



Seth Bodnar  
President

UNIVERSITY OF MONTANA

# FY 2019 Federal Initiatives

## Table of Contents

*Electronic copies of the project descriptions are available at:  
[www.umt.edu/research/fedrelations](http://www.umt.edu/research/fedrelations)*

### **Agriculture**

- Mass Timber  
*\$2 million plus report language in Agriculture Research Service*

### **Defense**

- Defense Critical Language and Culture  
*\$10 million increase plus report language under Defense Language and National Security Education Office*  
*\$4 million increase plus report language under SOCOM Specialized Skill Training*
- Advanced Warfighter Physiology and Operational Readiness Program  
*\$5 million plus report language in Air Force RDT&E*
- Gender-specific Physical Training to Optimize Operational Readiness  
*\$5 million plus report language in Army RDT&E*
- Assessment of Montana Veterans for Repetitive Mild Traumatic Brain Injury  
*\$2 million plus report language in Defense Health Program*

### **Homeland Security**

- Assistance to Firefighter Grants  
*\$15 million increase plus report language under FEMA Federal Assistance*
- Self-Adapting Security Mechanisms  
*\$3 million plus report language under DHS S&T*

### **Interior**

- Fire Center and the Wildland Fire Science Partnership  
*\$3 million plus report language in U.S. Forest Service Rangeland Research*
- Integrated Wildlife Analysis  
*\$2 million plus report language in Fish and Wildlife Service*

## **Continuing Projects of National Importance**

### **Agriculture and Related Agencies**

- McIntire Stennis Cooperative Forest Research Program -- \$40.6 million

### **Interior**

- Forest Service/Joint Fire Science Research Program -- \$6.914 million (same as FY 16 enacted)
- Cooperative Wildlife Research Unit (CWRU) -- \$23.9 million

### **Established Program to Stimulate Competitive Research (EPSCoR)**

- NSF EPSCoR under CJS Appropriations -- \$170 million
- NIH Institutional Development Award (IDeA) under LHHS Appropriations -- \$380 million
- DoD EPSCoR under Defense Appropriations -- \$15 million

## Mass-Timber Tall Wood Living Building

### National Need

Increasing temperatures and decreasing rainfall conditions cause drought and dry conditions that, along with a shift in forest management strategies on federal lands, has greatly increased the risk of catastrophic wildfires across the Northwest. This puts homes and livelihoods at risk and puts more carbon back into the atmosphere, perpetuating a vicious cycle. Meanwhile, small towns are struggling with the decline of traditional industries like forest products, resulting in a steady shift of populations from rural to urban centers.



### Addressing the Need

In Montana, these two glaring problems overlap and the solution may as well. Working together, individuals from the University, industry, and the environmental sectors can increase forest health, create jobs in rural communities, and create beautiful, smart structures that store carbon. As the oldest academic forestry program in the west, the Franke College at the University of Montana can serve as a leader in creating a bright future by building a new forestry facility that showcases progressive research and education in natural resource sciences, innovative strategies for sustainable forest management, a resilient and integrated forest industry, and a new path forward in green building design.

### Reduced Carbon Footprint

-  Volume of wood products used:  
1,451 cubic meters (51,250 cubic feet)
-  U.S. and Canadian forests grow this much wood in:  
4 minutes
-  Carbon stored in the wood:  
1118 metric tons of carbon dioxide
-  Avoided greenhouse gas emissions:  
433 metric tons of carbon dioxide
-  Total potential carbon benefit:  
1551 metric tons of carbon dioxide

This new building – framed and built with cross-laminated timber (CLT) – will demonstrate one path to sustainability: harvesting our nation’s forests in a strategic way that promotes forest health, sequesters carbon and provides an inexpensive, renewable resource for construction. CLT is an engineered wood panel that is redefining the building industry. Developed in Europe over 20 years ago, CLT is now in demand across North America as a lighter, low-carbon, renewable and sustainable building material. The product rivals the strength and durability of steel and concrete.

### FY 2019 Request – \$2.0 Million

**Project Title:** Mass-Timber Tall Wood Living Building  
**Appropriation Bill:** Agriculture  
**Service/Agency:** Agriculture  
**Account:** Agriculture Research Service  
**Requested Amount:** \$2.0 Million  
**Language:** Report

*Value-Added Wood Products – The Committee provides \$2,000,000 to support Mass-Timber research and demonstration projects, with an emphasis on laminated timber technology and tall wood buildings.*

The Living Building Challenge, part of the International Living Future Institute, is a green building certification program and sustainable design framework that visualizes the ideal for the built

environment. Currently, there are only a dozen buildings in the U.S. that are certified as Living Buildings. Qualifying for this prestigious certification and using the State of Montana as replicable model, this effort will also show how the timber and wood product manufacturing industries can flourish again with a building made with Montana wood, processed in a Montana mill and use technology from a Montana company.

## **Economic Impact in Montana**

This initiative would benefit the emerging mass-timber industry in Montana, as well as the wood industry supply chain from logging to transport of construction materials. Columbia Falls, Montana was chosen in 2012 as the site for the first cross laminated timber manufacturing facility in the U.S. The SmartLam Technologies Group recently announced plans to expand production from 20,000 cubic meters to more than 80,000 cubic meters, and add 75 new employees by the end of 2019. Demand for mass-timber products is growing in the U.S., and construction of tall wood buildings will increase demand and open new markets.

## **Contact Information**

### **University of Montana Contact**

Tom DeLuca

Dean

W.A. Franke College of Forestry & Conservation

University of Montana

Missoula, MT 59812

(406) 243-5521

tom.deluca@umontana.edu

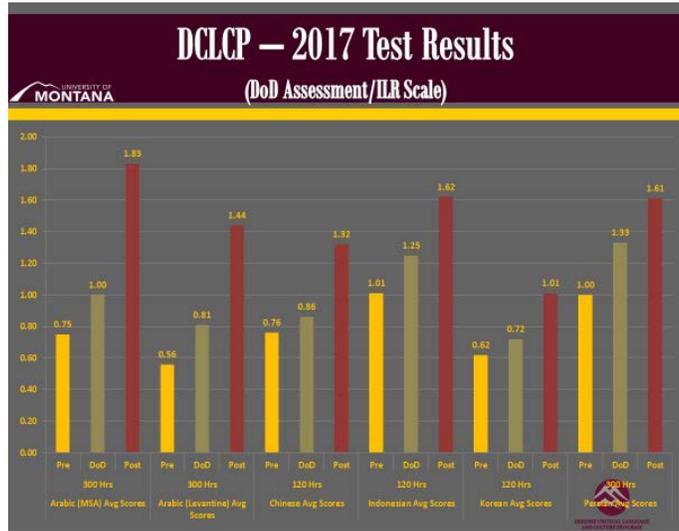
[www.cfc.umt.edu](http://www.cfc.umt.edu)

## Defense Critical Language and Culture

The Defense Critical Language and Culture Program (DCLCP) provides intensive language and culture training for members of the Active Duty Military, the National Guard, Reserve and Intelligence Agencies utilizing a congressionally funded contract through the Defense Language and National Security Education Office (DLNSEO). DCLCP customers are primarily Special Operations Forces, Intelligence Agencies, and the National Guard. Currently, training includes on-site (University of Montana) and synchronous on-line language courses in Arabic (MSA and Levantine dialect), Chinese, Dari, Indonesian, Korean, French, Persian and Pashto; as well as culture courses about the Middle East and East/Central Asia. Our current Language Training Center contract is for \$2.54m. For FY 2019, program sustainment at our current level of requested service from DoD will require \$2.75m.

### Benefits of the Program

DCLCP courses are designed to enable students to learn languages and understand cultures of strategically significant nations at a time when bilateral and multilateral relations are increasingly complex. DCLCP provides students with language fluency and cultural awareness, essential elements of Counter-Insurgency Warfare, allowing them to conduct effective interaction in a variety of settings with heritage populations through language classes ranging from basic to advance. Each class is presented by language and culture professors and is an accredited college course from the University of Montana. DCLCP is committed to adapting the content, length, location and timing of instruction and courses offered to fit the needs of military units and US government agencies.



Department of Defense test results demonstrate DCLCP students' end of course fluency rates are among the best in the nation—fully 38% better than the DoD language fluency standard.

DCLCP has leveraged the academic capabilities of The UM and fully integrated our program to afford our DoD students the optimal academic experience that fortifies them with a deep cultural and area studies understanding of their region and its peoples as well as language fluency consistent with their diverse needs. Their accomplishments are validated with transferable college credit as well as the opportunity to combine their UM credits with those earned elsewhere and thereby earn a college degree.

### FY 19 Request

The University of Montana requests continued support from the Montana delegation to fully integrate the DCLCP into DOD language training activities, and to ensure that the quality of the training is considered in addition to price when DOD contracts for language and culture training services. To that end, and as a means to better prepare and reward our military members with earned college credit, the University requests Congressional language that encourages DoD and the service components, to include Special Operations Forces, to use accredited academic institutions as the preferred method of providing language and cultural training. The faster proficiency based turn time associated with civilian educational institutions will also yield DoD significant manpower dollar savings associated with the reduced time need to attain requisite fluency. (See blocks below for specific language)

## **FY 2019 Request - \$10 million**

**Project Title:** Defense Critical Language and Culture Program  
**Appropriation Bill:** Department of Defense  
**Service/Agency:** Office of Secretary of Defense  
**Account:** Operations and Maintenance, Defense Wide  
**Line #:** Line #120, Budget Area 4  
**Line Title:** Defense Human Resources Activity; Defense Language and National Security Education Office (DLNSEO)  
**Requested Amount:** \$10 million increase to President's Budget Request  
**Language:** Report

*"The Committee recognizes that, in partnership with universities across the country, the National Security Education Program provides critical college accredited training for service members and government officials in a number of languages and strategic cultures. In addition to amounts already made available by the Secretary, The Committee appropriates for each fiscal year, beginning with fiscal year 2019, \$10,000,000 to support the Language Training Centers of the Armed Forces and Civilian Employees of the Department of Defense."*

## **FY 2019 Request - \$4 million**

**Project Title:** Defense Critical Language and Culture Program  
**Appropriation Bill:** Department of Defense  
**Service/Agency:** Office of Secretary of Defense  
**Account:** Operations and Maintenance, Defense Wide  
**Line #:** Line #70, Budget Area 3  
**Line Title:** Special Operations Command; Specialized Skill Training  
**Requested Amount:** \$4 million increase to President's Budget Request  
**Language:** Report

*"The Committee notes the growing need for language and culture training for US Special Operations Forces engaged in counter terrorism operations. Additional funds are provided to conduct language and training instruction to close gaps identified in recent DoD surveys. Special emphasis shall be placed on quality of language education in addition to the price of training to ensure that warfighters retain language skills throughout their deployments, including preference for programs that provide college education credits."*

## **Contact Information**

### **University of Montana Contact**

Major General (USAF, Ret.) Don Loranger  
Director, Defense Critical Language and Culture Program  
Maureen and Mike Mansfield Center  
University of Montana  
Missoula, MT 59812  
(406) 243-3610  
[donald.loranger@umontana.edu](mailto:donald.loranger@umontana.edu)  
[www.umt.edu/mansfield/dclcp](http://www.umt.edu/mansfield/dclcp)

## Advanced Warfighter Physiology and Operational Readiness Program

---

### Problem to be Studied

Air Force Special Operations and other military personnel frequently operate under highly stressful conditions in the field for extended periods of time. Human performance is a key factor in mission success and the mitigation of fatigue and cognitive errors, nutritional strain, and disorientation and confusion is particularly important. Current attempts to predict and measure operational human performance and mitigate injury are cost prohibitive, inaccurate, and unable to aid in decision making. Sensor technologies are constantly being developed to address this problem, but the incorporation of scientifically-backed software within the technology is inadequate.

The Montana Center for Work Physiology and Exercise Metabolism (WPEM) is working with Air Force Special Operations Command (AFSOC) to develop and refine physiological algorithms that will provide measures of real-time human performance and operational readiness when accompanied with current and future sensor technologies. As part of the Trump Administration's focus on warfighter readiness, additional funding is needed in the following areas.

- Further develop and refine predictive algorithms using physiological and environmental measures by conducting field and laboratory studies with existing sensors.
- Collaborate with USAF to test algorithms' ability to predict performance and reduce injury within the US military.
- Partner with US Forest Service and DoD to implement predictive algorithms to improve performance and reduce injuries.

### Organizational Capabilities

WPEM is a research center on the University of Montana campus (Missoula), boasting two mobile laboratory setups, and a 3,550 square foot high-tech, state of the art facility, including an environmental chamber that can simulate nearly any location on earth. Since inception in 2007, WPEM has successfully conducted several studies for the DoD resulting in nearly \$10 million in funding. We have published over 50 peer-reviewed publications, and established working relationships with; US Air Force, US Army, US Navy, US Special Operations Command and the US Forest Service.



WPEM's recent work with the Air Force, Army, Office of Naval Research, and USSOCOM has led to the early development of predictive algorithms that will allow us to forecast physiological stress and identify individuals at risk for heat and/or cold related injury or reduced performance. The cooperative agreements in place across DOD and ongoing work with AFSOC enable WPEM to serve the U.S. military and other agencies to better understand the physiological demands during training and operational stress in every environment.

The University of Montana requests a \$5 million general increase to Air Force RDT&E Line #6 to develop and refine physiological algorithms that will provide measures of real-time human performance and operational readiness when accompanied with current and future sensor technologies.

## FY 2019 Request - \$5 million

**Project Title:** Advanced Warfighter Physiology and Operational Readiness Program  
**Appropriation Bill:** Department of Defense  
**Service/Agency:** Air Force  
**Account:** Air Force RDT&E  
**Line Title:** Human Effectiveness Applied Research  
**Line # and PE:** Line #6; PE 0602202F  
**Requested Amount:** \$5 million increase to President's Budget Request  
**Language:** Report

*"The Committee recognizes that physiological performance is a key factor in warfighter mission readiness. The Committee supports the Air Force's efforts to develop and deploy wearable and other sensor technologies to monitor the physiological condition of warfighters, but notes a capability gap to predict operational human performance and aid in decision making. A \$5 million general increase is provided to develop and refine physiological algorithms that will provide measures of real-time human performance and operational readiness when accompanied with current and future sensor technologies."*

## Contact Information

### University of Montana Contact

Brent C. Ruby, Ph.D., FACSM  
Director, Montana Center for Work Physiology  
and Exercise Metabolism  
University of Montana McGill Hall, Dept. of HHP  
Missoula, MT 59812  
(406) 243-2117 | fax (406) 243-6252  
[brent.ruby@umontana.edu](mailto:brent.ruby@umontana.edu)  
[www.umt.edu/wpemenvironment](http://www.umt.edu/wpemenvironment)



## Gender-Specific Physical Training to Optimize Operational Readiness

---

### National Need

In January 2016 the Department of Defense opened all military occupations and positions to women, without exception. The policy to fully integrate women into combat roles requires men and women to meet the same standards for combat jobs. As USSOCOM Commander, General Joseph Votel, commented in December 2015, "As USSOCOM moves forward with integration, the command will absolutely not lower, raise, or create multiple sets of standards for special operations. If candidates meet time-tested and scientifically validated standards, and if they have proven that they have the physical, intellectual, professional, and character attributes that are so critical to special operations - they will be welcomed into the special operations forces rank."



Proper military training is essential to developing skills and physical abilities to qualify for infantry, special operations and other combat positions now open to women. Military training and readiness need to align with the new female integration policy in order to better prepare the thousands of women in uniform to qualify for combat duties. Changes to military training need to be based on physiology research and experience. To that end, a more comprehensive inclusion of females in DOD sponsored research is needed to further the understanding of sex-differences and physiological stresses with training and operations. The research needs to be conducted now as more and more female soldiers come forward to pursue combat roles. Currently, the dropout rate for females entering US Army Infantry Training is around 44% compared to only 20% dropout rate for males. The Army anticipates hundreds of female soldiers will continue training for infantry and armor jobs, we must prepare them to meet and exceed expectations.

### Objective

The specific aim of this program is to determine and provide gender specific countermeasures to increase operational readiness through enhanced training adaptations while reducing the deleterious effects of operational stress and the associated increase in musculoskeletal and heat related injury risk. While operational specific stressors are integral to the training of the warfighter, even minor energy imbalances can disrupt menstrual health, protein synthesis and exercise performance. This may ultimately compromise skeletal muscle health and increase risks for musculoskeletal injury, disrupting training and reducing operational readiness.

WPEM will:

- Further develop and refine the Army's understanding regarding sex specific responses to exercise training and adaptive capacities to extreme operational environmental stress.
- Develop clear nutritional countermeasures to reduce negative protein balance and preserve skeletal muscle despite operational negative energy balance.
- Develop gender specific predictive models to forecast training adaptation timelines to optimize training response schedules and compliance.

### Organizational Capabilities

The Montana Center for Work Physiology and Exercise Metabolism (WPEM) is a research center on the University of Montana campus (Missoula). Boasting two mobile laboratory setups, and a

3,550 square foot high-tech, state of the art facility, including an environmental chamber that can simulate nearly any location on earth.

Since inception in 2007, WPEM has successfully conducted several studies for the DoD resulting in nearly \$10 million in funding. Our research efforts have resulted in over 50 peer-reviewed publications, and established working relationships with; US Air Force, US Army, US Navy, US Special Operations Command and the US Forest Service.



WPEM utilizes a state of the art research facility on the University campus and our mobile research labs to conduct translational research in extreme environments. This combination of efforts increases the capacity at which we can provide actionable data to teams and organizations within the operational environment.

Leveraging cooperative agreements with the U.S. Army Research Institute for Environmental Medicine (USARIEM) and the United States Forest Service (USFS) along with data share agreements with the Office of Naval Research (ONR) and collaborations with Air Force Special Operations Command (AFSOC) and the Air Force Research Labs (AFRL), WPEM has unique capacity to serve the US military.

WPEM's recent work with the Air Force, Army, Office of Naval Research, USSOCOM, and the USFS has led to policy shifts to enhance training methodologies, field-feeding strategies, and reduce heat related injury risk. WPEM can access a wide range of study participants that mirror the physiological capabilities of elite warfighters while considering the potential implications of gender differences

### **FY 2019 Request - \$5 million**

**Project Title:** Gender-Specific Physical Training to Optimize Operational Readiness  
**Appropriation Bill:** Department of Defense  
**Service/Agency:** Army  
**Account:** Army RDT&E  
**Line Title:** Medical Technology  
**Line # and PE:** Line #29, PE 0602787A  
**Requested Amount:** \$5 million increase to President's Budget Request  
**Language:** Report

*"The Committee notes the increasing number of females entering military training for infantry and other combat duties now open women as of January 2016. Proper military training is essential for all soldiers to meet the demanding physical, mental, and skill requirements for combat positions. A \$5 million increase is provided to conduct foundational physiological research that will inform Army training doctrine and practice to meet the needs of female soldiers and prepare them to qualify for military occupations previously restricted to men.*

### **Contact Information**

Brent C. Ruby, Ph.D., FACSM  
Director, Montana Center for Work Physiology and Exercise Metabolism  
University of Montana McGill Hall, Dept. of HHP  
Missoula, MT 59812  
(406) 243-2117 | fax (406) 243-6252  
[brent.ruby@umontana.edu](mailto:brent.ruby@umontana.edu)  
[www.umt.edu/wpemenvironment](http://www.umt.edu/wpemenvironment)



## **Comprehensive Clinical, Physiological, and Biochemical Assessment of Montana Veterans for Repetitive Mild TBI**

---

**National Need.** Mild Traumatic Brain Injury (mTBI) caused by blast effects of explosive devices is the “signature injury” of soldiers, Marines, and other service members in the Iraq and Afghanistan conflicts: Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND). Early on, 18% of soldiers returning from Iraq met criteria for mTBI; as the conduct of these armed conflicts progressed, many troops were redeployed to additional tours of duty with yet increased exposure to blast trauma. Active duty and reserve service members are at an increased risk of sustaining traumatic brain injury (TBI), which directly impacts the health and safety of service members, unit readiness, troop retention, and subsequent quality of life post-deployment. Although termed “mild” in comparison to major brain injuries which can result in death, coma, or paralysis, mTBI, particularly repetitive mTBI, may have devastating personal, professional and domestic consequences, with many patients experiencing significant changes in cognition and personality. For example, Veterans are experiencing impairment of memory and concentration, increased anxiety, irritability and mood instability, and sleep disturbances that interfere with job and family relationships, leading to substantial disability. In addition to these immediate consequences of mTBI, blast trauma damage to brain tissue and/or subsequent brain reparative effects may initiate processes leading to neurodegeneration and dementia. Although significant progress has been made in diagnosing and treating mTBI, little is known about the neuropathological underpinnings of repetitive mTBI in veterans.

With leadership from Congress, the Department of Defense and the Department of Veterans Affairs established programs that focus on TBI, including treatment, diagnosis, monitoring, and research to better understand TBI and the brain. The Puget Sound VA is studying tissue from veterans who have donated brains to a novel, pilot Brain Donor Program. Additional funding is needed to add Montana to this Brain Donor program, and to support MSU and UM collaboration with Puget Sound VA/University of Washington on this project that seeks to better understand mTBI in war fighters from both the Iraq and Afghanistan conflicts. This partnership will develop and expand the highly successful pilot Brain Donor Program that will ultimately lend insight into the consequences of repetitive mTBI in veteran populations.

### **Project Summary.**

In this project, Montana State University and University of Montana will partner with VA Puget Sound and the University of Washington to extend the successful Brain Donor Program to understand the consequences of mTBI in Montana veterans. Primary aims will include:

- Correlation of clinical assessments to physiological findings to better understand mTBI
- Correlation of neuropathological findings to mTBI biomarkers from cerebrospinal fluid (CSF) and blood

In the near term, these studies will increase critical knowledge on the underlying causes of repetitive mTBI and the risks that veterans face of debilitating neurodegenerative disease later in life. These studies will improve early diagnosis and catalyze new and effective treatments for mTBI.

To accomplish this project two main objectives are:

- 1. Identify 20 OIF/OEF/OND study participants in Montana with mTBI for coordinated evaluation and inclusion in research programs in both Montana and Washington. Funding will allow the team to assess Montana and Washington veterans to enable:**

- Clinical assessment of mTBI symptoms
- Obtain blood (plasma/serum) and cerebrospinal fluid (CSF) and analyze for mTBI biomarkers, as well as integration of Montana samples with bio-fluids already in hand in Seattle.
- Multimodal neuroimaging (MRI, PET) of abnormalities and correlate TBI-related neuroimaging abnormalities in specific anatomical brain regions with the clinical and oculomotor/balance/sensorimotor data
- Multimodal assessment of cognitive/behavioral, oculomotor/balance/sensorimotor abnormalities with the goal validating a multimodal diagnostic approach of developing a unified composite score to screen for mTBI and monitor treatment efficiency.

**2. Extend successful Brain Donor Network to Montana.**

- Building upon important recent successes of the UW/VA brain donor network in Pierce county WA, a novel Montana/Washington brain donor network will be established in order to collect, analyze, and ultimately understand the neuropathological underpinnings of repetitive mTBI in Veterans.
- Data and specimen sharing among researchers in Montana and Washington will be used to facilitate understanding of mTBI and its clinical correlates to cognitive/behavioral, oculomotor/balance/sensorimotor, and neuroimaging abnormalities.
- In addition, the neuropathological findings may also be helpful in understanding some specific biomarker findings. For example, systemic inflammation continues for many years after traumatic brain injury, with extended expression of inflammatory cytokines causing secondary tissue and neuronal damage. Montana researchers have found that continuous ingestion of concentrated polyphenols (found in apple peels) alleviates severe inflammation in mice by augmenting key immunomodulatory pathways, thus promising to be a safe and complementary approach to TBI therapy.

**FY 2019 Request - \$2 Million**

<b>Requested Amount:</b>	\$2 million increase to President's Budget Request
<b>Project Title:</b>	Comprehensive Clinical, Physiological, and Biochemical Assessment of Veterans for Repetitive Mild TBI
<b>Appropriation Bill:</b>	Defense
<b>Account:</b>	Defense Health Program
<b>Line Title:</b>	Research and Development; Peer Reviewed Traumatic Brain Injury and Psychological Health Research
<b>Line Number:</b>	Line #80
<b>Language:</b>	Report
<i>The Committee is aware of research to establish a brain donor network to better understand mild traumatic brain injury, identify biomarkers for diagnosis and monitoring, and develop novel therapies. The committee supports expansion of this network and research to include veterans in states with high populations of veterans and high instance of suicide.</i>	

**Regional Benefits.** The research at the Puget Sound VA is showing excellent potential for diagnosing and understanding mTBI. Near and long term benefits include:

**Near-term:**

In the near term, veterans in Montana will benefit from:

- Additional clinical behavioral, neurological, neuropsychological, and physiological assessments—integrated with ongoing evaluation and testing in Montana.
- Multimodal structural and functional neuroimaging, CSF, and blood biomarkers.

- Veterans may receive copies of clinically relevant assessments which may help with clinical care.
- Seattle clinicians are willing to provide phone consultation to Montana Veterans' providers to optimize management of PTSD, depression, and migraine headache.

**Long-term:**

In the long term, these studies will increase critical knowledge on the underlying causes of repetitive mTBI and the risks that veterans face of debilitating neurodegenerative disease later in life. These studies, the first of its kind, will improve early diagnosis and catalyze new and effective treatments for mTBI, ultimately leading to better quality of life and potentially reducing the cost of healthcare for veterans.

**Contact Information**

Joe Thiel, Director of Academic Policy and Research  
Montana University System  
[jthiel@montana.edu](mailto:jthiel@montana.edu)  
406-994-6480

## Add Wildland Firefighters for Assistance to Firefighter Grants

---

2017 was one of the most costly years on record for federal emergency and disaster assistance funding associated with wildfires. The past decade has demonstrated that the threat of wildfires is increasing with climate change, and the risk to property and life is growing as population centers expand into areas prone to wildfires. Significant federal and local resources are allocated each year to fighting wildland fires, yet wildland firefighting ranks as a low priority for award under one of the primary firefighting grant programs in the Federal Emergency Management Agency (FEMA): the Assistance to Firefighters Grant (AFG) program. The focus of the AFG program should be expanded to more comprehensively address the unique health and safety issues of the wildland firefighter distinct from structural and wildland urban interface (WUI) fire suppression.



### Program Plan

The Montana Center for Work Physiology and Exercise Metabolism (WPEM) performs groundbreaking research to better understand the underlying health and safety issues of the wildland firefighter workforce. WPEM research has led to an improved understanding of energy and hydration demands, field nutrition strategies, risks of heat related injuries, and the use of physiological status monitoring. Moreover, all of this research has been completed during actual wildfire incidents. Comprehensively, this 20-year research history has contributed to improving the health and safety of wildland firefighters both in and out of the fire season.

The wildland firefighter community relies on the University of Montana to better understand the implications of new technologies, human performance recommendations, and best practices to help them meet the growing demands of work on the fire lines. The University seeks support from the FEMA AFG program to expand their research efforts including:

- 1) Develop a comprehensive pre-season assessment tool to identify wildland firefighters at higher risk for musculoskeletal injury.
- 2) Develop a pre-season readiness assessment and establish job specific levels of aerobic/anaerobic and muscular fitness.
- 3) Develop pre and post-season evaluation platforms to improve job specific physical training and off season rehabilitation.
- 4) Characterize seasonal changes in musculoskeletal health in wildland firefighters and evaluate the need for potential nutritional countermeasures.
- 5) Quantify the impacts of acute and extended woodsmoke inhalation on cardiovascular health and cellular stress.
- 6) Identify acute and seasonal changes in cardiovascular risk markers and evaluate the need for appropriate countermeasures.
- 7) Quantify the quality of sleep during wildland fire incident deployments and the impacts on performance, cognitive impairment and above measures of cardiovascular health.

This project series will be accomplished using a multi-disciplinary research team to capture state of the art measurements related to musculoskeletal health and comprehensive cardiovascular risk profiles on

a large, diverse sample of male and female wildland firefighters in laboratory and field environments. Using a series of acute and extended data collection efforts under controlled laboratory settings and during wildfire incidents, our primary objective is to identify modifiable factors associated with injury risk and develop appropriate countermeasures to decrease risk and increase operational performance. These may included physical training strategies, nutritional countermeasures to combat fatigue, promote cardio-protection and reduce the impacts of smoke and potentially sleep hygiene strategies to increase post-shift recovery.

While the work environment cannot be significantly altered, pre-season fitness parameters can be developed to optimize readiness and improve job specific performance while dramatically increasing safety on the line. Moreover, in season countermeasures can be developed and deployed while on assignment to reduce the impacts of modifiable risk factors for injury. Our center has become a world leader in wildland fire physiology and is uniquely positioned with a long-standing memorandum of understanding with the USFS, Missoula Technology and Development Center, and relationships with fire crews and incident management teams across the country.

These research programs would provide immediate benefit to wildland firefighters in Montana and across the U.S by improving seasonal readiness and preserving the health of wildland firefighters across the wildfire season and throughout extended careers. The outcomes from the laboratory and field studies will result in strategic development of physical training countermeasures and tools to reduce risk while increasing fireline productivity.

## FY 19 Request

### **FY 2019 Request – \$15 million**

**Appropriation Bill:** Homeland Security  
**Service/Agency:** Federal Emergency Management Agency  
**Account:** Federal Assistance  
**Line Title:** Assistance to Firefighter Grants  
**Requested Amount:** \$15 Million above President’s Budget Request  
**Language:** Report

*“The Committee recognizes the growing risk of wildland fires and the increasing demands on the wildland firefighting workforce. Wildland firefighters have unique training, health, and safety needs that should be better supported within FEMA Federal Assistance programs. The Committee provides an increase of \$15 million to the Assistance to Firefighter Grants program, and directs FEMA to use these additional funds only for awards focused on improving Wildland Firefighter health, safety, and performance.”*

## Contact Information

### **University of Montana Contact**

Brent C. Ruby, Ph.D., FACSM  
Director, Montana Center for Work Physiology and Exercise Metabolism  
University of Montana McGill Hall, Dept. of HHP  
Missoula, MT 59812  
(406) 243-2117 | fax (406) 243-6252 [brent.ruby@umontana.edu](mailto:brent.ruby@umontana.edu)

## Self-Adapting Security Mechanisms

**National Need.** Machine Learning combined with Big Data has become a game changer for many industries, including Cyber Infrastructure for the Department of Homeland Security. Malicious disruption to critical infrastructure components are broad and varied. Machine Learning provides the ability to learn from past experience and apply the learned knowledge to mitigate a wide range of cyberattacks. A learning algorithm needs to leverage as much data and capabilities as possible to increase accuracy while still being able to quickly finetune this model to new emerging attacks.

One critically important new cyber infrastructure need is for a scoring mechanism that measures weaknesses in a package's software design, particularly early in the software development lifecycle (Figure 1 highlights a proposed solution). Such a mechanism allows software developers to identify and prioritize weaknesses to fix. It also allows software acquirers and managers to ensure the software they include into their infrastructure has a reasonable level of quality assurance to reduce overall security risk.

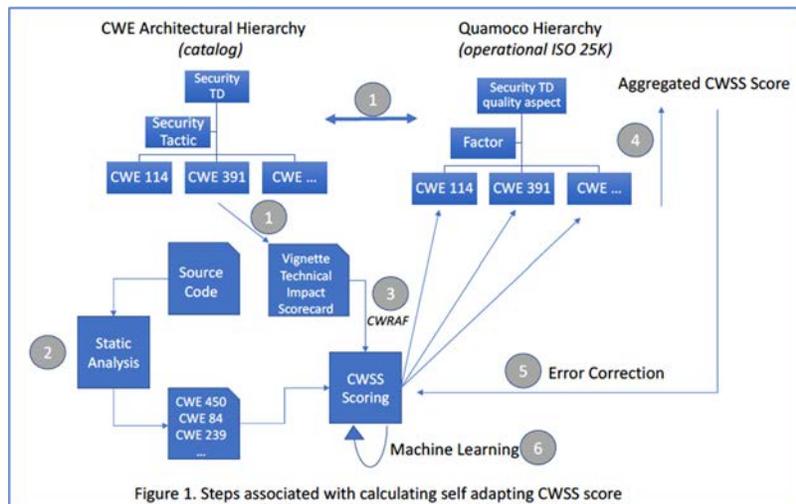


Figure 1. Steps associated with calculating self adapting CWSS score

To that end, the DHS Science and Technology Directorate is working to develop the Next Generation Cyber Infrastructure program. The desired focus is to provide technologies and tools to protect critical systems and networks which enable infrastructure to operate effectively in the face of sophisticated, targeted cyberattacks

**Project Summary.** The University of Montana's department of Computer Science, Montana State University (MSU), through the Gianforte School of Computing's Software Engineering Laboratory (SEL), and local industry partners have nationally recognized research capabilities to include (a) state-of-the-art machine learning algorithms that are accurate and quickly self-adaptive to new cyber infrastructure situations, (b) the usage of agreed upon weaknesses (CWEs) as a basis for scoring threat levels during the design and development of software, thus preempting sophisticated cyberattacks, and (c) the integration and commercialization of these capabilities. Principal tasks include:

- Develop and operationalize architectural CWEs (Figure 1) using the implementation of the Quamoco quality model (an ISO 25k standard) and select the static analysis tools that detect relevant software weaknesses.
- Research and develop machine learning algorithms that can learn from large amounts of data (e.g., deep learning) while quickly adapting to changing environments, and apply these algorithms to various Cybersecurity tasks.
- Integrate one or more of the developed machine learning algorithms to adjust threat scores to fit the context and environment of the developing organization by leveraging DHS's Common Weakness Scoring Systems (CWSS) sponsored research.

A combined approach that includes university research and Montana based small businesses can allow efficient and innovative commercialized research products that support DHS Cybersecurity requirements.

Controlled research at MSU supports applied research at all classification levels from ITAR, Q, and Top Secret, providing the flexibility to support platforms and technology development at any national security level.

### **FY 2019 Request - \$3 million**

The President's FY 19 DHS Budget Request proposes to shift cybersecurity research from the DHS Science and Technology Directorate to the National Protection and Programs Directorate (NPPD). The Software Assurance program within the cybersecurity R&D portfolio drops from \$7.295 million to \$0. There is no mention of Software Assurance in the revised cybersecurity R&D portfolio described under NPPD.

<b>Requested Amount:</b>	\$3 million increase to President's Budget Request
<b>Project Title:</b>	Self-Adapting Security Mechanisms
<b>Appropriation Bill:</b>	Homeland Security
<b>Account:</b>	National Protection and Programs Directorate (NPPD)
<b>Line Title:</b>	Research and Development
<b>Language:</b>	Report

*"The Committee is concerned that critical elements of the Department's cybersecurity research and development program are being terminated as part of the Department's plans to shift cybersecurity research from DHS Science and Technology to the National Protection and Programs Directorate. The Committee directs the Secretary to continue investments in Software Assurance research, and provides \$3,000,000 for work in the area of self-adapting security mechanisms that involve data analytics to establish scoring that measures weaknesses in software design."*

**Regional Benefits.** The Board of Regents of the Montana University System approved in November 2016 the creation of an Applied Research Laboratory on the MSU Innovation Campus. This new 20,000 sf laboratory will be the first TOP SECRET/Q-level laboratory in Montana and is intended to support the growing portfolio of classified work at MSU and throughout the region. The nearest similar facility is the Space Dynamics Lab in Utah. Construction started in early 2017 with completion expected by end of 2018.

This FY 19 funding will support one of the first major classified research efforts to make us of the new Applied Research Lab, and will thereby help launch the new facility and accelerate growth in classified research at MSU. The enhanced capability to perform work on classified programs will support economic development for private industry in Montana through MSU and UM subcontracts and collaborations with U.S. defense contractors and DoD/DoE labs. The classified work will also create more high-paying career opportunities and enhance employment options for MSU and UM graduates. Major participants in this program include:

Gianforte School of Computing at Montana State University

- **Software Engineering Laboratory**

Department of Computer Science at The University of Montana

- **Machine Learning Laboratory**

### **Contact Information**

Justin Cook, Montana State University, [jcook@montana.edu](mailto:jcook@montana.edu), 406-994-4171

Clemente Izurieta, PhD, Montana State University, [clemente.izurieta@montana.edu](mailto:clemente.izurieta@montana.edu), 406-994-3720

Dave Opitz, PhD, University of Montana, [dave.opitz@mso.umt.edu](mailto:dave.opitz@mso.umt.edu), 406-243-2883

## Wildland Fire Science Partnership

The Wildland Fire Science Partnership consists of the UM National Center for Landscape Fire Analysis (Fire Center), the Forest Service's Rocky Mountain Research Station, and the University of Idaho, and serves as a unique bridge between on-the-ground fire managers, fire science, and applied fire technology.

This national Partnership provides sophisticated science and technical expertise to support fire and fuels management and promotes ownership of new science and technology by land managers while providing the research community with exposure to current fire management practices.

### National Need

In 2017, there were 71,499 wildfires across the nation that burned 10,026,086 acres. By developing tools and technologies that provide better information, while educating and training a workforce excited and able to use this information, the Partnership is building an integrated national fire management organization that is gaining efficiency and saving money. As fire managers face challenges in an ever-changing environment, this work will help them use information, solve problems, and apply scientific knowledge to achieve scientifically-sound, cost-effective decisions more quickly and efficiently than ever before.

The Partnership will continue to expand the utility of remote sensing science, geospatial tools, and UAS applications to help natural resource and fire managers collect and share better fire intelligence. Additionally, the Partnership will continue to advance networking and remote monitoring technologies to improve situational awareness on wildland fire incidents and expand mobile computing tools to facilitate data flow at all levels of fire management, including cloud-based management systems that allow fire managers to better access and apply fire intelligence data.



### FY 2019 Request – \$3.0 Million

The FY 19 President's budget eliminates funding for Fire Science Research. The University of Montana requests support to provide a minimum of \$3 million wildland fire science, and the following report language to ensure that a portion of these funds are allocated to the Wildland Fire Science Partnership. This language is similar to what was included in the FY 17 Senate Interior Appropriations report.

**Project Title:** Wildland Fire Science Partnership  
**Appropriation Bill:** Interior  
**Service/Agency:** U.S. Forest Service  
**Account:** Forest and Rangeland Research  
**Requested Amount:** \$3 Million for Fire Science Research  
**Language:** Report

*Wildland Fire Science Partnership – The Committee appreciates the work of the Wildland Fire Science Partnership and directs that \$2 million out of the \$3 million requested by the U.S. Forest Service for Fire Science Research within the Joint Fire Science program be used to study current wildland firefighting operations and the safety and health impacts of such operations on wildland firefighters.*

## Strategic investments

- Drone R&D has established a flight facility with a fleet of aircraft and sensors, test drones for use on wildfires, and trained pilots with regulatory authority to fly. Unmanned Aerial Systems reduce risks and costs of firefighting, and remote sensing technologies characterize fuels, fire behavior, and fire effects.
- Smart IT is in national use with five Fire Center information technology systems and firefighters are using smartphone apps to collect fire weather, predict fire behavior, and share intelligence. Such fire monitoring through extendable internet systems has resulted in information services linking firefighters via smartphones and tablets.
- Begun in 2004, Remote Monitoring continues through networks on two dozen national forests, parks, and other public lands.
- MOUs with four state, federal, and NGO partners are in place and demonstrate long-term commitments to Technology Development and Transfer, testing, and adoption.
- The Partnership possesses unparalleled Knowledge & Experience as staff average 200+ days per year on fire assignments, ensuring that Partnership perspectives are grounded in the current challenges of fire management.
- Fire Management in the new century requires Workforce Development efforts so that skilled employees are trained in resource management and knowledgeable in science, technology, and application development. As part of the Partnership, UM trains and educates future fire managers through innovative curriculum and learning experiences and works directly with collaborators listed below. UM offers new curricula and training, including a minor in Fire Sciences & Management and a Prescribed Fire Practicum, that has allowed 110 students to treat fuels on more than 9,000 acres

## Collaborators

National Forest Systems	National Parks	Local, State, and NGOs
Lolo Bitterroot Flathead Gallatin Bridger-Teton Beverhead-Deerlodge Caribou-Targhee Clearwater Nez Perce Gila Kaibab Lewis and Clark Okanogan-Wenatchee	Glacier Yellowstone Denali North Cascades Grand Canyon Grand Teton	The Nature Conservancy, GA and OR Chapters Georgia Forestry Commission, Georgia Non-Game Div. Missoula County Headwaters Economics Missoula Fire Sciences Lab and four USDA Forest Service Research Stations: RMRS, Pacific SW, