Small Business Innovation Research (SBIR), Tech Ventures and Small Business Technology Transfer Programs (STTR); the friction stir welder; groundbreaking on the new business incubator building.
**Weaknesses:** Pursuing economic development opportunities in multiple areas and the subsequent lack of focus on a few areas. We have projects with possible economic development ramifications in nanoscience and nanoengineering, friction stir welding, and in our new Ph.D. program in atmospheric and environmental science. If we attempt to do too much, through too many separate projects, we could fail.

**Opportunities:** The Vice President for Research has created an Intellectual Property Committee and has hired consultants and tasked committee members to create an Intellectual Property Policy that empowers our creative faculty, favors local business development, and creates specific practices to evaluate disclosures and respond to inventors in a timely way. Once in place, this policy in and of itself will spawn disclosures.

**Threats:** Our intellectual property and workload policies are set through a negotiation process that involves the Board of Regents, their university presidents and vice-presidents, and the Council on Higher Education (COHE), which is the bargaining unit for the faculty within the Board of Regents system. Around the time of conducting our SWOT analyses, the Board of Regents proposed new policies during the contract negotiation process with COHE that some faculty members identified as a threat to our focus on economic development. One proposed policy would have required those faculty members who do consulting to remit a percentage of their consulting income to the university; another proposed policy could have had the effect of reducing the salary of a faculty member who had a low teaching load due to the cancellation of a scheduled class because of low enrollments. Both of these policies were proposed and then withdrawn as part of the negotiation process. COHE and the Board of Regents negotiated a new policy on intellectual property, which is described in more detail in the section below on Core Component A.

**Overview of our activities in economic development service and engagement:**

We are involved in a variety of ways that serve our economic development constituencies. Below is a listing of our major activities. Greater detail is presented on most of these in the discussion of the core components, as indicated below.

**Core Component A**
- Intellectual Property policies were revised by our Board of Regents to provide more incentive for faculty members to pursue research with the potential for commercial profitability.
- Ph.D. program in Atmospheric and Environmental Sciences was established.
- Rapid City 2012 funding program provided funding for partnership initiatives.
- Tech Ventures LLC was established by the SDSM&T Foundation.

**Core Component B**
- The Center for Accelerated Applications at the Nanoscale (CAAN) was created.
- Homestake Deep Underground Science and Engineering Laboratory (H-DUSEL) was proposed for the now closed Homestake Mine in Lead, South Dakota.
- Military-sponsored research programs were designed to lead to economic development opportunities: These projects have enabled us to secure additional infrastructure in the form of the Tech Development Laboratory, an off-campus building devoted to these research programs.
- Ph.D. program in nanoscience and nanoengineering was created.
• Rapid City Area Economic Development Partnership is collaborating with us to locate a business incubator building on our campus.
• South Dakota’s 2010 Initiative has produced collaborations with the University.
• Tech Development Laboratory

Core Component C
• Black Hills Business Development Center
• Center of Excellence for Advanced Manufacturing and Production (CAMP)

Core Component D
• Advanced Materials Processing and Joining Laboratory for research on friction-stir welding and laser-additive manufacturing
• Small Business Innovation Research (SBIR) and the Small Business Technology Transfer (STTR) programs
• Zyvex nanotechnology testing service

The following activities are not further discussed below but should be noted:

• Black Hills Vision collaborates with us in promoting a technology corridor along the eastern edge of the Black Hills.
• Entrepreneurial Studies Minor: Created by our Board of Regents to provide educational opportunities available to all baccalaureate students in regents’ institutions for the purpose of preparing more college graduates to establish and operate small businesses.
• Senior design projects that involve local businesses and industries.

Core Component 5a. (for economic development): The organization learns from the constituencies it serves and analyzes its capacity to serve their needs and expectations.

Evaluative statement for Component 5a

We engage in direct contact with our constituencies in order to continually update our capacity to serve them. We have created mechanisms that give faculty members opportunities and incentives to pursue their entrepreneurial ideas. We have created new academic programs oriented toward practical research that will lead to economic development, and we are engaged with our city government to find mutually beneficial endeavors. We are committed to engage in this learning and analysis as called for in our mission. The evidence demonstrates that we are making significant progress toward doing this with respect to our economic development constituencies.

Evidence cited:

1. Revised Intellectual Property policies
2. Tech Ventures LLC
3. New Ph.D. programs
4. Rapid City 2012 Funding
1st item of evidence in support of Core Component A

Revised Intellectual Property policies

Discussion of 1st example of evidence

The institution’s policies on Intellectual Property (IP) are currently midway through a process of review and revision. The need for such revision became particularly apparent when the institution received research funding from the Army Research Laboratory and the Air Force Research Laboratory; a potential outcome of the funded research was the development of products that would be produced by the private sector. In working with these research sponsors, it became apparent that our IP policies needed to be expanded with more detailed procedures for moving ideas from the lab bench to the commercial sector. The Vice President for Research and the Research and Intellectual Property Council are working with leaders of the Offices of Technology Transfer from Georgia Tech and Virginia Tech to revise SDSM&T’s policies.

Additionally, entrepreneurial faculty had been saying for years that the IP policies in South Dakota were not as generous to authors and inventors as those policies are in other states. Our faculty bargaining unit, COHE, worked with the Board of Regents to negotiate a revised IP policy in January of 2004 (RR95). This policy superseded our former institutional policy last revised in 1991. The 2004 revisions to the regents’ IP policy expands the range of scholarly and artistic works for which ownership will be held by the individual who created them, and establishes a distribution-of-income schedule that is more generous to the individual who creates the work than allowed in the former policy. The new policy’s 50%/50% split of royalties between inventor and institution, having no sliding scale or cap on the return to the inventor, is within the top 5% of equitable IP profit sharing policies in the nation. In 2005, our Vice President for Research created an institutional Research and Intellectual Property Council. This council will review the latest regents’ policy and will develop a new institutional IP policy that will be a revision of current SDSM&T policies in light of the latest regents’ policy. The SDSM&T policy will conform to the regents’ policy and describe the detailed procedural steps for implementing the policy at our institution.

2nd item of evidence for Core Component A

Tech Ventures LLC

Discussion of 2nd example of evidence

In 2004, the institution obtained an enhancement for economic development activities when the SDSM&T Foundation formed Tech Ventures Inc., a for-profit corporation wholly owned by the SDSM&T Foundation. Its purpose is to support commercialization of research projects linked to SDSM&T faculty researchers. Tech Ventures assists in all aspects from start up, to seeking venture capital, to operating a new company. Through these partnerships, Tech Ventures will generate unrestricted revenues used to support the institution. Tech Ventures operates by assisting in the formation of separate limited liability corporations (LLC) for each economic development project and benefits by taking a small ownership share in each LLC. The first project of Tech Ventures was the formation of Control Systems Technology, formed to commercialize a system for the robotic processing of jewelry manufacturing invented by a professor of mechanical engineering at SDSM&T. The
university and the Foundation worked with the professor, the Army Research Laboratory, and the Boeing Corporation in obtaining an additional $400,000 grant to adapt the robotics process to the assembly of subcomponents for aircraft. A second LLC formed was SisMed, a firm for manufacturing specialty surgical instruments that was developed by a local alumnus of the institution. Tech Ventures is currently pursuing three patent applications for clients.

