

**A 2010 Vision
The Future of Research and Graduate
Education in The South Dakota
Regental System**

December 2005

Introduction

The Executive Director, South Dakota Board of Regents, is charged with the task of providing a “2010 Vision” of what the nature, scope and quality of the SDBOR system research and graduate education programs should be by 2010. The vision is for the Regental system to play a leadership role in establishing South Dakota as a recognized leader in research and technology development by 2010.

This research vision should be read in the context of the political and financial realities existing in South Dakota at this time. The state has made limited funds available for specific targeted research areas in support of technology based economic development. The Regental system today is principally grounded in an instructional model with requisite faculty teaching loads and a limited resource base supporting research. Funding for changing to a more research oriented model must initially be specifically focused and targeted on the science, engineering and technology programs most likely to result in a timely economic return on the state’s investment. The system will play a leadership role in fostering innovation and entrepreneurship consistent with the Governor’s 2010 Initiative. The vision is that an initial success in building a targeted research culture will create the opportunity for other disciplines to build their research programs. The universities are encouraged to bolster their overall research agenda through careful rationalization of existing programs and resource reallocation.

This “2010” Vision” document provides a broad framework for discussion on the individual campuses as they prepare their strategic plans for research and graduate education. The system needs to commit itself to building and retaining strong faculty who are dedicated to the discovery process and to creating an environment that encourages and supports their best efforts. The steps outlined in the “2010 Vision” are designed to create such an environment and the system campus community is urged to consider how to implement this vision at every level of their university. Implementation will necessarily occur in a stepwise fashion as we carefully prioritize our resources and build for the future.

Expanding knowledge, developing new applications of existing knowledge, and nurturing creative activity are among the central functions of research universities. These functions, subsumed under the term scholarship, are core responsibilities of faculty members. Active and strong scholarship is essential to producing vibrant graduate programs.

Through our graduate programs and strong undergraduate research emphasis, South Dakota’s public universities will play an important role in improving the standard of living and economic well-being of the state’s citizens through research and technology based economic

development. The globalization of the world economy will require our system to be on the “cutting edge” of technology lest our best efforts and expenditures become quickly redundant.

To enhance SD’s stature for research and research productivity requires thoughtful and proactive attention to: sustaining graduate education, strengthening interdisciplinary support for targeted areas of distinction, and building research infrastructure.

The structure and function of graduate education within the system presents several challenges. Increasing the number and national prominence of graduate programs will attract quality faculty. Strengthening cross-departmental, cross-college and cross-university interdisciplinary activity will help achieve and sustain scholarly depth and critical mass in graduate programs and research. Building research infrastructure involves careful budgeting and rationalization of resources, zealous pursuit of external awards, and accountability for investments in research. There is a critical need for research faculty positions which includes consideration of appropriate workloads and assignments. Substantial state government, community and business financial support will be necessary to help accomplish this vision. The university system can not accomplish this mission alone out of its’ own limited resources.

“Prominent economists agree that no other investment generates a greater long-term return to the economy than scientific R & D” (2005 ASTRA, The Alliance for Science and Technology Research in America).

The Future Environment for Research in the South Dakota Regental System and in the New Global Economy

A. Globalization

Research and industry will have a more global focus. This will affect the topics of research, consumers of research, reward structures for research, and the languages and practices through which research is disseminated. South Dakota needs to transition into an innovation-driven economy creating value through increased productivity and new products and services sold globally.

B. Greater role for-profit sector in research/graduate education

Universities will develop closer ties to business and industry to support themselves while maintaining their independent mission. Business and industry will become firm partners and stake holders in university research and graduate education. Much professional and undergraduate education will be done in the for-profit sector by both for-profit universities and those associated with large corporations. Additionally, collaboration with business and industry provides a synergism of research ideas, research and development, and opportunities for students’ education, internships, and placement. Professional education increasingly will be shaped by the needs, standards and priorities of professional organizations.

