

Research & Technology Transfer Report

Board of Regents Meeting, January 2011

Under Policy 401 of the Board of Regents, The University of Montana – Missoula and Montana State University – Bozeman are required to meet the following reporting elements:

Federal Initiatives Report. Targeted federal initiative funds (commonly referred to as “earmarks”) are funds included in federal appropriations requested by members of Congress to fund specific projects or programs. To keep the regents informed of these funding requests, UM-Missoula and MSU-Bozeman, as representatives of the affiliated campuses, shall coordinate requests for federal initiatives for their affiliated campuses and shall each submit to the Commissioner of Higher Education a report of the requests for any non-competitive federal funds which the units anticipate submitting to Montana’s congressional delegation for inclusion in the federal budget. The report will be submitted before the January board meeting unless otherwise scheduled by the board.

Reports. Annually, at the September regents’ meeting, UM-Missoula and MSU-Bozeman, as representatives of the affiliated campuses, shall submit to the Commissioner of Higher Education a report summarizing the research and technology transfer activities for the previous fiscal year. The report shall contain, at a minimum, the following data for the previous fiscal year:

1. All expenditures from grants and contracts managed by the respective research administrative offices;
2. Number of new invention disclosures filed;
3. Number of new start-up companies which have licensed or commercialized university-developed intellectual property;
4. Number of new intellectual property licenses issued;
5. Total intellectual property licenses in effect at the close of the fiscal year;
6. Total gross revenues from intellectual property licenses; and
7. Assessment of progress toward meeting the goals pertaining to technology transfer outlined in the campus strategic plans.

Research and Technology Transfer Report, 2010
THE UNIVERSITY OF MONTANA-MISSOULA

| Data Elements for MUS Policy | FY 2006 | FY 2007 | FY2008 | FY2009 | FY2010 |
|---|----------------|----------------|---------------|---------------|---------------|
| R&D Expenditures (same data reported to NSF) | \$60,070,832 | \$62,020,361 | \$62,405,729 | \$67,117,785 | \$66,961,101 |
| Number of new invention disclosures filed | 10 | 5 | 6 | 6 | 7 |
| Number of new start-up companies which have licensed or commercialized university-developed intellectual property | 0 | 1 | 1 | 3 | 1 |
| Number of new intellectual property licenses issued | 2 | 1 | 2 | 5 | 1 |
| Total intellectual property licenses in effect at the close of the fiscal year | 22 | 23 | 22 | 21 | 21 |
| Total gross revenues from intellectual property licenses | \$0 | \$0 | \$0 | \$19,203 | \$13,490 |

| Data Elements for Strategic Plan | FY 2006 | FY 2007 | FY2008 | FY2009 | FY2010 |
|---|----------------|----------------|---------------|---------------|---------------|
| Patents Issued (annual) | 22 | 28 | 2 | 5 | 3 |
| Active Licenses (Total) | 23 | 24 | 22 | 21 | 21 |
| Active Licenses (MT Companies) | 14 | 15 | 16 | 12 | 11 |
| Percent Licenses w/ MT Companies | 64% | 63% | 73% | 57% | 57% |
| License/Patent Revenues | \$0 | \$0 | \$0 | \$15,203 | \$13,140 |
| Reimbursed Patent Costs from Licenses | \$0 | \$0 | \$0 | \$4,000 | \$350 |

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| Data Elements for MUS Policy | FY2006 | FY2007 | FY2008 | FY2009 | FY2010 |
|---|---------------|---------------|---------------|---------------|---------------|
| R&D Expenditures (same data reported to NSF) | \$7,842,753 | \$7,141,492 | \$7,882,940 | \$8,408,515 | \$9,656,552 |
| Number of new invention disclosures filed | 2 | 1 | 6 | 6 | 8 |
| Number of new start-up companies which have licensed or commercialized university-developed intellectual property | 0 | 0 | 0 | 0 | 0 |
| Number of new intellectual property licenses issued | 0 | 0 | 0 | 0 | 2 |
| Total intellectual property licenses in effect at the close of the fiscal year | 1 | 1 | 1 | 1 | 3 |
| Total gross revenues from intellectual property licenses | \$0 | \$0 | \$0 | \$0 | \$2,720 |

| Data Elements for Strategic Plan | FY2006 | FY2007 | FY2008 | FY2009 | FY2010 |
|---|---------------|---------------|---------------|---------------|---------------|
| Patents Issued (annual) | 0 | 0 | 1 | 1 | 0 |
| Active Licenses (Total) | 1 | 1 | 1 | 1 | 3 |
| Active Licenses (MT Companies) | 1 | 1 | 1 | 1 | 1 |
| Percent Licenses w/ MT Companies | 100% | 100% | 100% | 100% | 33% |
| License/Patent Revenues | \$0 | \$0 | \$0 | \$0 | \$1,500 |
| Reimbursed Patent Costs from Licenses | \$0 | \$0 | \$0 | \$0 | \$1,220 |

Total Number of Awarded
 Patents (Dates: 7/1/08, 1/1/08, and circa 1990) – 3
 Total Number of Full Patents Filed – 5



THE UNIVERSITY OF MONTANA
RESEARCH AND OTHER SPONSORED PROGRAMS
FISCAL YEAR 2010 EXPENDITURES BY COLLEGES AND DEPARTMENTS

College of Arts and Sciences

| | |
|---------------------------------|---------------------|
| Dean's Office | \$119,259 |
| Anthropology | \$432,908 |
| Chemistry | \$1,970,648 |
| Computer Science | \$291,387 |
| Division of Biological Sciences | \$9,300,061 |
| Economics | \$7,145 |
| English | \$201,464 |
| Environmental Studies | \$188,397 |
| Geography | \$230,305 |
| Geosciences | \$1,677,257 |
| History | \$74,585 |
| Mathematics | \$274,880 |
| Native American Studies | \$26,149 |
| Physics & Astronomy | \$490,500 |
| Psychology | \$574,608 |
| Sociology | \$1,077 |
| TOTAL | \$15,860,630 |

College of Education and Human Sciences

| | |
|------------------------------------|--------------------|
| Dean's Office | \$1,612,138 |
| Curriculum & Instruction | \$976,541 |
| Health & Human Performance | \$1,084,040 |
| Communicative Sciences & Disorders | \$127,874 |
| TOTAL | \$3,800,594 |