Tech Ventures provides a mechanism for the commercialization of ideas generated through research and development efforts on our campus. Our goal is to become a generator of new companies based on the constant flow of ideas that will be coming from our university. The evidence of what is being accomplished through Tech Ventures illustrates that we are working in cooperation with our constituencies to identify opportunities and to adapt to new opportunities.

3rd item of evidence for Core Component A

New Ph.D. programs

Discussion of 3rd item of evidence

In 2005 we proposed and were successful in establishing new and revised Ph.D. programs. Our Atmospheric, Environmental and Water Resources Ph.D. program was reestablished as a degree in atmospheric and environmental sciences (RR175). The revised curriculum emphasizes basic and applied research but has been tailored to foster work that supports South Dakota economic development in tourism, ecology, forestry, and agriculture. The program was specifically designed to promote research as a means to economic development and to address areas supported by funding agencies such as the National Aeronautic and Space Administration (NASA), the Environmental Protection Agency (EPA), the Department of Energy (DOE) and the National Science Foundation (NSF). Input from our constituencies of the State of South Dakota and the national governmental funding agencies was used in creating this revised academic program.

A new Ph.D. program in nanoscience and nanoengineering was also approved in 2005 (RR176), and the State funded the Center for Accelerated Applications at the Nanoscale (CAAN). The degree and the center will impact economic development and are described in detail in the section on Core Component B.

In December 2005, the Board of Regents approved an interdisciplinary M.S./Ph.D. Biomedical Engineering (BME) program that will be offered by SDSM&T in collaboration with the University of South Dakota (RR279 and RR317). The foci of the BME program will be 1) materials in bio and biomedical engineering, including nanoscience and nanoengineering; 2) computational biomechanics, including visualization; and 3) assistive technology, including sensor systems, neural systems, and controls.

4th item of evidence for Core Component A

Rapid City 2012 Funding
Discussion of 4th item of evidence

We are actively involved with the City of Rapid City as it prepares for the future of the city and region. In 2005, we submitted three proposals to the city 2012 committee that recommends funding for community projects from a special ½ cent sales tax. These have now been funded by the City Council. Two of the proposals will assist us in upgrading our track and stadium seating which will help us attract football and track events to our facilities. The third project involves the city building a connector street across an undeveloped section of our campus that will connect our main campus on Saint Joseph Street to Saint Patrick Street. The connector street is needed infrastructure for economic development because the new business incubator building, the Black Hills Business Development Center, is being built along the connector road on the edge of our current campus. The connector road will also provide an easier on-campus route to our Tech Development Laboratory located on Saint Patrick Street. The incubator building and the Tech Development Laboratory are described in more detail in the sections on core components D and B, respectively.

Core Component 5b. (for economic development) The organization has the capacity and the commitment to engage with its identified constituencies and communities.

Evaluative statement for Component 5b

Our activities provide strong evidence of our capacity and our commitment to engage with constituencies in pursuing opportunities for economic development. We have obtained additional facilities, added academic programs, created an organizational structure, and formed many new alliances with research sponsors and economic development entities.

Evidence cited:

1. 2010 Initiative
2. New Ph.D. programs
3. Tech Development Laboratory and Tech Ventures Inc.
4. Our relationship with research and development funding agencies and with regional economic development entities

1st item of evidence in support of Core Component B

2010 Initiative

Discussion of 1st item of evidence

The governor of South Dakota initiated the 2010 Initiative, (http://www.2010initiative.com) which outlines a series of specific goals and objectives for improving South Dakota’s economic growth. Within the initiative, Goal 3 is to “Become a Recognized Leader in Research and Technology Development by 2010.” The objectives within the governor’s Goal 3 include the following:

- Securing the Homestake Mine for use as an underground science laboratory
- Improving the ranking of the state of South Dakota for NSF funding
- Developing the research and technology infrastructure at our universities
Securing the Homestake Mine for use as an underground science laboratory: our institution helped initiate the discussions that have led to what is now called the Homestake-Deep Underground Science and Engineering Laboratory project (H-DUSEL). When the Homestake underground gold mine, which is located in the Black Hills town of Lead, closed in 2001, we participated with scientists involved in studying the sub-atomic neutrino particles in a decades-long experiment within the mine to propose the development of a deep underground national laboratory for scientific studies. These studies require ultra-low background with respect to cosmic radiation; therefore the deep underground workings of the facility should be ideal for these types of studies. Congress approved $10 million in Federal funds in November 2001 for start up efforts to convert the mine into an underground science laboratory.

In May of 2003 a National Science Foundation committee named Homestake as its preferred site for a national laboratory. In July, 2003, South Dakota Governor Rounds created the Homestake Laboratory Conversion Project to facilitate the development of the process to transfer the mine for conversion to the Laboratory. On February 11, 2004, Governor Rounds implemented the action of the Legislature to form the South Dakota Science and Technology Authority to complete the Agreement in Principle with the Barrick Gold Company to transfer the ownership of the mine to the Authority when NSF funds the conversion. The state legislature also provided $14.3 million in funding to implement the transfer. As the project developed, we became partners with the Lawrence Livermore National Laboratory and the University of California, which took on the leadership of the project.

In July, 2005, the National Science Foundation announced that Homestake was one of two finalists for the location of the Deep Underground Science and Engineering Laboratory. In a parallel effort, South Dakota appropriated an additional $19.9 million in October, 2005, to establish an interim laboratory for physics, geosciences, geomicrobiology, and engineering at a depth of 4850 ft in the mine. An SDSM&T professor is Co-PI for the NSF project; however, this is a large multi-agency effort. The following online information should be consulted for background and history relating to this effort:

- NSF DUSEL (a general site dealing with the DUSEL development process) http://www.dusel.org
- South Dakota Science and Technology Authority (a relatively small site dealing with the South Dakota efforts to maintain the Homestake Facility) http://www.state.sd.us/homestake
- Homestake Lab Information (an SDSMT site devoted to background material – primarily geologic – regarding Homestake) http://homestake.sdsmt.edu/Resources.htm
- Homestake Lab Reference Book (background material on physical facilities at Homestake) http://neutrino.lbl.gov/Homestake/HRB
- Homestake/AGU Meeting Website and Registration (this is the registration page for a series of workshops to be held at the end of 2005 and beginning of 2006 in conjunction with the S-2 project work) http://neutrino.lbl.gov/AGU
- Request for Letters of Interest to use the Homestake 4850 FT. Level (Interim Laboratory and the longer-term Homestake DUSEL facilities for experiments http://neutrino.lbl.gov/Homestake/LOI/)
Improving the ranking of the state of South Dakota for NSF funding: While the National Science Foundation remains an important source of our external funding, the percentage of our total external funding that comes from NSF has decreased in recent years from 40% in the late 1990’s to approximately 20% in 2004; total external funding has increased significantly during this same period as we have received more funding from other federal agencies, particularly the Department of Defense. We expect our renewed emphasis on basic and applied research coupled with economic development opportunities will lead to increased NSF funding.

Developing the research and technology infrastructure at our university: the institution continues to expand our capability in research leading to economic development by focusing our energies in particular areas and by building meaningful relationships with our constituencies. The institution received $585,000 as part of South Dakota’s 2010 Initiative to create the Center for Accelerated Applications at the Nanoscale (CAAN). CAAN research will focus on the areas of nano-particles and associated nano-sensors, with particular emphasis on South Dakota mineral development. CAAN is one of four university-based research centers funded through nearly $2.8 million in 2010 funds, and has involved the formation of a four-state “Northcentral States Nanosystems Consortium” to lead nanoscience and nanoengineering research in the region. (See http://nsnc.sdsmt.edu)

2nd item of evidence in support of Core Component B

New Ph.D. programs

Discussion of 2nd item of evidence

Our capacity and commitment to engage and serve our constituencies in economic development is evident in our activities to create and develop new knowledge through research and its application. As our mission states, we recognize our place as South Dakota’s technological university. Our new and emerging Ph.D. programs are evidence of our activities that place us at the forefront of advancing knowledge. In addition to the new AES degree described under Core Component A, we established a new Ph.D. program in nanoscience and nanoengineering in fall 2005. This new program’s objectives include the preparation of “graduate students who can support economic growth in this area” and the intent to “capitalize on the revolution in science and engineering research at the nanoscale and the economic development impacts it will have in technological areas, including information technology, materials, healthcare, energy, and the environment” (RR176).

Our Ph.D. program in biomedical engineering was presented to the regents in June 2005 (RR279), and the proposal was approved in December 2005 (RR317). Currently, we are exploring the possibility of addressing the professional needs of our students, alumni, and region through the development of a Masters of Engineering program. Such a program would offer an M.S. in engineering as a terminal degree for many engineering fields and, we believe, open new career paths for our students. The Dean of Graduate Studies is overseeing these discussions.

3rd item of evidence in support of Core Component B

Tech Development Laboratory and Tech Ventures Inc.
**Discussion of 3rd item of evidence**

The Tech Development Laboratory (TDL) is a building situated on East Saint Patrick Street, adjacent to the campus’ southern border. The structure was purchased by the SDSM&T Foundation as a means of alleviating the shortage of quality research space on campus. The 14,600 square feet of space was renovated in 2004-05 from its former commercial printing use to a state-of-the-art research laboratory. The TDL contains office, classroom, laboratory, and processing areas for several funded projects.

Tech Ventures, a for-profit corporation owned by the SDSM&T Foundation was described in the section on Core Component A. The combination of the TDL and Tech Ventures provides both the physical facilities for high quality research as well as an organizational structure that provides support for fledging businesses to develop. The first three projects to have assigned space in the building are being pursued by faculty members in chemical and mechanical engineering and chemistry and involve highly engineered polymers and polymer composites for use in defense applications.

**4th item of evidence in support of Core Component B**

Our relationship with research and development funding agencies and with regional economic development entities

**Discussion of 4th item of evidence**

We are proud of the relationships we have developed with the sponsors of economic-development oriented research and development and our local economic development agencies. Our support from agencies of the Federal government comprises over 85% of our total external funding for research, which has grown significantly over the past nine years as shown in Figure 9.1 below (source RR182). We have worked with our congressional delegation to expand our capabilities and to serve our constituencies. We have obtained support from Federal agencies, such as the Army and Air Force Research Laboratories, the National Science Foundation and other Federal constituencies. For example, we were awarded Department of Defense EPSCoR funding in 2005 to develop new optically clear polycarbonate plastics for use in protective armor and new explosive materials using nanoparticles.
Faculty and student research at SDSM&T primarily falls into one of five core technical areas:

1. Materials science and engineering
2. Nanosciences and nanoengineering
3. Atmospheric and environmental sciences
4. Geosciences and geological engineering
5. Biochemical process science and engineering

Strategic hiring is underway in these focus areas. For instance, we hired a director of the Center for Accelerated Applications at the Nanoscale (CAAN) in 2004 and have recently hired faculty members with expertise in biomedical engineering, composites, nanoscience, and nanoengineering.

State support has resulted in the establishment of a new focused research center in nanosciences. CAAN focuses on research in the areas of nanoparticles and associated nanosensors, with particular emphasis on South Dakota mineral development. When completed, Center staffing will include eleven new FTEs, three at South Dakota State University and eight at SDSM&T. These will be the new Center Director, four Ph.D. students, two technicians, three postdoctoral students and a center administrative assistant. The Center complements the new nanoscience and nanoengineering Ph.D. degree program that began in fall of 2005.

In addition to pursuing the nanosciences Ph.D. program, SDSM&T will partner with the University of South Dakota to establish M.S. and Ph.D. programs in biomedical engineering next year.
Industrial and economic development partnerships are also critical to developing and strengthening current and future research programs at SDSM&T by teaming the State of South Dakota, local economic development authorities, and private-sector partners to bring unique, state-of-the-art research capabilities to the university. A successful example of this engagement is the partnership between CAAN and the Zyvex Corporation. In March 2005, South Dakota Governor Mike Rounds announced a cooperative agreement involving Zyvex Corp. of Richardson, Texas, the state of South Dakota, and Rapid City economic development efforts to designate SDSM&T as the exclusive provider of integrated circuit (IC) failure analysis services to the semi-conductor industry. Under the agreement, Zyvex will outsource all of its testing services to CAAN. The agreement between SDSM&T and Zyvex requires the purchase of highly specialized equipment from Zyvex. The equipment measures structures smaller than 100 nanometers. SDSM&T will be the first university to have this type of fully integrated system installed and operational. The probing system will allow the university to utilize the most advanced integrated system developed for IC probing and nanomanipulation. Governor Rounds announced that the state has provided a $250,000 grant to help SDSM&T and CAAN acquire the equipment. Additional funds were provided through a loan from the Rapid Fund, a local economic development revolving loan fund.

By virtue of its location in South Dakota, SDSM&T also has specific research resources available, such as the competition for EPSCoR funding (available only in 27 states) from NSF, DOE, DOD, NASA, and NIH. The university has also successfully competed for support for nationally recognized centers of excellence. For example, SDSM&T and its partners announced the National Science Foundation Friction Stir Processing Industry/University Cooperative Research Center (I/UCRC) on 6 October, 2004. SDSM&T has joined with Brigham Young University, the University of South Carolina, the University of Missouri-Rolla and more than 18 industry partners to create the first NSF I/UCRC and national research center to focus on friction stir processing. This is the first such NSF center headquartered in South Dakota. The Center will address the needs of the aerospace, aeronautic, energy, military, and commercial industries in developing the rapidly growing friction stir processing technology. Industry partners will bring projects to the participating universities, where researchers, students, and other experts will work to solve the problems and advance the technology. The technologies developed under the I/UCRC will be integrated into the academic curriculum at each participating institution. SDSM&T is the lead institution for the Center. USC and BYU are the two participating site universities, while Missouri-Rolla is expected to become a full member next year.

**Core Component 5c. (for economic development) The organization demonstrates its responsiveness to those constituencies that depend on it for service.**

**Evaluative statement for Component 5c**

*We are learning to be responsive to the needs of our constituencies in economic development. We cite examples that demonstrate how we have partnered with other entities to collaborate with our constituents in creating opportunities for economic development. The rate of formation of such partnerships has increased in the past two years as we have begun to focus our energies on those partnerships that lead to economic development.*
Evidence cited:

1. The CAMP Program (Center for Advanced Manufacturing and Production)
2. Tech Ventures Inc.
3. The new Black Hills Business Development Center

We are developing an entrepreneurial culture on our campus. Each of the initiatives cited as evidence above focuses on a particular group of constituents although all constituents benefit in some way from each of the activities cited.

The Center of Excellence for Advanced Manufacturing and Production (CAMP) focuses on our student constituents by affording experiential learning opportunities through multidisciplinary project teams. The Tech Ventures Program focuses on the entrepreneurial faculty by affording them the opportunity to form their own commercial business. The new business incubator is focused on supporting entrepreneurs from the local community and campus alike. Combined, these three programs address the entrepreneurial/economic development needs of our constituents.

1st item of evidence in support of Core Component C

The CAMP Program (Center of Excellence for Advanced Manufacturing and Production)

Discussion of 1st item of evidence

As mentioned under Criterion 1, the CAMP program was established in 1996 as our institutional “Center for Excellence.” Currently, there are 10 multidisciplinary teams involving approximately 200 students in design and performance competitions on a local, regional, and national basis. All of these teams are involved in engineering challenges such as robotics, aircraft, concrete canoes, helicopters, racecars, off-road vehicles, and industrial design projects. Through CAMP we serve our economic development constituents by preparing our graduates for the demanding realities of engineering design and project management. Strong evidence that we prepare our students well in this regard are our repeated successes in national and international competitions.

The SAE Aero team offers a good example of the caliber of performance these team projects brings out in our students. The SAE Aero team placed 17th in the Design West International competition in 2004 (its 1st year of competition) but won the rating of “Best Team Overall.” This same team returned the next year and took 1st place through a remarkable display of character and persistence. At the end of day one of the competition, the SDSM&T Aero team was in 4th place, behind the University of Akron, National University of Australia, and Ohio State. One of the team’s two planes was smashed to bits. On the second day, they placed their full confidence in their design and loaded it heavily with 19 pounds of payload. On the second of two tries, the landing was perfect, and, when the heavy payload was announced, all teams knew that SDSM&T had taken first place. Figure 9.2 below offers a sense of how well SDSM&T student teams have fared in national competitions.
<table>
<thead>
<tr>
<th>Team</th>
<th>Competition</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini-Baja - senior</td>
<td>West Regional</td>
<td>9th (out of 75)</td>
<td>30th (out of 70)</td>
<td>53rd (out of 100/87)</td>
<td>6th (out of 127)</td>
<td>22nd (out of 100)</td>
<td>22nd (out of 100)</td>
<td>8th (out of 94)</td>
<td>76th (out of 131)</td>
<td></td>
</tr>
<tr>
<td>team</td>
<td></td>
<td>top 12%</td>
<td></td>
<td></td>
<td>top 5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mini-Baja - junior</td>
<td>West Regional</td>
<td>73rd (out of 100/87)</td>
<td>13th (out of 127)</td>
<td>30th (out of 100)</td>
<td>83rd (out of 100+)</td>
<td>NA</td>
<td></td>
<td></td>
<td>115th (out of 131)</td>
<td></td>
</tr>
<tr>
<td>team</td>
<td></td>
<td>top 12%</td>
<td></td>
<td></td>
<td>top 10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mini-Indy</td>
<td>International</td>
<td>24th (out of 77)</td>
<td>53rd (out of 94)</td>
<td>42nd (out of 104)</td>
<td>41st (out of 104)</td>
<td>59th (out of 125)</td>
<td>42nd (out of 126)</td>
<td>49th (out of 125)</td>
<td>74th (out of 134)</td>
<td>84th (out of 123)</td>
</tr>
<tr>
<td>Solar Car</td>
<td>International</td>
<td>Sunrayce 29th</td>
<td>NA</td>
<td>Sunrayce 25th</td>
<td>Formula Sun 8th</td>
<td>NA</td>
<td>Formula Sun 2nd Grand Prix Stock Class</td>
<td>NA</td>
<td>Formula Sun 4th Grand Prix Stock Class</td>
<td>NA</td>
</tr>
<tr>
<td>Concrete Canoe</td>
<td>National</td>
<td>7th</td>
<td>7th</td>
<td>5th (out of 200)</td>
<td>11th</td>
<td>5th (out of 200)</td>
<td>top 2.5%</td>
<td>7th</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>top 2.5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concrete Canoe</td>
<td>Regional</td>
<td>1st</td>
<td>1st</td>
<td>1st</td>
<td>1st</td>
<td>1st</td>
<td>1st or 2nd</td>
<td>2nd</td>
<td>2nd (out of 12)</td>
<td></td>
</tr>
<tr>
<td>Human Powered Vehicle</td>
<td>National</td>
<td>7th (out of 40)</td>
<td>12th</td>
<td>11th</td>
<td>3rd (out of 40)</td>
<td>top 8%</td>
<td>5th Overall/2nd Single Rider Utility</td>
<td>6th Overall (out of 25+4th Single Rider Utility)</td>
<td>16th (out of 25)</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>top 18%</td>
<td></td>
<td></td>
<td>top 8%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAE Aero</td>
<td>National</td>
<td>NA - First competition in 2001</td>
<td>12th (out of 37)</td>
<td>14th (out of 30)</td>
<td>12th (out of 39)</td>
<td>17th (out of 37)</td>
<td>1st (out of 39)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IEEE Robotics - team 1</td>
<td>Regional</td>
<td>3rd (out of 16)</td>
<td>3rd (out of 19)</td>
<td>2nd (out of 33)</td>
<td>1st (out of 37/33)</td>
<td>3rd (out of 40)</td>
<td>2nd (out of 26)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel Bridge</td>
<td>Regional</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>&gt;4 (out of 10)</td>
<td>DQ</td>
<td></td>
</tr>
<tr>
<td>UAV</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChemE Car</td>
<td>Regional</td>
<td>1st Car, 3rd Poster</td>
<td>1st</td>
<td>5th</td>
<td>1st Car</td>
<td>4th Car, 2nd poster</td>
<td>1st poster</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChemE Car</td>
<td>National</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4th Car</td>
</tr>
</tbody>
</table>

*Concrete canoe # of entrants in nationals is comprised of the first place team from each region, generally between 18 and 25. Each region usually has between 15 and 20 competitors.

** Only the first three places in Steel Bridge advance to national competition.

Figure 9.2 CAMP Team Competition Results 1997-2005

The array of projects has expanded over the past several years, and work is now underway to establish international CAMP projects. We regard this as an important development.
Our economic constituents among our donors clearly recognize the valuable service CAMP offers, and, in 2000, Caterpillar Inc. funded the creation of a specialized lab for our student project teams and since 1998 has provided approximately $25,000 a year for undergraduate scholarships.

Other important economic development constituents, our own entrepreneurial faculty, staff and students, gain valuable experience within CAMP by addressing open-ended problems where economic considerations are part of the analysis. Projects may be introduced by faculty members or students who have a viable idea; they then have the opportunity to develop the idea to the point of commercialization.

Ideas that are developed as projects within CAMP provide opportunities for undergraduate students to engage in real-life practical projects. The project originators or sponsors benefit by engaging undergraduate students who have been educated in a formal, team-based, interdisciplinary environment on their projects. Employers of our graduates benefit by hiring students who have had this real-world experience of developing projects in such an environment.

The South Dakota Board of Regents and state government are served by the enhanced quality of experiential learning experience afforded by CAMP programs. Some students spawn their own entrepreneurial businesses as a result of this experience as illustrated by the examples in the following Figure 9.3.

<table>
<thead>
<tr>
<th>Student Name</th>
<th>CAMP program</th>
<th>Degree/Yr</th>
<th>Business created</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robert Toms</td>
<td>Mini Baja</td>
<td>B.S. ME/ 1995</td>
<td>Design Advantage (electrical and mechanical product development)</td>
</tr>
<tr>
<td>Anthony Merkel</td>
<td>Formula SAE</td>
<td>B.S. ME/ 1997</td>
<td>Started his own sound and electronics company</td>
</tr>
<tr>
<td>Jason Nelson</td>
<td>Mini Baja</td>
<td>B.S. ME/ 2003</td>
<td>Rusher Racing (business was terminated after student graduated.)</td>
</tr>
<tr>
<td>Ryan Rusher</td>
<td>Formula SAE</td>
<td>B.S. ME/ 2005</td>
<td></td>
</tr>
</tbody>
</table>

Figure 9.3 CAMP-spawned entrepreneurial businesses.

The local community is well served by the CAMP program in that some of the projects accomplished every year are framed by entrepreneurs in the community. Once a community / business-based project is identified, the CAMP leadership facilitates the formation of an interdisciplinary student team and conducts oversight and mentoring throughout the project. A final project report by a student team often guides a local business in making decisions about commercialization of a product. One of our best examples of this type is our collaborations with Legend Air Suspensions, a local Rapid City company owned by Mr. Jesse Jurrens. The company produces after-market suspension systems for Harley Davidson motorcycles. In a first project for Mr. Jurrens, CAMP students helped test prototype parts for durability and performance. Then, in 2003-04, a CAMP senior design team designed a test
system for the company to build so that future testing of prototypes of new products can be done within the company.

CAMP is assessed in several ways including team success in placing in national project competitions; student success in job placement and starting salaries; student success in passing the Graduate Record Examination; successful commercialization of community-based projects, and faculty and student feedback. Please see the CAMP History (RR168) and the 2002 CAMP report to the Board of Regents (RR16) for additional assessment information.

Historically, the majority of CAMP projects have involved national student competitions. Over time, it is a CAMP goal to have more student teams working on more local engineering problems and to expand projects to include international humanitarian projects.

2nd item of evidence in support of Core Component C

Tech Ventures Inc.

Discussion of 2nd item of evidence

As described under Core Component A, Tech Ventures is a for-profit business entity owned in total by the SDSM&T Foundation. Tech Ventures demonstrates our responsiveness through its capacity for bringing together multiple constituencies under the leadership of the SDSM&T Foundation. The dimensions of expertise Tech Ventures offers include those of the creative author or inventor, the business manager, business service personnel, venture capitalists, and project managers. As limited liability corporations (LLC) are spun off from Tech Ventures, we will assess the success of the initiative by tracking the number of LLCs formed, the sustainability of the LLCs formed, and the SDSM&T Foundation’s return on investment. Success of this visionary venture will contribute greatly to the overall establishment of an entrepreneurial culture on the SDSM&T campus. As of mid 2005, two LLCs have been created and three patent applications are being pursued.

3rd item of evidence in support of Core Component C

The new Black Hills Business Development Center

Discussion of 3rd item of evidence

The Governor’s Office of Economic Development in concert with the Rapid City Economic Development Foundation has funded the creation of a business incubator building which will be named the Black Hills Business Development Center (RR141). SDSM&T has volunteered a site on the campus for location of the incubator and the foundation was excavated in June 2005.

The 30,000 to 40,000 square-foot space will undoubtedly facilitate the University’s economic development activities through collaboration with various community leaders. Collaboration currently exists with the West River Business Service Center, Western Research Alliance, SDSM&T, Black Hills State University, Black Hills Community Development, Black Hills Business Council and the Rapid City Economic Development Advocacy Committee (RR141). The construction funding sources are as follows: $750,000 EDA Grant, $450,000
HUD-EDI; $500,000 State of South Dakota, and $400,000 Rapid City Economic Development Foundation. The Rapid City Economic Development Foundation will assume all costs of building ownership, maintenance and operation. They will also be responsible for the day-to-day functions of the center and will provide oversight of the startup and expanding businesses that will locate in the facility.

Our economic development constituents will be served by the presence of this incubator facility on the campus since the facility will house many of the local entities that provide business development services to the community. Laboratory and office space will be made available at a reasonable rate to new businesses being incubated. Additionally, some of the traditional indirect overhead office activities will be shared from a central pool in the incubator.

Prior to 2003, the Rapid City Area Economic Development partnership was looking at off-campus locations for the facility. In 2003, our university president intervened and convinced the Black Hills Business Development Center (BHBDC) to locate the business incubator on the SDSM&T campus (RR141). This successful intervention demonstrates a new responsiveness on the part of SDSM&T as well as the value our constituents place on our involvement.

A part of the incubator function will be to provide entrepreneurial training for all individuals using the incubator service. The risk of starting a new business enterprise will be mitigated by better training and coaching for the entrepreneur. The presence of a business incubator will contribute greatly to the creation of a culture of entrepreneurship on the SDSM&T campus and within the local community.

The efficacy of the business incubator will be determined in terms of clients served, sustainable businesses started, occupancy, and jobs created. Discussions on campus have focused on the fact that the business incubator will be successful to the extent that it affords our constituents coordinated access to all of the support for business creation and planning available within our state, i.e. Small Business Development Center, Small Business Innovation Research, Readi-Fund, Rapid Fund, the Governor’s Office of Economic Development, West River Foundation, and the Genesis of Innovation/Equity.