Research and graduate training will become more interdisciplinary and multi-institutional

Multidisciplinary and/or multi-institutional efforts are the future direction of scientific research. Technologically, the capability of broad band electronic (cyber) communication will continue to evolve with emphasis in the following areas: real time, video/audio conferencing over the Internet, the remote control of laboratory equipment and worldwide access to traditional databases. These technological capabilities suggest that research and graduate education will be affected by increased collaboratories (collaborative laboratories) in which collaborators will work as effectively across the country (world) as they now do in the same building. Graduate students may be supervised by a committee of experts from different universities and participate in classes and seminars with students from around the world. Geography will become much less important as research will no longer need to be in the same facility.

C. Changes in how our universities “do their business”

Changes that impact how universities function include (a) increased expectations from students and their parents as well as administrators and public officials concerning the quality and cost-effectiveness of research and teaching activities (e.g., the expectation of doing more with fewer resources; consumer expectations), (b) advances in information technology and telecommunications that change the nature of interpersonal interaction within the university and across the country, and (c) growing importance of cross-disciplinary and interdisciplinary thinking that will blur traditional lines of scholarship.

Improving the quality and quantity of research and graduate studies in such an environment suggests that we must craft organizational forms and cultures that continually help faculty improve their research productivity.

Regental System Research In 2010

Governor Michael Rounds’ vision is for SD to be a recognized research leader in focused areas building upon the state’s resources. The Governor’s 2010 and 2010 Education Initiatives provide the impetus for investing in focused research and development through sustaining graduate education, strengthening interdisciplinary support and funding research infrastructure to support an innovation driven economy. The vision for the Regental system is to play a leadership role in establishing SD as a recognized leader in research and technology development by 2010.

A. Components of the 2010 Vision

Presently, the system has 18 Ph.D. programs with one program being discontinued and five new programs being added in FY05. The system has produced 202 Ph.D. graduates in the past five years (Table 1.) with 57% of those degrees being in science and engineering disciplines. Careful attention to providing quality undergraduate educational and research opportunities in mathematics and science will provide the numbers of well educated students needed to support the graduate programs in science and engineering. The 2010 Initiative Research Centers Program has provided resources to start the process of providing full, competitive stipends to graduate students. Data shows that the majority of graduate students in education are from SD and sciences and engineering graduate students are largely international.

1. Faculty

The core of a research program is its faculty with a significant number of nationally and internationally preeminent scholars associated with prominent research and graduate education. They will be connected to national and international scholarly networks. Hiring in selected areas will be competitive with the best public universities.

2. Research

The emphasis during the initial implementation period of South Dakota's research culture will be on quality basic and applied research programs, with several highly visible national centers and preeminence in selected areas in the sciences, engineering and technology. Universities have the latitude to reallocate and rationalize resources to create centers whose missions emphasize the application of the humanities, social sciences or professions to developing and maintaining the cultural and social resources that support high technology economic development. Fostering innovation and entrepreneurialism to support the state's 2010 Initiative for technology based economic development will be supported.

3. Teaching

High quality teaching, both at the undergraduate and graduate levels, is the cornerstone of a leading research system with strong graduate and professional programs. In order to support our status as a leading research system, teaching will be of the highest quality and focus on the integration of teaching and research. This is accomplished by having excellent instruction that provides the necessary information and skills in the content area and imparts to the students the ability to apply this knowledge to research activities. Teachers foster the kinds of critical thinking skills and quest for knowledge that are fundamental to the development of scholars and researchers.

4. Graduate education

Graduate studies will provide programs in selected fields whose graduates are highly sought after for professorships, positions in industrial R&D, in government, and in various professions. Selected programs will be internationally prominent. The Regental system will be more competitive in graduate student recruiting, with the result of increased quality and diversity in the student body. Mentoring graduate students will be valued by programs and colleagues and course credit allocated appropriately.

5. Engagement

The Regental system will be widely recognized as a source of expertise and collaboration with SD citizens, agriculture, business, government, and professional communities and also with national and international communities. Faculty and universities will want to have an impact on the world and devote effort to meaningful projects that are important for the future of humanity.

