

Montana State University Federal Priorities for FY2015

COMMITTEE

1. **AGRICULTURE**
 - NIFA Agricultural Programs

2. **COMMERCE, JUSTICE AND SCIENCE**
 - NSF EPSCoR
 - NASA EPSCoR
 - NASA Space Grant
 - Support for a Regional Climate Hub in Montana

3. **DEFENSE**
 - MilTech
 - TechLink

4. **INTERIOR**
 - Designation of the Northern Rockies as a USGS Priority Ecosystem

5. **ENERGY AND WATER**
 - Energy Efficiency and Renewable Energy (EERE)
 - Fossil Energy

6. **LABOR – HEALTH & HUMAN SERVICES – EDUCATION**
 - Brain Research and Recovery Center
 - Student Aid, Student Retention, Time to Graduation and Student Engagement

7. **TRANSPORTATION**
 - Unmanned Aircraft Systems (UAS) – FAA Center of Excellence Program
 - MMTrans: Western Transportation Institute / Montana Manufacturing Extension Center

NIFA Agricultural Programs

Agriculture

Three USDA NIFA programs are of special importance to MSU: Hatch Act, Smith-Lever and AFRI. Hatch Act funds support agricultural research through the State Agricultural Experiment Stations (SAES) at land grant institutions.

Smith-Lever 3 (b) and (c) provide funding for cooperative extension activities, providing practical applications for the knowledge, processes and technologies available. AFRI supports competitive funding solicitations which are usually released on an annual basis. In FY 2013, MSU received \$2,479,498 in Hatch Act funding and \$2,364,455 in Smith-Lever funding. Both Hatch Act and Smith-Lever funding were reduced 9% from the Federal 2012 level. Projects funded through AFRI in FY13 totaled approximately \$628,000.

Hatch Act:

Hatch Act funds benefit America by providing research capacity at 1862 land-grant universities and related institutions in order to:

- Develop new biofuels/bioproducts, enhance energy efficiency, and reduce dependence on foreign oil.
- Improve knowledge concerning the complex linkages between food, nutrition, and human health.
- Protect America's food supply and ensure our biosecurity.
- Combat the twin epidemics of obesity and diabetes.
- Preserve the nation's natural resources.
- Build strategies for producers, consumers, and communities to address climate change.
- Maintain competitiveness of US food, fiber, and fuel producers in the global marketplace.

Agriculture in Montana has historically adapted to wide swings in environmental conditions through scientific innovations, change in management practices and hard luck. The acceleration of environmental condition dynamics dramatically impacts water quantity and quality, temperature extremes, drought frequency, pest dynamics and other components. Current research is central to comprehensive adaptation science discoveries and application in agriculture and natural resource systems.

Smith-Lever:

The Smith-Lever Act of 1914 established the Cooperative Extension Service and provides federal funds for cooperative extension activities. The act requires that states provide a 100% match from non-federal resources. The act also authorizes special extension projects under section 3 (d). Current projects funded under this authority include the Expanded Food and Nutrition Education Program and Renewable Resources.

AFRI:

For FY2013, AFRI focused on five challenges: keeping US agriculture competitive while ending world hunger, improving nutrition and ending child obesity, improving food safety for all Americans, securing America's energy future and mitigating and adapting to climate change.

Issues:

In FY 2013, funding levels for Hatch Act were \$219 million, for Smith-Lever \$271 million, and AFRI \$277 million. These levels at least need to be maintained and increased if possible.

Montana NSF EPSCoR

Commerce, Justice, Science
National Science Foundation
Research and Related Activities

Background

Montana's NSF EPSCoR is a statewide science infrastructure program funded by the National Science Foundation. EPSCoR, which stands for Experimental Program to Stimulate Competitive Research, builds capacity across the state in science and technology through investments in people, tools, and ideas. This enhanced infrastructure enables Montana to better compete for the \$31 billion in research funding which the federal government annually makes available to universities, helps Montana institutions undertake research of importance to economic vitality and business development in the state and provides research experiences for students.

Impact on Montana

This capacity building has successfully catalyzed science and engineering research centers and groups that generate significant scientific discoveries for the nation and economic growth for the region. EPSCoR invests in:

- Hiring world-class faculty into the Montana University System. Since 2007, 34 new faculty members have been hired who have garnered over \$28 million in external funding. Ninety-eight (98) new faculty have been hired since 2001, with over 90% still at their institution.
- Training and recruiting of graduate students. Stipends and investment to recruit the best students has resulted in 306 graduate students supported by Montana NSF EPSCoR since 2001.
- Supporting undergraduate research to assist faculty and provide invaluable experience for training the next generation of scientists and engineers. Over 1,380 undergraduate students have received support for their research since 2001. Participation in research projects gives students valuable skills in conducting original and creative scholarship and often contributes to addressing state technology needs.
- Supporting Montana's Native American community: By supporting research projects at the tribal colleges, training graduate students, and strengthening math and science education, NSF EPSCoR has improved scientific capacity at tribal colleges. Since 2007, 124 Native American students have participated in EPSCoR supported research projects at the tribal colleges. Thirty-three (33) Native American high school students have participated in the summer Accelerated Math Program preparing them for Calculus in college.
- Communicating Science to all Montanans. Education and outreach efforts in 2012 reached over 100,000 people in Montana with travelling exhibits and on-line and print media.