**Core Component 5d. (for economic development): Internal and External Constituencies value the services the organization provides.**

**Evaluative statement for Component 5d**

*We cite strong evidence that the institution is valued for its role in collaborating with other entities in furthering economic development. The nature of the evidence is the significant monetary resources provided to the university in exchange for the service the university provides in conducting research and development leading to tangible results. The evidence shows a successful record of acquiring instrumentation and infrastructure for research and economic development-oriented projects; it also shows that we have established a number of partnerships with other entities in order to improve our ability to engage in meaningful economic development activities.*
Evidence cited:

1. The Advanced Materials Processing and Joining Laboratory (AMP-J) and the Additive Manufacturing Laboratory (AML)
2. The Small Business Innovation Research (SBIR) and the Small Business Technology Transfer (STTR) programs
3. Acquisition of Zyvex nanotechnology testing equipment and exclusive license

1st item of evidence in support of Core Component D

The Advanced Materials Processing and Joining Laboratory (AMP-J) and the Additive Manufacturing Laboratory (AML)

Discussion of 1st item of evidence

In 2001, the Advanced Materials Processing Center was established with a grant from the Army Research Laboratory and in 2004 was reorganized into the Advanced Materials Processing and Joining Laboratory (AMP-J) and the Additive Manufacture Laboratory (AML) (RR140). Under this grant, the latest in the state-of-the-art in friction stir welding was designed and procured by SDSM&T. AMP-J has an extensive government base of support and serves more than a dozen governmental and private research organizations with its unique research capabilities. During the past four years, the center has secured nearly $10 million (RR139) for research conducted at the regional, national, and international levels. Internationally, AMP-J is working with German and Japanese companies (RR139). Over the past three years, the center has supported over 40 graduate and undergraduate students and six faculty members in their research activities. In addition, the center has served 19 national and international industrial partners, 6 university partners and 6 governmental partners in carrying out research activities on their behalf (RR139). A major achievement during the first three years has been the establishment of the region’s first National Science Foundation Industry/University Cooperative Research for Friction Stir Processing. The center has an advisory board that oversees its research activities.

In spring 2004, the Additive Manufacturing Laboratory (AML) was established to perform applied research in the area of Direct Write and Laser Powder Deposition (LPD). The Direct Write Laboratory was established in the Tech Development Lab in summer 2004, and the AML became a unique organization focused on additive manufacturing techniques covering six orders of magnitude from microns to meters. The AML has directly supported over 20 graduate and undergraduate students and three faculty members and performs collaborative work with nine different departments on the SDSM&T campus. Current funding secured by the AML amounts to over $6 million in research equipment and project funds. Locally, the AML participates with RPM Associates of Rapid City on LPD developments and established a Direct Write program with the South Dakota Heart Research Foundation. Regionally the AML is working with TORO (Minneapolis, MN) on a cladding** project that could prevent work from going off shore. Nationally, the AML is a partner in a $3.5 million; 3-year program sponsored by the U.S. Department of Energy and performs research for the Army Research Laboratory and the Air Force Research Laboratory, along with a number of businesses with interests in additive manufacturing.

NOTE: ** cladding: an old jewelry art, now employed on an industrial scale to add the desirable surface properties of an expensive metal to a low-cost or strong base metal
2nd item of evidence in support of Core Component D

The Small Business Innovation Research and the Small Business Technology Transfer programs.

Discussion of 2nd item of evidence

The Small Business Innovation Research (SBIR) and the Small Business Technology Transfer (STTR) programs were created by Congress in 1982. In 2004, a total of over $2.5 billion dollars were made available by 12 federal funding agencies for SBIR and STTR programs. This amounts to 2.5% of each agency’s external research budget.

Recently, several companies in this area which involve SDSM&T faculty and graduates have been successful in obtaining funding from SBIR/STTR proposals, including Hydro Tech; Realtronic; Cynetics; Rapid Medical Systems; Edgecom; Lloyd’s, Inc.; Memsense; CHT Engineered Systems; Dakota Alpha; ReSpec; and others (RR155 and RR156). Thus far five SDSM&T faculty and staff members have been involved in successful SBIR grant projects. Beginning in the fall of 2004, we have a SBIR representative on campus to help organizations and individuals prepare and submit proposals for SBIR funding. This program stimulates practical research leading to commercialization of processes. The success of this program can be partially judged based on the number of proposals and awards produced by the faculty of this campus.

3rd item of evidence in support of Core Component D

Acquisition of Zyvex nanotechnology testing equipment and exclusive license

Discussion of 3rd item of evidence

In March 2005, SDSM&T formalized an agreement with the Zyvex Corporation of Richardson, Texas that designates our institution as Zyvex’s exclusive provider of integrated circuit failure analysis services to the semiconductor industry. The $250,000 purchase of Zyvex testing equipment was made possible by a grant from the Governor’s 2010 initiative, described under Core Component B, and a loan from the Rapid Fund, a local economic development revolving loan fund. The exclusive license as well as the grant and loan are indicative of the value our constituents place on the institution and its ability to participate in economic development by providing high-tech services to the private sector with the equipment procured (RR228).

Questions that arose from the self study relative to Economic Development

1. As described above in the concluding section on Educational Development, the question “who, precisely, are our constituencies?” arose very early in the self-study process and was answered via a whitepaper.
Actions taken relative to Economic Development

1. As noted throughout this chapter, the self-study was conducted within a framework of strategic planning and strategic actions. Particularly within this section on economic development, it is true to say that many of the specific examples of evidence cited are actions taken as a direct result of this strategic planning process. We are very much involved in the process of creating our future as a key player in economic development in Western South Dakota.

Recommendations relative to Economic Development

1. Continue the campus discussion of identifying our constituencies in economic development in order to develop a strong and common understanding of who we serve.

2. Form the Research and Intellectual Property Council, referred to in Core Component A, for the purpose of continually improving the policies and procedures that will encourage and facilitate the creation of intellectual property with the potential for economic development.
Appendix A: Organizational Charts

SDSM&T organization prior to July 1, 2005

SDSM&T organization after to July 1, 2005

Academic Affairs 2005

Business Affairs 2005

University and Public Relations 2005

Student Affairs 2005

Research Affairs

Academic and Enrollment Services 2005
After the July 1, 2005 reorganization

SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY

SOUTH DAKOTA BOARD OF REGENTS

PRESIDENT

ASSISTANT TO THE PRESIDENT

AFFIRMATIVE ACTION

DESAWAT FOUNDATION

SDMUT ALUMNI ASSOCIATION

ACADEMIC AFFAIRS

COLLEGE OF ENGINEERING

COLLEGE OF SCIENCE AND LETTERS

ACADEMIC SUPPORT & SPECIAL PROJECTS

GRADUATE EDUCATION

DIVERSE LIBRARY

INFORMATION TECHNOLOGY SERVICES

BUSINESS & ADMINISTRATION

ADMINISTRATIVE SERVICES

BUSINESS SERVICES

HUMAN RESOURCES

INTERCOLLEGIATE ATHLETICS

RESEARCH AFFAIRS

SPONSORED PROGRAMS

TECH TRANSFER

INTELLECTUAL PROPERTY, PATENT LICENSING

ECONOMIC DEVELOPMENT

FEDERAL RELATIONS

RESEARCH CENTERS

STUDENT AFFAIRS

CAREER PLANNING, PLACEMENT & CREDIT ED

COUNSELING & ADA

VANCE INTERNATIONAL CTR

MULTICULTURAL AFFAIRS

RESIDENCE LIFE, DIVERSE & JUDICIAL AFFAIRS

STUDENT ACTIVITIES & LEADERSHIP CENTER

UNIVERSITY & PUBLIC RELATIONS

MARKETING, PUBLICATIONS & MEDIA RELATIONS

ADMISSIONS

FINANCIAL AID

CONFERENCES AND OUTREACH

GOVERNMENT RELATIONS

*Coordinates w/VP UPR

APRIL, 2005
SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY

December 2005
Research Affairs

Vice President for Research
Gautam Pillay

- Sponsored Programs
  Sharon Reid
- Tech Transfer
- Intellectual Property, Patents, Licensing
- Economic Development
- Federal Relations*
- Research Centers
  - IAS
    Pat Zimmerman
  - CAAN
    Shawn Decker
  - AMP
    Bill Arbegast
  - AML
    James Sears
  - PTPCL
    Robb Winter & Dan Dolan
  - EMES
    Ed Duke
  - CML
    Mike Langerman & Karim Muci

Coordinates with Dean for Graduate Education
* Coordinates with VP of University Relations
Appendix B:
Reference list of Academic Department, Administrative Offices, and Contacts
<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<tbody>
<tr>
<td>Dr. Karen Whitehead</td>
<td>Provost and Vice President of Academic Affairs</td>
<td>394-2256</td>
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<tr>
<td>Craig Miske</td>
<td>Program Asst. II</td>
<td>394-2257</td>
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<td>Vi Stoltz</td>
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<tr>
<td>Kate Alley</td>
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<tr>
<td>Barbara Dolan</td>
<td>Director Academic &amp; Enrollment Services</td>
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<td>Joan Hardgrove</td>
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<td>Curtis Cook</td>
<td>Director WISE</td>
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<tr>
<td>Judy Chilstrom</td>
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<td>Patty Andersen</td>
<td>Director Devereaux Library</td>
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<td>Janet Taylor</td>
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<td>Bryan Schumacher</td>
<td>Director ITS</td>
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<tr>
<td>Deanna Bies</td>
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<td>394-6197</td>
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**College of Engineering**

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<tr>
<td>Robb Winter</td>
<td>Chair Chemical &amp; Biological Engr.</td>
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<td>Linda Embrock</td>
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<td>Scott Kenner</td>
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<tr>
<td>Henry Mott</td>
<td>Program Coord. Environmental Engineering</td>
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<td>Roger Johnson</td>
<td>Chair Computer Science</td>
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<td>Laurie Pope/Nina Byers</td>
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<tr>
<td>Abul Hasan</td>
<td>Chair Electrical &amp; Computer Engr.</td>
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<tr>
<td>Carolyn Brich</td>
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<td>Arden Davis</td>
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<td>Stuart Kellogg</td>
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<td>Rita Sabe</td>
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<tr>
<td>Jon Kellar</td>
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<td>Cindy Hise</td>
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<tr>
<td>Vojislav Kalanovic</td>
<td>Chair Mechanical Engineering</td>
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<td>Shashi Kanth</td>
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<td>Carrie Herbel</td>
<td>Manager Museum of Geology</td>
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<td>Kelly Clever</td>
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**College of Science and Letters**

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<td>Chair Atmospheric Sciences</td>
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<td>Paula DeMars</td>
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College of Science and Letters Cont.

Rodney Rice Chair Humanities & IS Program Coord 394-1244
Deb East 394-1243
Roger Johnson Chair Math 394-2471
Laurie Pope/Ginny Byers 394-2471
James Feiszli Director Music Dept 394-5101
Linda Beyer 394-2433
Kent Guthrie Chair Military Science 394-6035
Nicole Evans 394-2355
Robert Corey Chair Physics 394-2362
Christal Krein 394-2361
Jerry Schafer Chair Physical Education 394-2603
Lori Hodgin 394-2351
Roger Dendinger Chair Social Sciences 394-5111
Debbie Zeidler 394-2481

Research Affairs
Gautam Pillay Vice President for Research 394-2493
Jeanette Nilson 394-1206
Sharon Reid Manager Sponsored Programs 394-1205
Sheila Lien 394-1213
Ed Duke Director Engr. and Mining Exp. Station 394-2388
James Sears Director AML 394-2477
Cassie Schweigerdt 394-6888
Bill Arbegast Director AMP 394-6924
Colleen Gustafson 394-1933
Shawn Decker Director CAAN 394-5210
Brenda Brown 394-5381
Pat Zimmerman Director IAS 394-2291
Pam Cox 394-2291

Graduate Studies
Ken Han Dean 394-2342
Julie Volimas 394-2493
Linda Carlson 355-3468

Important Telephone Numbers to Keep at Hand:
Help Desk 394-1234
Kathy Crawford Registration Officer 394-1288
Toni Schauer VA Officer 394-2553
Marge Marken Budget Business Office 394-1207
Kelli Schuman Payroll 394-1208
Deb Sloat Director Human Resources 394-1203
Lisa DeVries 394-1203
Carol Sturm Pres. Asst. President’s Office 394-2413
Tami Gregoire 394-2411
Tim Henderson VP Business Business Office 394-2371
Audrey Painter 394-2371
Sandy Fischer Purchasing Business Office 394-2228
Switchboard 394-2511
Appendix C: Map of Campus
Appendix C: Map of Campus
Appendix D:
List of Acronyms & Abbreviations
## Appendix D: List of Acronyms and Abbreviations

Organizations or reports that could be identified as having a website are hot-linked for your convenience.

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<thead>
<tr>
<th>Acronym</th>
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<td>Academic Affairs Council</td>
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<td>AAHE</td>
<td>American Association for Higher Education</td>
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<tr>
<td>ABET</td>
<td>Accreditation Board for Engineering &amp; Technology</td>
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<tr>
<td>ACS</td>
<td>American Chemical Society</td>
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<tr>
<td>ACT</td>
<td>American College Testing</td>
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<tr>
<td>ADA</td>
<td>Americans with Disabilities Act</td>
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<tr>
<td>ADS</td>
<td>Advanced Data Solutions</td>
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<tr>
<td>AES</td>
<td>Academic &amp; Enrollment Services</td>
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<tr>
<td>AES</td>
<td>Atmospheric &amp; Environmental Science</td>
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<tr>
<td>AFRL</td>
<td>Air Force Research Laboratory</td>
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<tr>
<td>AISES</td>
<td>American Indian Science &amp; Engineering Society</td>
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<tr>
<td>AML</td>
<td>Additive Manufacturing Laboratory</td>
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<tr>
<td>AMP</td>
<td>Advanced Materials Processing</td>
</tr>
<tr>
<td>AMP-A</td>
<td>Advanced Materials Processing &amp; Additive Manufacture</td>
</tr>
<tr>
<td>AMP-J</td>
<td>Advanced Materials Processing &amp; Joining</td>
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<tr>
<td>ANLSAMP</td>
<td>All Nations Louis Stokes Alliance for Minority Participation</td>
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<tr>
<td>AP</td>
<td>Advanced Placement</td>
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<tr>
<td>ARDEC</td>
<td>Armament Research, Development &amp; Engineering Center (U.S. Army)</td>
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<tr>
<td>ARL</td>
<td>Army Research Laboratory</td>
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<td>BAC</td>
<td>Budget Advisory Committee</td>
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<td>BHBDCC</td>
<td>Black Hills Business Development Center</td>
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<td>BHSU</td>
<td>Black Hills State University</td>
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<td>BLAHST</td>
<td>Black Hills Science Teaching Project</td>
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<tr>
<td>BME</td>
<td>Biomedical Engineering</td>
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<td>BOR</td>
<td>Board of Regents (South Dakota)</td>
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<td>BYU</td>
<td>Brigham Young University</td>
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<td>C/M</td>
<td>Civil/Mechanical Building</td>
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<td>CAAN</td>
<td>Center for Accelerated Applications at the Nanoscale</td>
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<tr>
<td>CAAP</td>
<td>Collegiate Assessment of Academic Proficiency</td>
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<tr>
<td>CAC</td>
<td>Computing Accreditation Commission (ABET)</td>
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<tr>
<td>CAMP</td>
<td>Center for Advanced Manufacturing &amp; Production</td>
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<tr>
<td>CAMSE</td>
<td>Center for the Advancement of Math &amp; Science Education</td>
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<tr>
<td>CAT</td>
<td>Campus Action Team</td>
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<tr>
<td>CCPC</td>
<td>Campuses Community Prevention Coalition (Rapid City’s)</td>
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<td>CEE</td>
<td>Civil &amp; Environmental Engineering</td>
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<td>CENG</td>
<td>Computer Engineering</td>
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<tr>
<td>CFO</td>
<td>Chief Financial Officer</td>
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<tr>
<td>CHEM</td>
<td>Chemical Engineering</td>
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<tr>
<td>CML</td>
<td>Computational Mechanics Laboratory</td>
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<tr>
<td>CIP</td>
<td>Classification of Instructional Programs</td>
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<td>COHE</td>
<td>Council on Higher Education</td>
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<td>CSA</td>
<td>Career Service Act</td>
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**Note:** Some acronyms may link to websites for further information.
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<th>Acronym</th>
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<td>Computer Science</td>
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<td>CSEMS</td>
<td>Computer Science, Engineering and Mathematics Scholarship</td>
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<td>CSM</td>
<td>Colorado School of Mines</td>
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<tr>
<td>DAT</td>
<td>Digital Archival Tool</td>
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<td>DDN</td>
<td>Digital Dakota Network</td>
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<tr>
<td>DMIS</td>
<td>Developmental Model of Intercultural Sensitivity</td>
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<td>DOC</td>
<td>Director of Commercialization</td>
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<tr>
<td>DoD</td>
<td>Department of Defense</td>
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<td>DOE</td>
<td>Department of Energy</td>
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<td>DSU</td>
<td>Dakota State University</td>
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<td>GTA</td>
<td>Differential Thermal Analyzer</td>
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<td>DW</td>
<td>Direct Write</td>
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<td>DWL</td>
<td>Direct Write Laboratory</td>
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<td>Educational Benchmarking, Inc.</td>
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<td>ECE</td>
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<td>EDA</td>
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<td>Electronic Data Interchange</td>
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<td>Equal Employment Opportunity</td>
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<td>Engineering &amp; Mining Experiment Station</td>
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<td>ENVE</td>
<td>Environmental Engineering</td>
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<td>Environmental Protection Agency</td>
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<td>EPICS</td>
<td>Engineering Practices Introductory Course Sequence (Colorado School of Mines)</td>
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<td>EPR</td>
<td>Enrollment Projection Report</td>
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<td>EPSCoR</td>
<td>Experimental Program to Stimulate Competitive Research</td>
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<td>EROS</td>
<td>Earth Resources Observation Systems (Data Center)</td>
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<td>ESC</td>
<td>Enrollment Services Center</td>
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<td>EUC</td>
<td>Electronic University Consortium (South Dakota)</td>
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<td>F&amp;A</td>
<td>Facilities &amp; Administrative (Costs)</td>
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<td>Foundation Coalition</td>
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<td>FE</td>
<td>Fundamental of Engineering</td>
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<td>FIRST</td>
<td>Freshman Introduction to Real Success at Tech</td>
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<td>Faculty Survey of Student Engagement</td>
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<td>GEC</td>
<td>Governor’s Electronic Classroom</td>
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<td>GIRLS</td>
<td>Girls Into Real Learning Succeed</td>
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<td>GIS</td>
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<td>Governor’s Office of Economic Development</td>
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<td>GRKRRR</td>
<td>Group of Researchers Ready for Real Research Resources</td>
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<td>H-DUSEL</td>
<td>Homestake-Deep Underground Science &amp; Engineering Laboratory</td>
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<td>Abbreviation</td>
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<td>I/U CRC</td>
<td>Industry/University Cooperative Research Center</td>
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<td>IAS</td>
<td>Institute of Atmospheric Sciences</td>
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<td>IC</td>
<td>Integrated Circuit</td>
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<td>Intercultural Development Inventory</td>
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<td>IIT</td>
<td>Illinois Institute of Technology</td>
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<td>IMM</td>
<td>Institute for Minerals &amp; Materials</td>
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<td>IMM</td>
<td>Institute for Multi-Scale Materials</td>
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<td>Intellectual Property</td>
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<td>Local Area Network</td>
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<td>Learning &amp; Study Strategies Inventory</td>
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<td>LDT</td>
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<td>Limited Liability Corporation</td>
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<td>Midwest Instruction &amp; Computing Symposium</td>
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<td>Mining Engineering</td>
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<td>MOU</td>
<td>Memorandum of Understanding</td>
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<td>Mongolian University of Science &amp; Technology</td>
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<td>National Association of College &amp; University Business Officers</td>
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<td>National Aeronautics &amp; Space Administration</td>
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<td>National American University</td>
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Appendix F: List of items in Electronic Resource Room

“RR” refers to Resource Room. All “RR” items in the text are hyperlinks that can be activated by holding down the “control” key while clicking the underlined RR number. Online, these same items are found in alphabetic order at http://www.hpcnet.org/ResourceRoom. During the team visit, all RR items will be available in hard copy format in the Resource Room.

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