6. Institutional support

State government, the business community, citizens and professionals must work with the Regental system in bringing together the financial resources needed to achieve nationally competitive facilities, salaries, and general support. Expectations for the System's contributions to teaching, research and engagement are appropriate within the context of these funding constraints. Excellence in (a) high-performance computing and broadband communication (b)

state-of-the-art laboratory and instrumentation resources, (c) library and museum collections pertinent to prominent areas of scholarship, and (d) clerical and professional staff to support research will be realized.

7. External research funding

The System will significantly increase competitive grant funding, both through increased numbers of grants as well as increased average size of grants. Strong ties to state; public and private grants programs will be realized. A strong visible presence in Washington, DC will be developed matching researchers with funding sources and securing funding. The infrastructure to support increased funding activity will be strengthened to eliminate duplication where possible and to include more emphasis on pre-award and post-award support, compliance management, and intellectual property and technology transfer guidance and support. While stewardship of the sponsored program activity belongs at the university level, the system and the state Office of Commercialization must be prepared to play a role in those areas where resources are limited and to assure accountability.

8. Collaborative and multi-institutional graduate teaching and research

Faculty research interactions across campuses, colleges, and disciplines will be encouraged, flexible and easily accomplished. Faculty will continue the tradition of working with researchers at other institutions (public, private, and commercial) inside and outside of South Dakota.

B. Our Aspirational Peer Group

A set of peer states and universities have been identified for comparison in terms of reputations and productivity in research and graduate education. Montana, with the University of Montana and Montana State University as their flagship institutions and a slightly larger population base represents the best peer target for comparison. Presently most of the national universities (US News and World Report rankings) in our region of comparison (Montana, Nebraska, North Dakota, Wyoming) rank in the third tier with UN-L in the second tier and NDSU in the fourth tier. The University of Nebraska and the University of Wyoming are Carnegie Classification Doctoral/Research Universities–Extensive (These institutions typically offer a wide range of baccalaureate programs, and they are committed to graduate education through the doctorate. During the period studied, they awarded 50 or more doctoral degrees per year across at least 15 disciplines). The UM, MSU, UND, NDSU, SDSU and USD are Carnegie Classification Doctoral/Research Universities-Intensive (These institutions typically offer a wide range of baccalaureate programs, and they are committed to graduate education through the doctorate. During the period studied, they awarded at least ten doctoral degrees per year across three or more disciplines, or at least 20 doctoral degrees per year overall). The Carnegie classification also provides a benchmark for comparison of South Dakota with Montana research capabilities. Among the 50 states, only AK, MT, ND and SD lack a research extensive university in the state. South Dakota’s two research intensive universities do not rank in the top 200 of their peer institutions.

The characteristics of a research extensive university environment includes strong doctoral programs across all disciplines, contemporary library and museum collection resources adequate to support the research mission, state of the art equipment, laboratories and facilities, a strong technological framework including high speed broadband connectivity, intellectual

property and technology transfer support, and a comprehensive sponsored programs office providing pre-award and post-award support, compliance training and support, and federal relations liaison.

Tables 2 - 4 give an indication where SD places with its regional peer group in the competition for federal dollars in support of science and engineering programs. South Dakota has shown substantial growth but due to a low starting position trails our regional competition in accruing federal monies. Table 3 also indicates the lack of diversity in our research portfolio as we have not been competitive until recently in obtaining DOE or DOD funds. In a recent article in *Nature* (vol. 434, 3 March 2005, p. 10-12) South Dakota was shown to be last in the nation in federal spending on academic research and development per capita (2000 data). Maryland was first with \$206 per person while SD spent just \$18 per person.

According to the National Science Foundation (NSF), Science and Engineering State Profiles, 2001-03 (Table 4), SD ranks 50th and 51st in doctoral scientists and engineers, and 49th and 48th in science and engineering postdoctorates and graduate students in academic research and development and 52nd in academic research and development. **South Dakota needs more federal funding for scientific research.** Comparisons with the states of Montana (our first benchmark), Iowa (our second regional benchmark for Goal 3 of the 2010 Initiative to achieve the ranking of 30th in National Science Foundation federal funding) and our other peer states will allow the system to establish short and long range goals to improve our competitive position. Metrics will be established by each university to greatly increase the number of postdoctorates and graduate students and the average number of federal dollars awarded per doctoral scientist and engineer.

In the Development Report Card for the States, 2003 (Corporation for Enterprise Development) (Table 5) SD ranked 50th in university research and development and near the bottom in several other important measures related to research activity and technology based economic development. These results indicate the key role the SD Regental System needs to play in creating an innovation driven economy for SD.

Clearly, South Dakota has much to do to meet the goals our vision expects us to achieve.

C. What Steps Need to be Taken?

The State Research and Technology Vision for SD is to be a recognized research leader in focused areas building upon the states resources and to support achievement of the South Dakota 2010 Initiative and The Governor's 2010 Education Initiative. These two initiatives provide the impetus for investing in focused research and development, building infrastructure to support an innovation-driven economy, commercialization of intellectual property, building a highly skilled technical work force based on a focused K-20 educational strategy, and stimulating an entrepreneurial culture throughout the state.

The State Objectives in Relation to the Regental System are as Follows:

- The SD Science and Technology Authority will be supported in implementing and sustaining its business plan to develop the deep underground science and engineering

laboratory initially at the 4850' level at Homestake and ultimately the NSF supported DUSEL. The DUSEL plan calls for the entire state to be involved and benefit from the investment in the laboratory. The Regental system's support and participation in the research, outreach and education programs at the 4850' level and the DUSEL will be critical to the success of this high priority state endeavor.

- Emerging areas and current research enterprises that are critical to a state-wide technology based economy will be pursued independently and collaboratively by researchers at the state's institutions of higher education. These fields include: materials science and engineering; biotechnology, including bioprocessing, biofuels and biomedical; information technology and assurance; agricultural sciences; medical sciences and technology development; and business and economics.
- South Dakota's Regental system and universities will be encouraged to establish procedures to strategically hire tenure-track and research faculty in senior leadership and entry-level positions to support the research focus areas undertaken in this vision.
- Strong collaborative research programs with the USGS EROS Center, the proposed NSF DUSEL at Homestake and other national laboratories will be developed.
- Strong doctoral programs in areas that are critical to the planned research focus areas and that encourage innovation and entrepreneurship will be developed.
- The 2010 Initiative Research Centers will become sustainable Centers of research excellence and contribute to the state's economic development.
- DOE/DOD/NASA/NSF EPSCoR and NIH IDeA/COBRE infrastructure programs will be coordinated to maximize the positive impact on higher education's and industry infrastructure development in support of the 2010 Initiative.
- The number of patents and other intellectual property entities from both the private sector and higher education and commercialization of those innovations will be increased.
- Collaborative research efforts between private business, higher education, federal and state agencies and health care providers will be fostered.
- Higher education degree programs will be strengthened by creating opportunities for more interdisciplinary and inter-institutional participation in research and internship activities at undergraduate and graduate levels.

Necessary Steps

The steps outlined below are developed from the underlying perspective that the common thread across the campuses should be an emphasis on excellence and on scholarly impact, however defined within each discipline. Every faculty member regardless of discipline has a scholarship requirement. This will vary by faculty member and program in which they are

teaching. Teaching loads will reflect the research mission of their academic unit. Strategic Masters or Doctoral programs will have an appropriate teaching load in order that faculty can fulfill their research mission. Before we can expect departments and faculty members to establish high research standards for hiring and promotion and tenure, there must be a reasonable belief that this is a sustained and important priority of the university and the System.

1. Maintain a strong faculty

a. Recruiting and hiring faculty

The recruitment and retention of outstanding faculty are the most important actions that we can take to upgrade our reputation and research output. Aggressive recruiting of nationally recognized senior faculty and the recruitment, development and support of outstanding junior faculty are all necessary. Chairs, deans and every member of search advisory committees should be selected for their commitment to an uncompromising search for excellence, hence, hiring the most highly qualified candidates. The goal of every search committee should be to hire the very best candidate. Faculty recruiting policies must encourage diversity in background, perspective, even ideology. Strategic faculty hiring practices should permit the development of clusters of strong researchers working on allied problems. Persons with research potential and/or demonstrated capability in research and/or creative activity should be our priority.

b. Retaining outstanding faculty

Efforts to recruit and develop outstanding junior faculty need to be paired with sustained efforts to retain them, and our nationally recognized senior faculty. At some leading universities, for example, special professorships are created that include a salary supplement (to ensure that salaries are strong compared to those offered by competitors), incentive plans and funds to enhance the senior faculty's research and/or teaching program through travel support, equipment purchases, research assistance, competitive graduate student stipends and the like.

c. Reviews, tenure, promotion and annual salary increases

Departments will be encouraged to establish very high standards for research and creative activity in promotion and tenure decisions. The vision is that all current tenure track and tenured faculty will be actively engaged in scholarly endeavors appropriate to their discipline. Personnel policies and practices (hiring, workload, tenure, and reward) should be orientated towards excellence in all expressions of scholarly endeavors while recognizing different missions across colleges, programs, and faculty members within programs.

d. Non-tenure track research faculty

The vision of a significantly expanded research agenda funded by outside grants will result in an increase in the number of research track appointments as part of a contract research project team. Such positions are non-tenure track and will be supported solely with outside funding for specific projects.

2. Sustaining Graduate Education

Recruiting, graduating, and placing more top quality students is central to improving our reputation. Strong research programs with strong research faculty are the key requirements for increasing our graduate programs in selected areas. The number of doctoral programs in areas important to South Dakota's technology and science based economic development will be increased in accordance with 2010 and 2010E Initiative Goals. This calls for the number of Ph.D. and D.Sc. programs and graduates to be doubled by 2010 from a 2005 base of 18 programs and a 2003 base of 47 Ph.D. graduates. The number of full, competitive postdoctoral and graduate student stipends to attract high quality post doctorates, graduate students and research faculty, will be increased. This is a major component of fulfilling the 2010 Vision for the Regental system. A mechanism for reallocating (moving faculty lines between academic units, changing percent effort of faculty work) existing faculty and recruiting new research faculty with reduced teaching loads will be encouraged to be developed, thereby allowing stronger programs to obtain critical mass and flourish. This will require a peer review and assessment process for all graduate programs. The 2010 Research Centers will play a pivotal role in linking graduate education to their Center goals and objectives.

3. Strengthening Inter-institutional and Interdisciplinary Support

Departments offering doctoral programs will be encouraged to invite qualified faculty members from other Regental universities to participate in the education of doctoral students as members of that university's graduate faculty. Incentives need to be developed to encourage the disciplines to become actively engaged in this process. This initiative would be closely coordinated by the System Chief Academic Officer. Graduate assistantships will be created and specifically allocated for innovative and interdisciplinary graduate programs.

4. Supporting Research Infrastructure

The purchase and installation of an advanced high speed broadband network for South Dakota is necessary. Funds will be allocated to match federal and private grants to purchase scientific equipment. Seed money will be provided to upgrade library holdings in support of the new and existing programs in science and engineering. Funds will be provided to establish additional 2010 Initiative Research Centers in areas important to South Dakota's economic development. Steps must be taken to secure a NSF EPSCoR RII Grant in the 2005 - 2006 competition. The Regental system's role as a venue for a premier undergraduate research experience must be supported and promoted. Support for research and teaching museum collections must be found so these valuable state resources are preserved and nurtured. Pre-award, post-award, compliance, and intellectual property/technology transfer staffing shortages in relation to increased grants and contract activity will be addressed.

References:

- A 2020 Vision, The Future of Research and Graduate Education at UNL
- University of Wyoming, Academic Plan, 2004-2009

Table 1.