College of Forestry and Conservation

| | |
|------------------|--------------------|
| Dean's Office | \$7,536,224 |
| Wildlife Biology | \$50,575 |
| TOTAL | \$7,586,799 |

College of Technology

| | |
|---------------|------------------|
| Dean's Office | \$721,622 |
| TOTAL | \$721,622 |

College of Visual and Performing Arts

| | |
|--------------|-----------------|
| Theatre | \$77,552 |
| TOTAL | \$77,552 |

College of Health Professions and Biomedical Sciences

| | |
|-------------------------------------|---------------------|
| Dean's Office | \$328,670 |
| Biomedical/Pharmaceutical Sciences | \$2,313,133 |
| Sciences | \$3,916,337 |
| Neurosciences | \$5,522,071 |
| School of Physical Therapy/Rehab | \$149,870 |
| Pharmacy Practice | \$869,401 |
| School of Public & Community Health | \$173,269 |
| School of Social Work | \$914,729 |
| TOTAL | \$14,187,481 |

School of Business Administration

| | |
|---------------|------------------|
| Dean's Office | \$37,875 |
| Research | \$950,567 |
| TOTAL | \$988,442 |

School of Law

| | |
|---------------|----------------|
| Dean's Office | \$89 |
| School of Law | \$1,818 |
| TOTAL | \$1,907 |

Continuing Education

| | |
|-------------------------------------|--------------------|
| Continuing Education Administration | \$1,538,269 |
| TOTAL | \$1,538,269 |

Davidson Honors College

| | |
|-------------------------|----------------|
| Davidson Honors College | \$4,500 |
| TOTAL | \$4,500 |

Facilities Services

| | |
|------------------------------------|-------------|
| Facilities Services Administration | \$13 |
| TOTAL | \$13 |

President's Office:

| | |
|---------------------------------|--------------------|
| Broadcast Media Administration | \$378,105 |
| Campus Compact | \$1,287,179 |
| Information Technology | \$3,902 |
| Mansfield Center Administration | \$2,560,548 |
| Montana Museum of Art & Culture | \$10,204 |
| Office for Civic Engagement | \$149,012 |
| Radio-TV | \$18,584 |
| University Relations | \$9,340 |
| President's Office | \$79,832 |
| TOTAL | \$4,496,706 |

Provost's Office:

| | |
|--------------------------------|--------------------|
| Center for Ethics | \$35,327 |
| Graduate School Administration | \$41,753 |
| International Programs | \$334,742 |
| Internship Services | \$102,522 |
| TRIO Student Support Services | \$465,086 |
| Upward Bound | \$407,477 |
| TOTAL | \$1,386,906 |

Research Office:

| | |
|---|---------------------|
| Flathead Lake Biological Station | \$2,632,489 |
| Animal Care | \$456,267 |
| Biomolecular Structure & Dynamics | \$265,077 |
| Biotechnology Center | \$737,168 |
| Montana World Trade Center | \$476,769 |
| MT Cooperative Wildlife Research Unit | \$1,205,061 |
| MT Natural Heritage Program | \$2,075,253 |
| NSF EPSCoR | \$2,530,110 |
| O'Connor Center for the Rocky Mountain West | \$42,737 |
| Research Administration | \$912,812 |
| Rural Institute On Disabilities | \$4,954,476 |
| TOTAL | \$16,288,219 |

Student Affairs:

| | |
|-------------------------------|-----------------|
| Foreign Student Services | \$2,175 |
| Career Services | \$7,778 |
| Health Service Administration | \$11,509 |
| TOTAL | \$21,462 |

GRAND TOTAL \$66,961,101

The University of Montana – Federal Initiative Requests for FY 2012

| COMMITTEE | CAMPUS | REQUESTED |
|---|----------|-------------|
| AGRICULTURE | | |
| <u>New Request</u> | | |
| <ul style="list-style-type: none"> Wood Utilization Research (WUR): Sustainable Forest Bioproducts and Bioenergy Act | Missoula | \$1,000,000 |
| COMMERCE, JUSTICE, SCIENCE | | |
| <u>Continuing Request</u> | | |
| <ul style="list-style-type: none"> The Montana Safe Schools Center: Foundations for a Safe Beginning | Missoula | \$ 850,000 |
| DEFENSE | | |
| <u>Continuing Request</u> | | |
| <ul style="list-style-type: none"> Defense Critical Languages and Cultures Program | Missoula | \$2,500,000 |
| <u>New Request</u> | | |
| <ul style="list-style-type: none"> Spin-Torque Effect research for MRAM | Missoula | \$2,000,000 |
| <ul style="list-style-type: none"> Identification and Detection of Chemical Agent Injury | Missoula | \$4,000,000 |
| <ul style="list-style-type: none"> Rare Earths Initiative | Butte | \$4,200,000 |
| <ul style="list-style-type: none"> Montana Institute for Simulation Technologies (MIST) | Butte | \$2,300,000 |
| ENERGY AND WATER | | |
| <u>New Request</u> | | |
| <ul style="list-style-type: none"> Mobile Energy Unit for Diseased Timber Harvesting | Missoula | \$2,400,000 |
| <ul style="list-style-type: none"> Test Facility for Technology Development of CO₂ Sequestration Monitoring and Leakage Mitigation | Butte | \$3,000,000 |
| INTERIOR AND ENVIRONMENT | | |
| <u>New Request</u> | | |
| <ul style="list-style-type: none"> The Wildland Fire Science Partnership and The University of Montana's National Center for Landscape Fire Analysis (NCLFA) | Missoula | \$1,000,000 |
| <ul style="list-style-type: none"> Natural Resources Building Addition | Missoula | \$5,000,000 |
| LABOR, HEALTH & HUMAN SERVICES, EDUCATION | | |
| <u>New Request</u> | | |
| <ul style="list-style-type: none"> Living Well with a Disability: Extending Health Promotion to Veterans with Disabilities | Missoula | \$ 500,000 |