Issues

The FY 2012 appropriations level was \$150 million. The FY 2013 request was \$158 million. The FY 2014 goal is \$158 million plus an amount that reflects any increase in overall NSF funding. NSF EPSCoR will also need to be reauthorized in America COMPETES, which expired September 30, 2013.

NASA EPSCoR

Commerce, Justice, Science
NASA—Education

Background

The NASA Experimental Program to Stimulate Competitive Research (EPSCoR) is designed to develop a national research capacity in support of NASA by expanding research infrastructure and expertise in states that have traditionally had a limited research base in NASA and NASA-related areas, including space, aerospace and earth sciences. The program consists of (a) a small award (\$125,000 per year) to each participating jurisdiction to facilitate interactions with NASA centers and programs and to develop research proposals and (b) competitively awarded three year, \$750,000 grants to pursue a specific research topic. The FY 2013 funding level, after sequestration cuts, was \$16.7 million.

Impact on Montana

Montana EPSCoR has competed successfully for a number of research awards, including the grant instrumental in forming the Montana Gravitational Wave Astronomy Group (MTGWAG), the grant key to forming the Native American Research Laboratory (NARL) at UM, and several others in the fields of Lidar, Solid Oxide Fuel Cells, Climate Change, Radiation Tolerant Computing, Content-Based Image Recognition, and extra-solar planets. Montana NASA EPSCoR research principal investigators and teams have subsequently won over \$10M in federal, state, and private *directly-related* follow-on awards.

MTGWAG is now one of the world's leading Gravitational Wave Astronomy groups. Headed by Dr. Neil Cornish, the group specializes in determining how we will decode the data resulting from this revolutionary new field in astronomy. Several doctoral graduates of the group now work for NASA, and the group adds to the MSU Department of Physics' high achieving reputation.

The mission of NARL is to provide American Indian undergraduate students and graduate students with "hands-on" research opportunities in basic sciences in a culturally-relevant cross-disciplinary and cross-cultural environment. The NASA EPSCoR grant enabled NARL to enter into competitive research in the field of extremophiles such as live in the thermal pools in Yellowstone, offering Native Americans from across the country the opportunity to do NASA-related research at UM.

NASA EPSCoR continues to build infrastructure and support technology transfer activity in Montana in scientific areas important to the nation. In electrical engineering, Montana is a leader in developing Lidar systems for analyzing the effects of aerosols on Earth's climate. Researchers in computer engineering are finding ways to mitigate radiation damage to computers in space, an important field as NASA's current 'radiation-hardened' computer components lag in technology by 15 years. In mechanical engineering, a NASA EPSCoR supported group is researching better solid oxide fuel cells, an exciting potential power source for space missions. In earth and computer science, researchers are studying the Greenland ice-bridge for clues on how our global climate is changing. Researchers in physics and computer science are developing significant changes in how scientists search huge astronomical images databases, which will make searching data and recognizing patterns much more efficient. In astrophysics, UM researchers are part of a nation-wide team that will make great leaps in finding and studying extra-solar planets in the habitable zones of their stars.

Issues

The FY 2015 goal is \$25 million, the current authorized amount. The NASA EPSCoR program will be reauthorized in the 2014 NASA Reauthorization Bill.

NASA Space Grant

Commerce, Justice, Science
NASA-Education

Background

The NASA Space Grant program, operating through an awardee in each state and connecting more than 1,000 affiliates around the country, promotes NASA science, research, education and outreach through scholarships and fellowships, public programs, teacher support, research, curriculum enhancement, faculty development and related activities designed to ensure a trained workforce pipeline for NASA and NASA-related industries, as well as for STEM-related professions. The FY 2013 funding level, after sequestration cuts, was \$38 million.

Impact on Montana

Space Grant in Montana is a statewide program operated out of MSU. Montana Space Grant Consortium (MTSGC) has been widely recognized for its student flight programs and for its systems approach to projects which enables students to experience research and development processes similar to those used at NASA and in industry. Major programs in Montana include the student satellite program which launched Montana's first satellite; BOREALIS student scientific high altitude ballooning programs; research funds available to STEM undergraduate students in Montana; Tribal College tethered ballooning and aurora detector programs; internships in Montana and at NASA Centers; STEM education grants to Montana faculty for new courses or other enhancements; the Space Public Outreach Team (SPOT) where specially trained undergraduates travel around the state teaching K-12 students about current NASA missions, and more.