Ph.D. Degrees Conferred (FY01 – FY06)

University Major	Degree	FY01 00-01	FY02 01-02	FY03 02-03	FY04 03-04	FY05 04-05	5Years Total
South Dakota School of Mines & Technology							
Atmos, Environ, Water Resources *	PHD	2	3	1	4	5	15
Materials Engineering & Science	PHD	1	2	5	2	3	13
Geology/Geological Engineering	PHD	1	0	0	1	1	3
Nanoscience & Nanoengineering **	PHD	-	-	-	-	-	-
Atmospheric & Environmental Sciences **	PHD	-	-	-	-	-	-
Sub Total SDSMT		4	5	6	7	9	31
South Dakota State University							
Animal Sciences	PHD	2	1	4	0	2	9
Agronomy	PHD	2	4	1	1	1	9
Atmos, Environ, Water Resource *	PHD	1	0	1	0	0	2
Biological Sciences	PHD	7	6	3	11	8	35
Chemistry	PHD	2	2	1	2	3	10
Sociology	PHD	5	5	2	7	4	23
Geospatial Science & Engineering **	PHD	-	-	-	-	-	-
Computational Science & Statistics ** (with USD)	PHD	-	-	-	-	-	-
Nursing **	PHD	-	-	-	-	-	-
Sub Total SDSU		19	18	12	21	18	88
University of South Dakota							
Educational Psyc & Couns	PHD	4	3	1	9	3	20
English	PHD	2	1	2	0	2	7
Biological Sciences	PHD	1	1	1	0	3	6
Basic Biomedical Sciences	PHD	0	0	0	1	1	2
Anatomy & Structural Biology ***	PHD	1	0	0	0	0	1
Biochemistry & Molecular Biol ***	PHD	1	1	2	1	0	5
Microbiology ***	PHD	0	2	2	0	0	4

Physiology/Pharmacology ***	PHD	0	1	0	0	1	2
Psychology	PHD	7	6	9	8	6	36
Computational Science & Statistics ** (with SDSU)	PHD	-	-	-	-	-	-
Combined Ph.D. – M.D. **, ****	PHD	-	-	-	-	-	-
Sub Total USD		16	15	17	19	16	83
Total Ph.D. Graduates		39	38	35	47	43	202
Total Science & Engineering Graduates		21	22	21	23	28	115 (57%)

- * Joint SDSMT/SDSU program was discontinued starting FY06
- ** New programs approved in FY05 and started in FY06
- *** These programs have been combined into Basic Biomedical Sciences
- **** Degrees will most likely be conferred in the Basic Biomedical Sciences program

Source: Report generated by Regents Information Systems; data entered by the universities (8/30/2005)

Table 2.

**Federal obligations for science and engineering to universities and colleges,
by geographic division and State: fiscal years 1995 – 2002**
(Dollars in thousands)

Geographic division and State	1995	2002	% Growth 1995 - 2002
West North Central, total	875,878	1,553,450	77%
Iowa	164,793	289,378	77%
Kansas	78,400	140,425	79%
Minnesota	237,446	336,756	42%
Missouri	275,488	577,097	110%
Nebraska	61,222	109,244	78%
North Dakota	40,895	67,977	38%
South Dakota	17,634	32,573	85%
Mountain, total	908,604	1,579,345	74%
Arizona	203,561	290,230	43%
Colorado	296,025	625,534	111%
Idaho	20,515	50,358	146%
Montana	36,572	87,669	140%
Nevada	28,144	69,286	146%
New Mexico	146,119	179,213	23%
Utah	160,677	254,427	58%
Wyoming	16,991	22,628	33%

SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, Fiscal Year 2002.

Table 3.

**Federal obligations for science and engineering to universities and colleges,
by State and agency: fiscal year 2002**
(Dollars in thousands)

State	Total	USDA	Com	DoD	ED	DOE	EPA	HHS	Int	NASA	NSF	Other
Montana	87,669	15,334	2,104	5,778	1,840	1,800	0	23,893	1,760	9,894	23,276	1,990
Nebraska	109,244	19,560	126	11,522	1,527	2,689	870	55,608	1,130	1,594	13,018	1,600
North Dakota	67,977	15,695	150	12,599	209	8,566	1,388	13,306	107	4,861	9,780	1,316
South Dakota	32,573	9,851	75	1,023	947	0	0	10,646	1,072	923	7,478	558
Wyoming	22,628	4,619	80	1,393	734	501	363	6,213	537	947	7,241	0

USDA = Department of Agriculture; Com = Department of Commerce; DoD = Department of Defense; ED = Department of Education; DOE = Department of Energy; EPA = Environmental Protection Agency; HHS = Department of Health and Human Services; Int = Department of the Interior; NASA = National Aeronautics and Space Administration; NSF = National Science Foundation.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, fiscal Year 2002.

Table 4.

Federal obligations for research and development: fiscal years 1970 – 2000
(Latest Data Available)
(Dollars in thousands)

State	1970	1980	1990	2000	% Growth 1970 – 2000
Montana	11,646	45,664	30,933	95,025	715%
Nebraska	10,648	31,608	76,445	98,491	825%
North Dakota	8,878	38,650	53,061	64,051	622%
South Dakota	6,091	9,867	15,730	38,803	537%
Wyoming	7,161	53,904	57,363	35,059	390%

SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, Fiscal Year 2002.

Table 5.**Science and Engineering State Profile***

	South Dakota	Rank	Montana	Rank	Nebraska	Rank	North Dakota	Rank	Wyoming	Rank	Iowa	Rank
Doctoral Scientists, 2001	1160	50	1730	47	2820	37	1150	51	940	52	4500	32
Doctoral Engineers, 2001	90	51	100	49	330	43	130	48	100	49	560	36
S & E Postdoctorates in Doctorate Granting Institutions, 2002	12	49	117	39	190	32	57	44	28	48	564	23
S & E Graduate Students in Doctorate Granting Institutions, 2002	1244	48	1315	46	3105	37	1290	47	943	49	5045	28
<u>Federal Spending</u>												
Total R & D Performance, 2002 (\$M)	111	50	236	49	663	40	295	48	80	51	1346	34
Academic R & D, 2002 (\$M)	38	52	122	43	267	35	106	44	42	51	486	25
National Science Foundation, 2002 (\$K)	2953	52	9986	45	15703	39	6401	48	7411	46	23579	29
Number of Federal Dollars Awarded Per Doctoral Scientist & Engineer	\$30,400		\$66,667		\$84,762		\$82,813		\$40,385		\$96,047	

* NSF, Science and Engineering State Profiles, 2001-03

Table 6.
Development Report Card for the States, 2003

South Dakota

<u>Weaknesses (Bottom 10 Rank)</u>	
<u>Rank</u>	<u>Measure</u>
41	Venture Capital Investments
41	University Spin-Outs
41	Basic Educational Skills Proficiency-Math
42	Urban Mass Transit
42	Strength of Traded Sector
43	PHD Scientists and Engineers
43	SBIR Grants
43	Patents Issued
44	Basic Educational Skills Proficiency-Reading
44	Private R&D
45	Health Professional Shortage Areas
46	Federal R&D
46	Recycling Rate
46	Job Growth Due to New Business
48	Average Teacher Salary
49	Royalties and Licenses
49	Average Annual Pay
50	Manufacturing Investment
50	Change in New Companies
50	New Companies
50	Charitable Giving
50	University R&D

A	Performance	Employment	A
		Earnings and Job Quality	B
		Equity	A
		Quality of Life	B
		Resource Efficiency	C
F	Business Vitality	Competitiveness of Existing Bus.	D
		Entrepreneurial Energy	F
C	Development Capacity	Human Resources	C
		Financial Resources	B
		Infrastructure Resources	C
		Amenity Resources	C
		Innovation Assets	F

<u>Strengths (Top 10 Rank)</u>	
<u>Rank</u>	<u>Measure</u>
1	Income Distribution Change
1	Income Distribution
1	Unemployment Rate
2	Employment Growth: Short Term
2	Mass Layoffs
2	Crime Rate
3	Private Lending to Small Businesses
3	Conversion of Cropland to Other Uses
3	Business Closings
5	High School Completion
6	Renewable Energy
6	Infant Mortality
7	Involuntary Part-Time Employment
8	High School Attainment
9	Electronic Public Services

Source: Corporation for Enterprise Development