The University of
Montana

The University of Montana – Federal Initiatives Report for FY 2011

| COMMITTEE | CAMPUS | REQUESTED | FUNDED |
|--|----------|--------------|--------|
| AGRICULTURE | | | |
| <u>New Request</u> | | | |
| <ul style="list-style-type: none"> Mobile Energy Unit for Diseased Timber Harvesting | Missoula | \$2,400,000 | |
| COMMERCE, JUSTICE, SCIENCE | | | |
| <u>New Request</u> | | | |
| <ul style="list-style-type: none"> Montana Safe Schools Center: Trauma-Informed Communities | Missoula | \$ 850,000 | |
| <u>New Request</u> | | | |
| <ul style="list-style-type: none"> State of the Art Physics Laboratories for The University of Montana | Missoula | \$2,000,000 | |
| DEFENSE | | | |
| <u>Continuing Request</u> | | | |
| <ul style="list-style-type: none"> Defense Critical Languages and Cultures Program | Missoula | \$2,500,000 | |
| <ul style="list-style-type: none"> Low Acoustic and Thermal Signature Battlefield Power Source | Butte | \$4,000,000 | |
| <u>New Request</u> | | | |
| <ul style="list-style-type: none"> Approaches to Preventing and Treating Epilepsy in Military Personnel | Missoula | \$2,000,000 | |
| ENERGY AND WATER | | | |
| <u>New Request</u> | | | |
| <ul style="list-style-type: none"> Phase I I Biomass to Synthetic Natural Gas (SNG) Commercialization Project for the Montana University System and State Government Facilities | Missoula | \$5,000,000 | |
| <ul style="list-style-type: none"> Geoexchange Demonstration System for Montana Tech | Butte | \$ 550,000 | |
| FOREIGN OPERATIONS | | | |
| <u>New Request</u> | | | |
| <ul style="list-style-type: none"> Vietnamese Affairs Program | Missoula | \$2,500,000 | |
| LABOR, HEALTH & HUMAN SERVICES, EDUCATION | | | |
| <u>New Request</u> | | | |
| <ul style="list-style-type: none"> Living Well with a Disability: Extending Health Promotion to Veterans with Disabilities | Missoula | \$ 1,500,000 | |
| <ul style="list-style-type: none"> The University of Montana Native American and Rural Health Initiative | Missoula | \$ 1,000,000 | |





Proposed Federal Initiatives – FY 2012

The University of Montana-Missoula:

- Wood Utilization Research (WUR): Sustainable Forest Bioproducts and Bioenergy Act
- The Montana Safe Schools Center: Foundations for a Safe Beginning
- Defense Critical Languages and Cultures Program
- Spin-Torque Effect Research for MRAM
- Identification and Detection of Chemical Agent Injury
- Mobile Energy Unit for Diseased Timber Harvesting
- The Wildland Fire Science Partnership and The University of Montana's National Center for Landscape Fire Analysis (NCLFA)
- Natural Resources Building Addition
- Living Well with a Disability: Extending Health Promotion to Veterans with Disabilities

Montana Tech of The University of Montana:

- Rare Earths Initiative
- Montana Institute for Simulation Technologies (MIST)
- Test Facility for Technology Development of CO₂ Sequestration Monitoring and Leakage Mitigation

AGRICULTURE

Project Title: Wood Utilization Research (WUR): Sustainable Forest Bioproducts and Bioenergy Act

Executive Summary: UM supports the request for \$1 million for the Wood Utilization Research – Sustainable Forest Bioproducts and Bioenergy (WUR-SFBB) Grant University Program that provide grants to the following WUR-SFBB Centers: (1) University of Alaska Fairbanks, (2) University of Idaho, (3) Louisiana State University AgCenter, (4) University of Maine, (5) Michigan State University, (6) Mississippi State University, (7) University of Minnesota Duluth, (8) University of Montana, (9) North Carolina State University, (10) Oregon State University, (11) University of Tennessee, (12) Virginia Tech University, (13) Washington State University, and (14) West Virginia University.

Project Description: The purpose of the Wood Utilization Research (WUR) program is to create economic growth and opportunities through an integrated research, education and outreach effort through the fourteen University partners. These partners will develop new innovative science, technology and advanced business practices that will help transform our use of domestic forest resources. Further, these partners will introduce new renewable products, sustainable biofuels, and develop other innovations to strengthen our traditional wood products industries and build new industries with advanced technologies for the sustainable use of wood and lignocellulose-based products.

This program will be established with specific responsibilities to conduct research on: sustainable bioproducts from wood and woody residues; advanced engineered wood and biopolymer composites; biofuels; biopharmaceuticals; and the manufacture, marketing and economic analyses of these bioproducts. These activities will:

- 1) enhance the global competitiveness of the American wood products industry and strengthen rural economies,
- 2) provide leadership and direction to a US industry which is seeking new business opportunities
- 3) advance energy independence and environmental stewardship through the sustainable use of wood and lignocellulose for both transportation fuels as well as other renewable energy sources, and
- 4) demonstrate sustainability through socially and environmentally acceptable production and consumption of wood products.

Education and outreach programs will complement the research effort and they will help educate future technical leadership and build an advanced workforce that will enable future success of a sustainable, globally competitive industry. Outreach programs will effectively transfer research knowledge and technology to industry participants and consumers.

Congressional Action Needed: An appropriation of \$1 million is requested.

Importance to Montana: The University of Montana is an active member of the Inland Northwest Forest Products Research Consortium and is one of fourteen “WUR universities:”

- | | |
|--|------------------------------------|
| 1) University of Alaska Fairbanks | 8) University of Montana |
| 2) University of Idaho | 9) North Carolina State University |
| 3) Louisiana State University AgCenter | 10) Oregon State University |
| 4) University of Maine | 11) University of Tennessee |
| 5) Michigan State University | 12) Virginia Tech University |
| 6) Mississippi State University | 13) Washington State University |
| 7) University of Minnesota Duluth | 14) West Virginia University |

Contact at UM: Todd Morgan, Bureau of Business and Economic Research (BBER), 406-243-5113, todd.morgan@business.umt.edu

COMMERCE, JUSTICE, SCIENCE

Project Title: The Montana Safe Schools Center: Foundations for a Safe Beginning

Executive Summary: UM requests \$850,000 to remote economic development by providing critically needed, cost-effective and otherwise unavailable professional development for schools and youth service agencies. Our organization is Montana-based and will promote economic development by delivering critically needed, cost-effective and otherwise unavailable services. Our work aligns with Senator Baucus' leadership in health care reform, Senator Tester's membership on Veterans' Affairs Committee and Indian Affairs Subcommittee, as well as Representative Rehberg's work on the Labor, Health and Human Services and Education Committee.

Project Description: Montana's school children are placed at particular risk by a disproportionately high number of deployments, limited access to care, and poverty on our seven Indian reservations. Our FY11 request proposed to extend diagnostic and treatment services to military children. This FY12 request expands services to focus on younger children.