The MTSGC student satellite, then called Explorer 1 [PRIME], was chosen as the number one qualifier for NASA's first EVER Cubesat launch, positioning Montana's student satellite program as the best in the nation. When the first launch vehicle failed, Montana was ready with a backup and successfully launched in October 2011. Now called the Hiscock Radiation Belt Explorer, or HRBE, the satellite is operating in orbit and sending back a wealth of scientific data. Over 150 students worked on the HRBE project from its infancy in 2006 until the current operations phase. Two more MSGC-supported satellites will launch in December, 2013. Students graduating from this Montana program have extraordinary success in obtaining jobs in aerospace industry and with NASA. **Over 95% of MTSGC graduates go on to a higher STEM degree or STEM employment.**

Montana's high altitude ballooning programs are also national leaders, having co-hosted five national workshops to help start ballooning programs in other states. The SPOT program engages 5-10% of *all* K-12 students in Montana in space science each year. As a result of a MTSGC program, Montana has a network of aurora detectors at Tribal Colleges across the state. When aurora takes place, the detectors automatically send text messages alerting students and their communities to 'look up!' All detector data is available online for students to analyze. Each year, MTSGC participants gather to share their results at the Student Research Symposium. In 2013, 80 students plus their advisors from 15 Montana campuses gave presentations at the Symposium. Not only does the Symposium offer students a chance to give a public presentation, but it also provides a great avenue for sharing Montana research.

Issues

Maintain at least the FY 2013 level of \$38 million; return to \$45 million authorized level if possible. Ensure that funding goes directly to each Space Grant. In FY 2012, NASA withheld the Space Grant congressional funding increase, resulting in a 30% reduction for each state consortium. Currently, we still haven't been informed if we will receive the FY 2013 Space Grant congressional funding increase. The NASA Space Grant program will be reauthorized in the 2014 NASA Reauthorization Bill.

Support for a Regional Climate Hub in Montana

Commerce, Justice, Science – NOAA

Background

In a July 9, 2013 letter to President Obama, Senator Max Baucus outlined his ideas for dealing with climate change in Montana in a manner that promotes jobs and growth. The priorities reflect Montana's strong commitment to protecting our natural heritage while developing energy potential and supporting jobs.

Among the priorities was the development of a Regional Climate Hub in Montana, recognizing that the Montana University System is a natural fit for a hub that brings together scientists and decision makers to find solutions for Montana's resource challenges. This hub currently exists as the Montana Institute on Ecosystems (IoE). In 2010, the Board of Regents approved the IoE as first statewide institute in Montana's history to address the need for coordinated science in natural resources and environmental areas. The Montana Institute on Ecosystems (IoE) has operational offices at Montana State University and University of Montana and is home to the USGS Montana Water Center and receiving current MtEPSCoR RII Track 1 investment. Affiliated IoE faculty work with other university institutes, field stations and Montana Extension to undertake research on the region's vulnerability to ecosystem change. In addition to reaching across the University System, the IoE has affiliates from Montana's other two- and four-year colleges (including our tribal colleges), federal and state agencies, the business community, and non-governmental organizations. It is truly a community of scholars who draw on the extraordinary landscapes of Montana and to advance knowledge and stewardship of mountain and high plains ecosystems.

The Institute on Ecosystems works across disciplinary, institutional, and geographic boundaries to: (1) **Catalyze and support interdisciplinary scholarly activities** focused on mountain and high plains ecosystems; **Educate and train the next generation** of environmental scholars, educators, and leaders; and **Inspire and engage the broader community** by translating science into solutions that foster sustainable outcomes

The IoE seeks federal funding to develop new statewide research and education initiatives focused on Montana's vulnerability to climate change with respect to water resources, forest health, economic sustainability, and energy development. This investment will result in workforce preparation for a changing future and development of translational science products including production of a biennial State of the State report to be shared with local communities, state and federal land-management agencies, and Montana's decision makers.

Impact on Montana

The goal of the IoE is to improve land management decisions in the region, undertake research that makes a difference in the West, and provide timely information that examines the challenges and accurately conveys the uncertainty in understanding Montana's future. The IoE exists as Montana's resource for science-based knowledge and solutions necessary to tackle the pressing environmental challenges facing mountains and high plains ecosystems and their communities. The high level of inter-institutional and interdisciplinary collaboration that defines the IoE is a model of how a small-population state can excel in research and education, build a well-trained workforce and improve the lives of its citizens. We believe that both universities working together enhance Montana's national visibility and competitiveness in research and education on environmental issues of broad concern.

Issues

Montana is peripheral in current DOI Climate Science Centers and NOAA RISA sites based in Colorado and Oregon. The state is also split in the proposed USDA Climate Hub designation, with the western half served by the Pacific Northwest hub and the eastern half served by the Northern Plains hub. Hence, Montanans are underserved in terms of sharing and receiving climate information, participating in broader national initiatives, and finding solutions for the environmental, wildlife, and economic challenges facing the Northern Rockies and High Plains.

MilTech

Defense

Background

MilTech is a Department of Defense (DoD) “partnership intermediary” that helps DoD Program Managers and small US companies to overcome technical hurdles and manufacturing problems in production of new technology for DoD. Its mission is to get innovative technology into the hands of the US military more quickly, reliably, and cost-effectively. MilTech was established at MSU in 2004 and works closely with MSU's TechLink partnership intermediary and the Montana Manufacturing Extension Center (MMEC).

MilTech provides hands-on assistance directly to DoD Program Managers and small companies to:

- Improve product design to ensure survivability, systems integration, and cost-effectiveness
- Develop sustainable, cost-effective supply chains and manufacturing processes
- Provide technology scouting services for solutions from small manufacturers that solve unique DoD challenges.

MilTech draws on Montana-based and nationwide technical experts as needed and leverages the Dept. of Commerce's Manufacturing Extension Partnership (MEP) centers approximately 1,450 manufacturing engineers at 370 locations around the United States. MilTech's assistance has resulted in the successful transition of more than 95 new technologies from US small business to DoD operational use. Many of these new technologies have supported US military operations in Iraq and Afghanistan, helping to save lives and improve combat operations.

Impact on Montana

MilTech has directly helped Montana companies obtain millions of dollars in DoD procurement contracts and has helped increase the number of high-paying, defense-related jobs in the state. MilTech regularly hires Montana-based engineering, design, and fabrication service providers to assist with prototype development and manufacturing consulting for DoD customers. Montana companies assisted/hired include: Cable Technologies (Great Falls); S&K Electronics (Pablo); Big Arm Design, Dr. Down, and Kimir Machine (Polson); Acutech (Columbia Falls); Summit Aeronautics and Helena Industries (Helena); Nomad Technologies (Kalispell); Arcomac Surface Engineering, Diversified Plastics, and GCS Research (Missoula); PFM Manufacturing (Townsend); Mystery Ranch, Scientific Materials, BlackHawk, CrossTac, K7RND, AutoPilot, Platform2, Pika Design, RixHaus, Sweet Onion Creations, Lattice Materials, Salient Technologies, Bridger Armory, Backpacking Light, and Oboz (Bozeman); CleanWaste, J.E. Soares, Bacterin, and Sunrift Studios (Belgrade); Spika Welding (Lewistown); Lilja Barrels (Plains).

Issues

MilTech was started with Congressional-interest funding in 2004, which it received until 2009. It subsequently has received direct funding by DoD program managers. However, this project-based funding does not cover basic operation and overhead costs. An alternative source of core funding is needed to maintain and sustain this important program.

DoD Program Element (PE) and Contact Person:

- DoD PE Number in the Air Force RDT&E Budget: PE 0604317F, *Technology Transfer*
- DoD Program Manager: Keith Quinn, Air Force Technology Transfer Program Manager, AFRL/XPPD, Wright-Patterson AFB, OH, Tel (937) 656-6159

MSU TechLink

Defense

Background

TechLink was established as a federally funded technology transfer center at Montana State University in 1996. Since 1999, it has served as the US Department of Defense's primary external "partnership intermediary," helping DoD to develop productive technology partnerships with US small business. Based on its success, TechLink "graduated" from Congressional earmark funding to being a line item in the DoD budget in FY 2004.

TechLink helps companies to: (1) license DoD-developed inventions, enabling them to develop new commercial products and services using these innovations; and (2) secure competitive R&D contracts for new technology development, primarily through the DoD Small Business Innovation Research Program.

Results: TechLink has established more than 925 technology partnerships between DoD and US companies. These partnerships include over 365 license agreements, resulting in the transfer of approximately 900 DoD patented or patent-pending inventions to US companies for conversion into new commercial and military products. TechLink brokers approximately 60% of all DoD license agreements with US industry nationwide. It also has helped companies in Montana and the region to secure approximately \$200 million in competitive R&D funding, primarily from DoD, for new technology development. These technology partnerships have resulted in substantial new economic activity and employment.

Economic Impacts: The Bureau of Business and Economic Research (BBER) at the University of Montana conducted a study of TechLink's economic impacts in 2012. That study found that TechLink-brokered agreements between DoD and industry from 2000-2011 generated slightly over \$1 billion in sales of new products and services. Total economic output nationwide from these TechLink agreements was estimated at \$2.9 billion, with nearly 18,000 jobs created or retained. For Montana alone, these figures were estimated at \$190 million in total economic output, with 1,620 jobs created or retained.

Impact on Montana

TechLink has assisted over 160 Montana companies, including most of the state's major technology businesses. Nearly a third of its technology partnerships involve companies in the state. TechLink has helped Montana companies to secure approximately \$92 million in competitive R&D funding, contributing significantly to technology-based economic development in the state. The BBER study in 2012 found that TechLink-brokered partnerships between DoD and Montana companies resulted in \$190 million in total economic output from sales of new products and services. As a consequence, over 1,600 jobs were created or retained in Montana.

Issues

Maintain current annual DoD funding of \$2.5 million for TechLink

DoD Program Element (PE) and Contact Person:

- DoD PE Number in the Air Force RDT&E Budget: PE 0604317F, *Technology Transfer*
- DoD Program Manager: Keith Quinn, Air Force Technology Transfer Program Manager, AFRL/XPPD, Wright-Patterson AFB, OH, Tel (937) 656-9868

Designation of the Northern Rockies as a USGS Priority Ecosystem

Interior

Background

The mission of USGS Priority Ecosystem Science (PES) is to provide scientific studies in support of adaptive management of ecosystems that have near-term societal concern and significant long-term societal and ecological value. These studies bring the broad range of scientific expertise within USGS and our partners needed to address specific environmental challenges of targeted ecosystems identified by the PES program. Studies are designed both to serve local ecosystem management needs and to provide knowledge and approaches transferable to similar ecosystems across the Nation. PES efforts focus on ecosystems where new integrated science approaches can be developed to address the needs of a diverse group of decision-makers. Activities require collaboration and integration of expertise from multiple USGS disciplines, universities, and NGO's to achieve a system scale understanding of ecosystems including response to natural and anthropogenic factors. The efforts have transferability to other ecosystems and contribute to a broader capability needed to understand and assess the health of the Nation's ecosystems.

Priority ecosystems are identified based on the following criteria:

- USGS mission and capabilities fit the science needs of the ecosystem.
- Ecosystem management requires system level understanding based on integrated science, and development of information management systems, predictive models, and decision support tools.
- A strong partnership base is associated with the ecosystem and good funding potential exists.
- The ecosystem or major attributes of that ecosystem are representative of other ecosystems and offers strong potential for transferability of knowledge to other "places" or topics.
- This activity builds upon the efforts and expertise of the entire USGS, bringing a systems approach to the targeted ecosystems.
- This activity has a National context that includes a level of planning, coordination and synthesis, which goes beyond that of other place-based activities.
- Science activities bring together expertise from across USGS and universities so as to focus on the scientific questions of the ecosystem being studied.

We request USGS target the Northern Rockies as full PES with funding of \$2M/year for five years. This level and duration was the stated goal when the program was established.

Outcome for Montana

We believe that the Northern Rockies, particularly the Crown of the Continent and the Greater Yellowstone represent a unique opportunity to study relatively intact ecosystems across broad scales. The current management and research partnerships in both areas, the emergence of the Montana Institute on Ecosystems, and the presence of the Great Northern Landscape Conservation Cooperative provide a unique opportunity to leverage funding to develop an understanding of how emerging management, exurban development and climate change will influence these important mountain ecosystems. The contribution of significant USGS funds from the PES effort could help advance interdisciplinary science on a number of fronts in a part of the world where restoration at broad scales is still possible and there is a willing coalition of partners.

Issues

The current PES program has focused on three major ecosystems that include the Florida Everglades, San Francisco Bay/Delta, and the Chesapeake Bay. These ecosystems represent over 95% of the funding to the program. Other ecosystems like the Mojave Desert and the Platte River have received smaller amounts of support (@\$300K/ea), while the current Yellowstone program has received approximately \$100K/year. Current funding is largely being spent in watersheds and ecosystems that have a coastal influence and are heavily influenced by large population centers nearby. These ecosystems are under duress from a variety of stressors and will be difficult to restore based on the large human footprint nearby. Interior ecosystems have not received the same level of support, yet they are typically not as degraded and offer a real chance of achieving conservation and management goals.

Energy Efficiency and Renewable Energy (EERE)

Energy and Water

Background

The Department of Energy's Energy Efficiency and Renewable Energy (EERE) is of special interest to Montana. The EERE's renewable energy program focuses on biomass and biorefinery systems, geothermal technology, hydrogen and fuel cell technology, water power, solar energy and wind technologies. EERE's energy efficiency activities include reducing the energy consumption of vehicle, building and industrial technologies.

Impact on Montana

MSU has active research programs in biofuels (both algal and plant based), solar, hydrogen energy, fuel cells, energy efficiency and wind energy. Annual total research expenditures in these areas (including private sector match) total more than \$5 million and more than 20 faculty, 30 professionals, 30 graduate students and 33 undergraduates are engaged in these funded projects.

Wind Energy Projects This effort has cataloged wind resources within the state that could assist in siting new wind projects. In addition, there is an ongoing collaborative research effort on the development of better quality composite materials for wind turbine blades. Highlight:

- MSU researchers have developed a multi-axial mechanical testing device and used this to create and maintain an internationally accessed database on composite materials.

Biofuels Projects Research on algal biofuels is with a very vertically integrated team that involves microbiologists that identify extremophiles and study their metabolism to engineers that work on increasing lipid production and investigate microbe mortality in industrial environments. There are also crop based biofuels efforts that focus on improving ethanol production from waste straw without detrimental impact on the primary food crop, and oilseed work that investigates higher value products such as bio-lubricants and bio-plastics. Highlights:

- An MSU researcher has developed use of NILE Red stain as a method to rapidly assay oil content in algae. This method is now standard in the field.
- Researchers have developed and patented a method to stimulate significantly higher oil production from algae using an inexpensive nutrient solution.

Fuel Cell Research Major focuses of the effort are on identifying materials that can operate at high temperatures, are less susceptible to "poisoning" by minute amounts of sulfur, have greater fuel flexibility, and don't require expensive precious metal catalysts. Research has also developed intelligent control schemes that protect the fuel cell from conditions that cause degradation or failure. Control schemes are also being developed for distributed generation systems that can integrate various sources of energy including the grid, fuel cells, wind and/or solar.

Highlight:

- Researchers are developing an innovative reversible fuel cell – battery hybrid that has potential for energy storage and release on both short (battery) and long (reversible fuel cell) time scales which could address intermittency issues in renewables such as wind.

Issues

Continued support for biofuels and other alternative energy development is critical for Montana and the nation and will give MSU an opportunity to compete in an area where it has strong expertise. Alternative energy solutions must look at issues beyond just the technologies for energy generation and must consider issues with integration with existing energy delivery systems, demand response, and implementation in different environments including rural settings.

Fossil Energy (FE)

Energy and Water

Background

The Department of Energy's Fossil Energy (FE) Research and Development program concentrates on improvement of existing technologies and development of next generation systems associated with fossil energy use, such as coal and natural gas which currently provide more than 70 percent of the nation's power.

Impact on Montana

MSU's major activities in fossil energy have involved Carbon Capture and Storage (CCS, also called Carbon Sequestration). Carbon capture and storage efforts are critical to our state and nation. With approximately 25% of the nation's coal supply (6% of the world's), Montana has a huge resource that can contribute to the nation's energy security and the state's economy. CCS provides a means to tap this resource in a more environmentally friendly fashion which can help ensure it remains viable for use. MSU annual total research expenditures in this area (including private sector match) total \$11.8 million and involve 24 faculty, 32 professionals, 31 graduate students and 17 undergraduates. These figures do not include the recent large scale test award mentioned in the second bullet below.

Big Sky Carbon Sequestration Regional Partnership (BSCSP) One of 7 DOE funded regional partnerships focused on mitigating greenhouse gases (particularly carbon dioxide, CO₂, a natural product of burning fossil fuels for energy) via storage in underground geological traps. It also has investigated "terrestrial" storage of CO₂ in soil and plants by change of land use. This program is focused on *demonstration* of carbon sequestration. The partnership includes the private sector, universities, national labs and state government agencies in the region. Highlights:

- BSCSP is gearing up the world's first pilot scale injection of CO₂ into basalts. If basalt storage is proven viable in this test, it significantly adds to world storage potential.
- In July 2011, MSU and DOE finalized negotiations on a large scale test of carbon sequestration. This eight year project is \$85 million in total with \$67 million coming from DOE-FE. This project may also help identify a potential source of CO₂ useful for enhanced oil recovery.

Zero Emission Research and Technology Center (ZERT) This center also deals with carbon sequestration, but has a *basic science and engineering* focus. ZERT is improving fluid flow models to predict the underground behavior of stored CO₂, measuring reaction rates of CO₂ with underground minerals under appropriate conditions, developing and testing the detection limits of new and existing CO₂ detection technologies, and investigating mitigation strategies.

Highlights:

- ZERT developed a first in the world field facility for testing near-surface detection technologies. Both MSU and Montana private sector technologies have been tested at this site and access to this site has helped a Bozeman company win a Phase II SBIR.
- Research into a novel microbially based method for sealing small aperture leaks around wellbores was initiated under ZERT and has attracted a \$1.8 M grant from DOE.

Issues

A significant challenge exists in achieving an appropriate level of regulatory oversight for research in this field. While protection of public and private resources is critical, regulations written for commercial activities that are conducted at very large scale over 25-50 years are onerous to prohibitive for research projects conducted at smaller scale over 1-5 years.

Brain Research and Recovery Center at Montana State University

Labor – Health and Human Services - Education

Background: It has been decades since the last major breakthrough in recovery from serious mental illnesses (SMI), such as schizophrenia, bipolar disorder, major depression and post-traumatic stress disorder. In comparison to other branches of medicine, there is a very poor understanding of the basic mechanisms that cause these conditions. The desperate need for a revolution in this field is clear in Montana where the traditional methods of diagnosing and treating these conditions have not been able to overcome geographic challenges, provider shortages, cultural biases, and funding constraints. Montana consistently has one of the highest suicide rates in the nation and our treatment system is overwhelmed with people at the edge of tragedy.

With the goal of addressing these critical challenges, Montana State University in conjunction with the National Alliance on Mental Illness for Montana (NAMI Montana) seeks to develop a Brain Research and Recovery Center (BRRC). The BRRC would be an interdisciplinary research center with the mission of improving the process of diagnosing and treating serious mental illness through collaborative efforts between neuroscientists, clinicians, engineers, people affected by mental illness, and their families. The Interim Report of the National Institute of Health's Brain Research Through Advancing Innovative Neurotechnologies (BRAIN) Working Group highlighted the need for interdisciplinary collaboration such as what we propose here to help advance brain science and technology. The Working Group specifically stated, "No single researcher or discovery will crack the brain's code. The most exciting approaches will bridge fields, linking experiment to theory, biology to engineering, tool development to experimental application, human neuroscience to non-human models, and more, in innovative ways."¹

Impact on Montana: A Montana-based brain research center would help ensure that Montanans have access within the state to the most cutting-edge, research-driven techniques for diagnosing and treating mental illness. It would also ensure that a portion of federal research into psychiatric conditions and treatment strategies consider the challenges presented when accessing treatment in isolated rural communities with limited treatment providers.

A brain research center would create jobs through the development of a regional "innovation cluster" based upon the revolutions in neuroscience and psychiatric treatment. MSU already offers a variety of specialized programs in the fields highlighted by the BRAIN Working Group, both at the undergraduate and graduate-level, that in combination could fuel a vigorous and preeminent interdisciplinary approach to understanding psychiatric conditions and developing new technologies for their diagnosis and treatment.

Issues: To succeed, our center will require (1) a building to house neuroscience research together with clinical diagnosis and treatment facilities, (2) new faculty lines to provide expertise in cognitive neuroscience, clinical psychology, psychiatry and human neurophysiology and psychopharmacology, and (3) facilities for imaging brain function in humans and experimental animals.

¹ The Interim Report of National Institute of Health's Brain Research Through Advancing Innovative Neurotechnologies Working Group. September 16, 2013. See, http://www.nih.gov/science/brain/09162013-Interim%20Report_Final%20Composite.pdf.

Student Aid, Student Retention, Time to Graduation and Student Engagement

Labor – Health and Human Services - Education

Department of Education

Higher Education

Background

Pell grants, the TRIO programs, student tax credits and deductions are all essential elements of support for students across Montana and the nation. In recent years, students have been forced to borrow more and student debt has increased. This is at least in part due to the general economy and the increase in students that come to us from an increasingly diverse demographic base. In addition, the DREAM Act offers new opportunities for many students seeking a college education. We support a full range of strong programs designed to ensure that our nation's students can pursue the education necessary for an increasingly competitive, technological and global world.

Impact on Montana

MSU is committed to assisting students in completing their education and in doing so in a timely manner. First generation students, students from some rural high schools and students wishing to pursue certain degrees often encounter difficulty in some courses that are necessary to make progress towards their intended degrees. Interventions can help them overcome these difficulties and complete their education, enhancing their own individual opportunities and contributing to a trained workforce for the state. Graduation within a six year period is an often cited goal in current higher education. A shortened time-to-graduation increases the chances that a student will complete a degree and also helps keep the student debt load at a minimum. Finally, student engagement in the community and state is a natural part of the land grant mission of outreach and an important component of community life. MSU believes these issues will be prominent during the next several years and plans to be an active participant in such activities for the benefit of our students, the state and the nation.

Issues

Two forces are likely to bring an array of issues to the forefront: the expiration of the Higher Education Act at the end of this year (although actual reauthorization is expected to slip into next year) and the proposals which President Obama outlined in his State of the Union address. The Higher Education Act is a comprehensive piece of legislation, encompassing a variety of programs from student aid to institutional development. Regulatory issues are also likely to come into play. President Obama put some of the issues on the table when he discussed "value and affordability" in his address. He referred to the Department of Education's Scorecard, which was released the following day and the Administration has suggested tying federal aid to accreditation. In supporting documents for his address, the Administration said, "The President will call on Congress to consider value, affordability and student outcomes in making determinations about which colleges and universities receive access to federal student aid, either by incorporating measures of value and affordability into the existing accreditation system; or by establishing a new, alternative system of accreditation that would provide pathways for higher education models and colleges to receive federal student aid based on performance and results."

The resolution of these issues can have a profound impact on higher education. MSU will need to track the issues closely and participate in the debate on them.

Unmanned Aircraft Systems (UAS) – FAA Center of Excellence Program

Transportation

HUD

FAA – Research, Engineering and Development

Background

The FAA operates a number of Centers of Excellence (COE), dedicated to specific topics and operated by universities with numerous academic and industrial partners. The lead for a CoE must be a research university and CoEs tend to have a number of academic partners. In fact, FAA encourages universities in different states to work together. MSU has been working with Mississippi State University (as the lead contractor) and numerous other universities on the creation of a dedicated and comprehensive UAS Center of Excellence. We anticipate a Federal Aviation Administration Unmanned Aircraft Systems Center of Excellence Request for Proposals will be released in the spring of 2013. Our team consisting of Mississippi State University as the lead contractor, MSU as a core team member and seven other universities as Affiliate Team Members along with scientist from government labs and the private sector will submit a proposal in response to this anticipated solicitation.

The focus of the efforts by Montana State University and Mississippi State will be:

- 1)** Development and operation of several low cost UAS platforms (fixed wing and rotorcraft)
- 2)** Montana State will work to leverage its Military Operations Areas (MOAs) within Montana to the benefit of UAS development. Companies throughout the US are eager for such opportunities. These sites are unique in that they cover large areas with minimal safety risk during the development of UAS.
- 3)** The combinations of Montana State and Mississippi State have strengths in the complete hierarchy for UAS activities and these will be combined for a synergistic whole. These include:
 - Advanced Materials and Structures (particularly low cost composites manufacturing)
 - Propulsion (including high power density fuel cells and bio-based liquid fuels)
 - Guidance and Control (redundant and reconfigurable computers)
 - Remote Sensing and sensor development
 - Large-scale data collection and interpretation
 - Mission planning (human factors and training)
 - Public policy related to UAS operations in civilian airspaces

These topics are consistent with ongoing FAA Centers of Excellence and will augment the existing centers, including but not limited to: Joint Center for Advanced Materials Research, Aircraft Noise and Aviation Emissions Mitigation, General Aviation, Airworthiness Assurance, Operations Research, Airport Technology, Commercial Space Transportation, and Computational Modeling of Aircraft Structures. In particular, using UAS technology as a testbed for the existing FAA Centers of Excellence offers a low risk opportunity. This is in direct support of **The FAA's**

Role: Safety First [as stated in the FAA Fact Sheet – UAS

http://www.faa.gov/news/fact_sheets/news_story.cfm?newsid=6287].

Impact on Montana

This project offers an opportunity to coalesce civilian and military utilization of UAS and airspaces to bring new research and business opportunities to the State. There are needs for ongoing projects which already utilize, or are testing UAS technologies in Montana. Among them, wildfire patrol and mission planning, border patrol, various law enforcement in remote areas, remote sensing for various agriculture needs, test platforms for existing Montana companies needing UAS access, surveillance of disaster areas, etc. Furthermore, Montana has had a track record of spinning off its research for the creation of high tech companies within the state. This project will serve to leverage several ongoing and relatively mature research disciplines to that end.

Issues

Support and fund separate FAA Center of Excellence for Unmanned Aerial Systems (UAS)

Support research in UAS technology

MMTrans: Western Transportation Institute / Montana Manufacturing Extension Center Transportation

Background

The Western Transportation Institute (WTI) advances the field of transportation and develops the next generation of professionals by conducting cutting-edge, multidisciplinary research. WTI excels at partnering with faculty, other universities, transportation agencies and private sector partners. It is the nation's largest transportation institute focusing on rural transportation and has been a designated University Transportation Center since 1998. WTI conducts collaborative research in more than 40 states, at local, state, and federal levels, and is often called upon to provide testimony at congressional hearings and to USDOT and industry advisory boards.

The Montana Manufacturing Extension Center (MMEC) is a statewide manufacturing outreach & assistance center with a mission to provide systems and solutions to help Montana manufacturers innovate, plan, perform and grow. MMEC has a proven record of positive impact for client firms and the economy. MMEC's "boots on the ground" outreach model is somewhat unique in government services, and the State of Montana views MMEC as the lead organization for manufacturing technical service.

A new organizational structure which will allow for greater collaboration between the two organizations while maintaining the mission and brand of each will provide great benefits to Montana State University and the State of Montana, while creating local, regional, national and international impacts for the manufacturing and transportation industries.

Impact on Montana

Transportation plays an enormous role in the success or failure of Montana's manufacturing firms, in both the supply and distribution chains. In the 2013 Manufacturing and Logistics Report on Montana sponsored by Conexus Indiana, Logistics Industry Health was given a grade of D+, while Global Reach earned an F. Cost and availability of raw materials and lack of local manufacturing support infrastructure were among the areas of greatest concern in a recent (2013) survey of Montana's small manufacturers.

According to the 2013 State of Montana Manufacturing Report, manufacturing accounts for approximately 21.5% of the state's economic base, and there is an ongoing trend toward increased emphasis on supply chain management and improved efficiency. The Montana Department of Labor and Industry suggests that 2.58 new jobs are created elsewhere in the economy as a result of one new manufacturing job.

Energy production, in particular, is experiencing a dramatic increase in Montana, especially from the Bakken oil fields and the Powder River Basin region, both in eastern Montana. This increased production will put a heavy strain on existing transportation infrastructure, and new solutions will be essential. In Heavy Traffic Ahead: Rail Impacts of Powder River Basin Coal to Asia by Way of Pacific Northwest Terminals prepared for the Western Organization of Resource Councils, the authors predict that "*The U.S. coal export market is headed for explosive growth of coal movements from the PRB region in Montana and Wyoming.... The projected movement of 75 million tons per year by 2017 to 170 million tons per year by 2022 will generate billions of dollars in annual revenues for railroad, coal and terminal companies.*"

Collaboration between WTI and MMEC will have far-reaching effects on Montana manufacturers and the transportation networks that support them and will also provide a conduit for direct interaction between private manufacturing firms, researchers, transportation providers and national, state, and local policy-makers.

Issues

Both WTI and MMEC rely on federal grants for a large portion of their base funding. Dollars are highly project-based; therefore, a separate funding source in the amount of \$400,000 is needed for the two organizations to strategically plan and implement structural changes which will best achieve the goals of synergistic collaboration and administrative economies of scale.