Our efforts to date demonstrate clearly that childhood trauma is treatable, but few mental health professionals, and fewer educators, police officers and justice personnel have been trained to recognize trauma. The military has developed trauma-informed interventions for military personnel, but these must be extended to families. Montana ranks second in the nation for veterans per capita. In particular, this places at risk children who do not live close to military communities, who live in places with limited resources, in single-parent families with the parent deployed, in dual-military parent families with one or both parents deployed or whose parent was deployed several times.

The Montana Safe Schools Center, in partnership with the National Native Children's Trauma Center, builds on fifty years of national and local research. We deliver services throughout the state, with emphasis on small, underserved communities. Our partners are otherwise unable to secure funding. No alternative source of funding exists for a statewide program to address the intersection of trauma, abuse, suicide, and school violence.

Congressional Action Needed: An appropriation of \$850,000 is requested.

Importance to Montana: Funding will allow for the provision of school-based mental health and safety services in these communities, and with a focus on younger children. Our services will include: trauma informed trainings for police, veterans agencies, educators, social workers, and juvenile justice personnel. Services will be culturally-appropriate, driven by local needs, and supportive for children and spouses of deployed soldiers, returning veterans, and early child care providers. Outcomes include: a) increased number of education, police and child service professionals trained, b) increased access to mental health care for military families, and c) decrease in children's rates of PTSD and depression.

Schedule:

Y1 (FY10) – Train personnel in childhood trauma awareness and screening instruments

Y2 (FY11) – Clinical service provision, middle and high school focus

Y3 (FY 12) – Clinical service provision, elementary and preschool focus

Contact at UM: Richard van den Pol, Ph.D., Director, Institute for Educational Research and Service, 406-243-6756; richard.vandenpol@umontana.edu

DEFENSE

Project Title: Defense Critical Languages and Cultures Program

Executive Summary: UM requests \$2.5 million to 1) expand a new program based on best practices to meet DoD and related needs in Arab, Afghan and Pakistani strategic culture by adding two new faculty members in those areas; 2) add one faculty member to meet DoD demand for basic and intermediate Arabic language and another to teach beginning/intermediate Pashto or Dari, including the development of flexible on-line training programs in those languages; 3) purchase and install the necessary computers, language software, and other language teaching hardware related to this expansion; and 4) extend scholarship assistance for Reserve Officer Training Students who enroll in a national pilot program in intensive Arabic or Chinese. The program is expected to be fully funded by training fees beginning in year five of its operation (2012-13) and to generate positive revenue in year six. Owing in part to university contributions, the cost of training federal personnel to obtain basic language and cultural proficiency or more advanced language/cultural proficiency is anticipated to be considerably lower than existing programs such as DLI or the Foreign Service Institute.

Project Description: Recent events have accentuated the continuing need for greater capacity in the strategic culture of the Middle East and South Asia as well as in Arabic, Dari and Pashto. Our military and reconstruction efforts in Iraq have clearly been hampered by a shortage of American speakers of Iraqi culture and Arabic. The U.S. is woefully short of soldiers with a pragmatic understanding of Afghan culture and Dari and Pashto speakers at a time Afghanistan is becoming the new battleground against terrorism, and when Pakistan's geographic proximity to Afghanistan and growing instability have dramatically elevated that nation's strategic importance.

Consistent with the urgent demand to produce more people with *functional* language proficiency, instruction at the UM Defense-Critical Languages and Cultures Center will continue to adapt the best practices of the nation's premier government language programs, notably the Defense Language Institute (DLI) in Monterrey, with which we are consulting closely on this program. As such, it will place a premium on small interactive classes (5-8 student/class); offer intensive instruction; require a boot camp-like dedication to study; make extensive use of computer-assisted programs using radio, newspapers, and other relevant media from the target country; and focus on vocabulary in the military, strategic, and economic realms. The Center will continue to respond to a key related need by providing trainees with the "operational culture" necessary to understand and function effectively in the Middle East, Afghanistan, and China. Instruction will include a thorough grounding in aspects of 1) history, society, culture, political economy, and other forces that affect its political orientation and political viability; 2) the regional strategic environment; 3) leadership dynamics and decision making, and 3) its worldview and strategic outlook, as they relate to the United States.

Congressional Action Needed: An appropriation of \$2.5 million is requested.

Importance to Montana: The expansion of this program will raise Montana's profile as an asset to national security. When fully established, the center will employ approximately 10 full-time professionals and bring in 400 salaried military/government personnel per year, all of whom will contribute to the Montana economy as short- or long-term trainees. Wherever possible, program instructors will also continue to contribute to the UM curriculum. Significantly, the Center will also contribute to the DoD goal of "surging" language and cultural proficiency among military officers by expanding a prototype program of intensive language and cultural instruction for *future* officers, namely students enrolled in the Reserve Officer Training Program in Montana and regional colleges and universities. Instruction for the latter program is provided by skilled foreign language instructors who have native or near-native fluency and by related area studies professionals, all of whom have extensive direct experience in the target country, relevant teaching experience, and have a hard-headed, practical understanding of the culture, leaders, and peoples of the targeted regions.

Contact at UM: Terry Weidner, Director, Maureen and Mike Mansfield Center, 406-243-2281, terry.weidner@umontana.edu

Project Title: Spin-Torque Effect Research for MRAM

Executive Summary: UM requests \$2 million to support additional research on spin-torque including theoretical modeling, experimentation, and test and evaluation as UM is in a unique position to measure the behavior of the materials being used in MRAM with and without the added spin-torque. For example, recent measurements made by a collaboration between UM and the National Institute of Standards and Technology confirmed that the reorientation of the magnetic bit is fundamentally different between traditional field switching and spin-torque switching.

Project Description: Magnetic Random Access Memory (MRAM) is a promising new technology with large potential impact across many fields. It is a magnetic based memory that is comparable in speed to current computer memory but does not require electrical power to maintain its information. In addition, it does not wear-out during long-term use, which makes MRAM ideal for critical data storage and security-critical applications. For example, current systems that use SRAM with battery backup in order to ensure no data loss could be replaced with a single MRAM chip saving power and space and eliminating the need for batteries, which are prone to failure in harsh environments. In addition to the ability to work under a large range of temperatures, MRAM is also promising as a technology for use in high radiation environments. It has already been chosen for use in the Japanese research satellite SpriteSat and for use in the new Airbus A350 XWB.

The main limitation of the current MRAM technology is in its data storage density. MRAM needs to have about 3 orders of magnitude improvement in storage density to compete with current computer memory. However, the current version of MRAM does not scale well to these densities. In order to increase the storage density to the levels of SRAM, two things must happen. The devices themselves must become smaller in size, and the power required to write the data must be reduced.

Because of the many advantages of MRAM, the Navy is investigating it for use in satellite and other military systems. Additional research is needed to increase storage density and reduce data writing power demands. The most promising avenue of research is using the recently discovered spin-torque effect. The University of Montana is a national leader in this field and this project will support collaborative research between the University of Montana and the Naval Research Lab to work on second generation MRAM for military applications.

Congressional Action Needed: An appropriation of \$2 million is requested.

Importance to Montana: The University of Montana is a national leader in the spin-torque for MRAM. This project will expand the University's capabilities and provide a foundation to pursue competitive awards resulting in higher levels of annual research funding. Funding would create approximately 10 jobs directly. This would include approximately 3 post-PhD positions, 3 graduate students, and 4 undergraduates.

Contact at UM: Michael Schneider, Department of Physics and Astronomy, 406-243-6641, michael.schneider@umontana.edu

Project Title: Identification and Detection of Chemical Agent Injury

Executive Summary: UM requests \$4 million to research chemical nerve gas (NG) agents, especially organophosphates (OP), which continue to be a terrorist and combative nation threat to national and international security because access to and use of these chemical agents remains possible. Recent use of these agents in the Middle East and subway in Japan has generated heightened awareness to these chemical agents. Interestingly, OP's are also in wide use as agricultural and domestic chemical agents for the control of insect pests. As such, the development of effective countermeasures to detect exposure to and detect poisoning by OP-NGs and the detection of OP-commercial products is important to protect the public and military personnel.

Project Description: To develop adequate countermeasures and detection kits first requires an understanding of how OP chemical agents react with molecules in the body, in particular, the susceptible proteins that undergo reaction with OP chemical agents is needed. Surprisingly, no systematic study of how OP chemical agents react with proteins has been undertaken. If the proteins that are susceptible to OP chemical agents could be identified, detection kits and countermeasures could be developed and better therapeutic intervention could be devised.

Historically, researchers and investigators have focused on one type of protein injury resulting from exposure to OP chemical agents - acetylcholinesterase inhibition. However, the OP-acetylcholinesterase interaction represents only one of hundreds of possible OP-protein interactions. As a result, new approaches and strategies are needed to identify injured proteins (protein markers) of OP exposure. The goal of this request is to build, develop and support a laboratory and personnel whose purpose is to identify new in vivo protein targets of OP injury, and to develop detection methods and countermeasures to these targets. Once key proteins are identified, antibodies will be made to recognize the injured protein and use this novel recognition to develop nanoparticle or nanofilm detection kits of exposure, or aid planned countermeasures.

Using customized, fluorescent molecules that simulate the way OP chemicals react, we will identify proteins that are modified by OP chemical agents because they will 'light up.' State-of-the-art technologies in mass spectrometry (MS) and immunochemistry will be used to identify and characterize the proteins. Detection kits will be used to establish exposure limits, and in the case of insecticides, will be critically important to an agriculture-based economy where field and farm workers are routinely exposed, possibly overdosed and become sick. Few citizens, and as noted above, understand that OP chemical nerve gas agents and OP insecticides share the same mechanism of action and differ only in the application. Knowing this, we are positioned to assist both military personnel and the general public through a synchronous effort to solve both exposure problems.

Congressional Action Needed: An appropriation of \$4 million is requested.

Importance to Montana: The University of Montana is a world leader in the area of OP chemical agent reactivity and will lead a path to new commercial detection products. Following successful identification of OP targets and development of detection kits, we will undertake similar projects with other chemical agents. The request would immediately support the hiring of 5-6 Montanan's into high technology jobs and with follow-up funding resulting from successful patents and licensing, additional staff hiring for a production facility and expansion of the project lab.

Contact at UM: Charles Thompson, Department of Biomedical and Pharmaceutical Sciences, 406-243-4643, charles.thompson@umontana.edu

Project Title: Rare Earths Initiative – Beneficiation Metallurgy to Optimize Availability of Strategic Elements for Manufacturing of Critical Components for Weapon System Munitions

Executive Summary: Montana Tech requests first year funding for Rare Earth/Strategic Metals Processing and Applications Development. The FY2012 request of \$4 million will support necessary equipment, personnel, and state of the art materials process research and design. This is a collaborative effort includes CAMP, Montana Mining Industry, and the Armaments Research Development Engineering Command (ARDEC) located at the Picatinny Arsenal in New Jersey.

Project Description: The overall goal is to help reestablish U.S. manufacturing capabilities, and at the same time, expand Montana-based manufacturing capabilities and technical expertise in the mineral processing and extractive metallurgy of rare earth element (REE) ores, as well as their recycling from waste streams, and manufacturing of strategic materials. New technology will also be developed to reduce the waste streams associated with extracting these strategic materials.

Historically the U.S. was a leading producer of REE, but currently 97% of the world's REE production comes from China. The U.S. needs to invest in applied research and manufacturing capabilities to regain and sustain a favorable strategic position in REE production and strategic materials manufacturing. Due to a rapid rise in demand for REE, the U.S. finds itself competing with many countries throughout the world for access to REE. There is an urgent need to develop leading-edge mineral processing and extractive metallurgy technologies for REE production and other strategic materials.

Currently, approximately 49 elements in the periodic table are considered rare earth/strategic metals. They include such elements as cerium, manganese, titanium and tungsten. Strategic metals are used in a variety of technologies including lasers, electro-optics, jet engines, hybrid cars, steel alloys, wind turbines, flat screen televisions and cellular phones. REE metals, a subset of strategic metals, are a collection of 17 chemical elements that are essential in many of today's most advanced technologies, with particular applications in electronics.

The following items constitute the major elements of the proposal:

- New geochemical and geophysical methods for exploration for undiscovered REE deposits
- Develop new models for the origin and geologic setting of unconventional REE deposits
- Develop advanced modeling and simulation techniques to maximize and optimize the harvest of strategic REE for critical weapon system components.
- Establish an in-house analysis capability which is at least equal to, and ideally a generation beyond, that of leading producers in the United States and the world.
- Develop improved technologies for processing and refining of REE mineral processing concentrates.
- Develop improved technologies for recycling REE from industrial waste streams.

Congressional Action Needed: An appropriation of \$4 million in FY 2012 is requested.

Importance to Montana: Montana Tech/CAMP research capabilities will be enhanced through the addition of state of the art analytical and processing equipment, collaborations with industrial producers and manufacturing partners, and the development of engineers, professors, postdocs, graduate students to work in the areas of REE beneficiation and strategic materials manufacturing. The State of Montana will expand its mining industry to develop this relatively untapped resource and will gain technologies for improved mineral and metal production, leading to less energy consumption and pollution. This will enable the Montana mining industry to create good paying industrial jobs. The U.S. Army will gain improved and reliable availability to REE and other strategic materials for critical weapons systems, and more sustainable manufacturing approaches, while the U.S. economy will benefit by improving availability of REE and other strategic materials using "green" technologies, boosting exports and improving the balance of trade.

Contact at Montana Tech: Jay W. McCloskey, Interim Director, Center for Advanced Mineral and Metallurgical Processing, 406-496-4875, jmccloskey@mtech.edu

Project Title: Montana Institute for Simulation Technologies (MIST)

Executive Summary: Montana Tech requests one year funding for the Montana Institute for Simulation Technologies. The FY-2012 request for \$2.3 million will provide support for necessary equipment to implement Montana Tech's connection to the Rocky Mountain Supercomputing Centers as a Center of Excellence in modeling, visualization, and simulation. This funding will be key in creating advanced computing, modeling, simulations, and visualization research capability within the Montana University System and will enable our leading research institutions to participate more fully in DoD missions resulting in increased research funding, personnel training and private economic development for Montana.

Project Description: Montana Governor Schweitzer initiated an effort in 2007 through the Montana legislature to establish an integrated high performance computing capability to support research and technology innovation in the State. This effort ultimately resulted in the formation of a private non-profit organization: The Rocky Mountain Supercomputing Center (RMSC). Montana Tech's Montana Institute for Simulation Technologies (MIST) will be a Center of Excellence for modeling, simulation, and visualization research that provides connection to RMSC and its clients.

This partnership in computing, modeling, simulation, visualization research, and advanced networking capability opens new opportunities for federal research and industrial in Montana. The Department of Defense (DoD) High Performance Computing Modernization Program (HPCMP) works to build computing capabilities in the U.S. to support DoD data-intensive missions such as persistent surveillance, missile defense, hypersonics and propulsion, and remote sensing (e.g. UXOs). The development of MIST's capabilities in modeling, simulation, and visualization research will enable our leading research institutions to participate in these DoD missions resulting in increased access to research and technical educational funding for Montana through competitive grants at NSF, DoE, and NIH.

Congressional Action Needed: An appropriation of \$2.3 million is requested.

Importance to Montana: MIST is partnered with RMSC to develop integrated, high-performance computing for advanced computation (especially those involving tera- or peta-scale data), modeling, simulation, and visualization research. This partnership will serve the needs of national and state industries, especially in the areas of energy exploration, transportation, geographic information systems, aerospace, material sciences, biotechnology and medicine. Currently, MIST is running several multi-processor, high-performance computers (e.g. a 28 processor, 64-bit Linux cluster with a sustained computational throughput of over 57 Giga-Flops) and is working with RMSC to develop comprehensive high-performance super-computing as part of an integrated cyberinfrastructure within the region, which will impact research funding in the Montana University System.

MIST could develop into an DOD HPCMP Allocated Distributed Center (ADC) to provide modeling, simulation, and visualization research capabilities to portions of the DoD research community in the mountain west. The ADC program deploys modest-sized systems to distributed centers where there is a significant advantage to having a local HPC system and where there is a potential for advancing DoD applications using investments in HPC capabilities and resources.

MIST's modeling, simulation, and visualization research capabilities would be focused on several specific mission requirements for the HPCMP including:

- Life-cycle infrastructure engineering (e.g. water, transportation, waste, energy and communications);
- Engineering materials, design and prototyping of nano-scale materials for application in aerospace and biomedical imaging; and,
- Medical, genomic and bioinformatics data analysis in support of areas such as infectious diseases, new diagnostic and surgical solutions and protein/pharmacophore interactions Virtualization and Training Simulations.

Contacts at Montana Tech: Dr. J. David Hobbs, Department of Chemistry, 406-496-4194, dhobbs@mtech.edu and Dr. Hal Millegan, P.E., General Engineering Department, 406-496-4856, hmillegan@mtech.edu

ENERGY AND WATER

Project Title: Mobile Biomass Energy Unit for Diseased Timber Harvesting

Executive Summary: UM requests \$2.4 million to support proof of concept, site analyses, converting fuel systems on equipment, procuring feedstock processing equipment (chippers, pelletizers, trommels, etc.), refurbishing the biomass unit (update systems, increasing output capacity, augment complement of engineers and operators, adding transformers and measurement ports), enhancing analytical capabilities (effluent composition and energy analyzers, calorimeters, gas chromatographs), building additional biomass units, installing hydrogen separation equipment, and adding gas collection and storage facilities.

Project Description: Forests all across the Rocky Mountain West are being decimated by the onslaughts of bark beetle infestation. In Montana alone, a 2008 survey by the U.S. Forest Service determined that 2.5 million acres of forests are under attack from beetles. That's over 17 million trees! Once a tree is attacked, there is little that can be done to prevent the eventual demise of the tree. It happens slowly, but inexorably over the course of 2 to 3 years. Trees grow pale, turn red, and then become a ghostly grey. Once the infected stand is dead, it presents a new risk in the form of dense fuel concentrations that substantially increase the probability of wildfires that burn with greater intensity. Besides threatening communities, wildfires pump enormous amounts of greenhouse gases and pollutants into the atmosphere and increase health risks as the smoke plumes cast across broad swaths of the region. Incredible quantities of useful biomass are also squandered in the process.

With grant funding from the USDA and DOE's Biomass Research and Development Initiative, The University of Montana developed and built a portable biomass electrical generator for a demonstration and outreach project that is in its final year of performance. The generator is capable of using wood or agricultural wastes as its feedstocks and generates 25 kilowatts of electrical power and 250,000 British thermal units (Btu) per hour of thermal heat that can be used to dry the feedstock or to provide space heating. The process uses clean and efficient downdraft gasification to render lignocellulosic material into a combustible gas which then acts as fuel for an internal combustion engine and generator. Because the process uses combined heat and power technologies, the overall efficiency is better than 70%.

This research initiative proposes to add another dimension to forest management practices as the Forest Service and other organizations develop strategies to cope with beetle damage. Forest treatments will be necessary to promote parasite and disease-resistant tree stands. Additionally, the same treatments will also help control fire and human health threats while also producing residue waste material in the form of forest slash. Mobile biomass generators could be deployed to treatment sites to salvage waste residues and convert them into an energy source that could then displace fossil fuels in treatment equipment and thereby defray costs. Alternatively, a mobile biomass unit could be positioned at a point on the utility power grid that is proximate to a treatment operation. In this way, a biomass unit adds value by generating power directly onto the grid and by minimizing the transportation costs of hauling the waste material. Such a system could help power remote command & control operation centers and emergency disaster relief facilities with locally available biomass. With the appropriate feedstock processing, other biomass residues such as straw, corn stover, invasive plant species and even trash could all be used to generate electricity and heat.

Congressional Action Needed: An appropriation of \$2.4 million is requested.

Importance to Montana: This proposal will add value to a biomass energy resource that is currently not utilized and is adding increased risk to the public. It can help supply the energy requirements for treatment on public lands and defray the costs to taxpayers and stakeholders. As a carbon-neutral process, energy production will not add new carbon dioxide to the environment. In Montana and the greater Pacific Northwest, forest industry jobs and infrastructure may be preserved by embracing such renewable technologies.

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Project Title: Test Facility for Technology Development of CO₂ Sequestration Monitoring and Leakage Mitigation

Executive Summary: Montana Tech requests first year funding for a laboratory scale test facility for technology development of CO₂ sequestration monitoring and leakage mitigation. The FY2012 request of \$3 million will provide funds for the design and preliminary construction of the facility. Long-term storage (sequestration) of CO₂ in geological formations (such as oil and gas reservoirs) has been proposed as a way to stabilize atmospheric CO₂ levels. To make geological sequestration a viable mitigation strategy, development and verification of monitoring methods to detect leaking CO₂ and identify leakage paths is needed. Unfortunately, the many unsuccessful attempts to stem the recent calamitous oil leak in the Gulf of Mexico demonstrate that we still lack technologies to quickly and effectively plug such leakage. The development of leakage remediation technologies is imperative to ensure the safe deployment of geological CO₂ sequestration.

Project Description: We propose to develop a laboratory scale test facility for CO₂ sequestration monitoring and leakage mitigation at Montana Tech. This test facility comprises a "CO₂ sequestration/leakage simulator" where supercritical CO₂ and brine are combined to form high-pressure CO₂ saturated brine, simulating the sequestered CO₂ in geological saline formations. Above the brine in the simulator is a caprock approximately 6 feet in diameter with variable thickness for testing. On top of the simulated reservoir, a diagnostic system creates and records scaled, high-resolution seismic data to be used for monitoring the caprock system before, during, and after various pressure/leakage scenarios. These seismic data will then be used to locate positions of cracks and fractures in the caprock and determine if leaking CO₂ can be detected directly. Cement may then be pumped into the leaking zone to simulate the effectiveness of various cementation formulations to seal the leakage.

Construction of this unique testing facility will address the following questions within two themes:

1. **Monitoring:** How to detect and locate the leaking zone if leakage occurs? Can baseline and time sequence seismic monitoring detect crack formation and directly detect leaking CO₂? Can seismic acquisition techniques and instrumentation be optimized for leak detection?
2. **Plugging:** How to seal off the leaking zone? What recipes for the cement slurry should be developed for a specific rock type in the leaking zone? What casing types should be chosen for the relief well? How can the effectiveness of the cementation job be assessed?

These questions address the necessary CO₂ sequestration technology development required to detect and remediate CO₂ leakage when it occurs. Using this facility, we can (1) investigate the detection and monitoring of CO₂ leakage in a controlled and reproducible environment using materials with known properties employing scaled seismic data to monitor conditions over time and (2) investigate effective plugging of CO₂ leakage through subsurface cementation by injection of cements and determining the best combination of cement and injection technology to achieve success.

Congressional Action Needed: An appropriation of \$3 million in FY 2012 is requested.

Importance to Montana: Montana's coal resources provide great opportunities in building coal-based power/fuel plants. Once CO₂ sequestration technology becomes mature, the major issue associated with coal-fired power plants, that of handling carbon dioxide, can be solved. The usage of Montana's vast coal reserves can be maximized. The facility will also be the first of its kind in the world to integrate the technologies of *detecting* and *remediating* leakage of sequestered CO₂ in deep geological formations. This facility would place Montana on the research frontier in CO₂ sequestration technology development. The two research themes will help Montana attract and retain the next generation of researchers in clean energy development, those who will shape the energy and technology futures of Montana, the nation, and the world. We also expect the test facility will further enhance Montana Tech's ability to produce one of the best engineering workforces, our students.

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INTERIOR AND ENVIRONMENT

Project Title: The Wildland Fire Science Partnership and The University of Montana's National Center for Landscape Fire Analysis (NCLFA)

Executive Summary: UM requests \$1 million to meet goals in core fire and fuels science, application development, science delivery, and workforce enhancement. Additional 2012 funds will be used to develop three new programs that: restore and sustain landscapes, link fire science regionally, and reconcile federal, state, and local firefighter education and training.

Project Description: Since 2001, The University of Montana's National Center for Landscape Fire Analysis (NCLFA) has produced well-grounded projects, programs and applications in response to priorities identified by land managers. Original funding for NCLFA came through the USDA Forest Service and the USDI Bureau of Land Management through Congressional appropriations. In 2007 NCLFA became part of the base budget in the USDA Forest Service Wildfire Research Program and in 2008 the Rocky Mountain Research Station (USDA Forest Service), the University of Idaho (College of Natural Resource), and The University of Montana (College of Forestry and Conservation) formed the Wildland Fire Science Partnership to continue developing and delivering useful products and services to fire management. The Wildland Fire Science Partnership currently operates with \$2.6 million in base funding within the Wildfire Research Program.

Specific activities:

- Partner with the Southwestern Crown Collaborative and affiliates to develop rigorous methods to monitor and assess landscape change and recovery; demonstrate state-of-the-art data management and sharing; and engage scientists in collaborative decision making.
- Establish a regional science delivery consortium that links the Joint Fire Science Program's national science delivery network to local users; identify emerging needs; develop innovative mechanisms for science delivery.
- Identify and reconcile gaps and overlap in federal, state, and local firefighter training and work with stakeholders to more fully integrate university-based education into agency training standards.

Congressional Action Needed: An appropriation of \$1 million is requested.

Importance to Montana: Since wildland fire is a major factor in Montana forests and grasslands, research and development dealing with wildland fire is important to effective fire management and suppression. The consortium that is the Wildland Fire Science Partnership brings together the Region's most accomplished and respected wildland fire science organizations into one coordinated unit to provide the needed service to the land management and fire communities. Benefits accrue from development of new knowledge and technologies, increased effectiveness in wildland fire management and suppression, increases in safety for wildland fire personnel, and potential cost savings from development of better techniques and fire management planning and strategies.

Contact at UM: LLoyd Queen, Director, National Center for Landscape Fire Analysis, 406-243-2709, lloyd.queen@umontana.edu

Project Title: Natural Resources Building Addition

Executive Summary: In collaboration with the Rocky Mountain Research Station, UM requests \$5 million to connect the existing Forestry Building and the Old Journalism Building, a structure of 60,000-80,000 square feet gross, to house parts of both the CFC/MFCES and Rocky Mountain Station activities. Both entities particularly need new laboratories/greenhouse and meeting spaces that are unavailable in current buildings and that will not be included in the renovated Forest Science Laboratory. Execution of this proposal would foster considerable integration of programs and result in synergy between the University and RMRS.

Project Description: The College of Forestry and Conservation (founded in 1913 as the School of Forestry) and the Montana Forest and Conservation Experiment Station (founded in 1937) currently occupy parts of seven buildings on the University Mountain Campus. These units are severely limited by lack of space and modern facilities for both research and education. In addition, the USDA Forest Service Rocky Mountain Research Station has relatively antiquated facilities on campus in the Forest Science Laboratory and the Aldo Leopold National Wilderness Research Building. Thus, both units need space and modern facilities.

By combining efforts it would be possible for these units to gain considerable synergy through the development of new facilities and the renovation of the Forest Science Laboratory. The Forest Service has within the President's FY 2011 budget funding to renovate the Forest Science Laboratory. They also have expressed interest in selling the land and building now recognized as the Aldo Leopold National Wilderness Research Center so that they can expand the Forest Science Laboratory beyond the renovation desired.

The objective is to provide the first installment on a joint facility housing activities of the College of Forestry and Conservation/Montana Forest and Conservation Experiment Station and the USDA Forest Service Rocky Mountain Research Station on the campus of The University of Montana-Missoula. This new facility will provide modern work space for a synergistic research effort between the University and the Rocky Mountain Research Station.

Congressional Action Needed: An appropriation of \$5 million is requested.

Importance to Montana: The state and regional benefit of this program is providing new and expanded facilities for the cooperating units (both Federal and University) in support of the natural resource information and technology needs of the US Northern Rockies region. Benefits in the form of new knowledge and technologies for the management and use of natural resources will be developed in this new facility. In the short term jobs will be provided in the construction industry and over the long term jobs will be created for scientists, graduate students, and others involved in research and development. This new facility will foster synergy between scientists of the University and the Rocky Mountain Research Station and one should expect expansion of research and development efforts in Missoula, especially regarding topics such as wildland fire management, forest ecology and silviculture, natural resource economics, wilderness and protected area stewardship, and wildlife management. All of these topics are quite important to the region since it is a region of relatively intact ecosystems, abundant wildlife populations, considerable recreation and wilderness activity, and frequent and critical wildland fire issues.

Contact at UM: Perry Brown, Provost and Vice President for Academic Affairs, 406-243-4689, perry.brown@umontana.edu

LABOR, HEALTH & HUMAN SERVICES, EDUCATION

Project Title: Living Well with a Disability: Extending Health Promotion to Veterans with Disabilities

Executive Summary: UM requests \$500,000 to extend the cost effective *Living Well with a Disability* program. Developed at The University of Montana, the Living Well with a Disability program has been widely recognized as an effective community-based health promotion program for reducing secondary conditions experienced by adults with disabilities. Use of *Living Well with a Disability for Veterans* could significantly assist veterans with disabilities in regaining independence and function. Moreover, its application may also reduce inappropriate and unnecessary medical service utilization and, thereby, save resources.

Project Description: While the initial medical care and rehabilitation is often the best that can be provided in the world, the pathways to services and support after hospital discharge are less well organized for military veterans. Many veterans experience significant disability from injuries and chronic conditions. This leaves many veterans at risk for an array of secondary conditions to their disability. Many of these conditions could be managed and prevented effectively through community-based health promotion. *Living Well with a Disability for Veterans* is a proven, community-based health promotion program that is delivered to veterans with disabilities through partnerships between veteran's programs and local community-based programs (i.e., centers for independent living).

To date, 642 Living Well facilitators from 176 organizations in 34 states have been trained. The combined efforts of these facilitators have served 5,072 individuals with significant impairments. Participants' annual symptom-free days are estimated at having increased by 60,356 days, and that the total cost savings range from \$4.7 to \$8.1 million. Discounting the cost of the program itself, the estimated net benefit to healthcare payers is between \$1.7 and \$5.1 million.

Depending on the economic perspective taken, extending the *Living Well with a Disability* to Veterans translates into medical service cost savings that range from \$340 to \$1,002 per participant over 12 months. Consequently, a modest national effort to implement Living Well with a Disability for Veterans could save the Veterans Administration and private insurers a significant amount of resources annually. In addition, the program could help VA patients with mobility impairments live healthier, more productive lives.

In addition to strong legislative support, national organizations with extensive memberships support Living Well and Working Well with a Disability, such as:

- American Association on Health and Disability (Roberta Carlin, Executive Director) – representing over 4,000 professionals across the nation; and,
- Association of Programs for Rural Independent Living (Billy Altom, Director) – representing 250 organizations in 43 states.

Congressional Action Needed: An appropriation of \$500,000 is requested.

Importance to Montana: There are approximately 2.8 million Veterans receiving Veteran Administration disability compensation, of which 257,100 are rated 100% disabled. Approximately 40% of current military recruits come from rural areas, nearly twice the proportion of the total population living in rural areas.

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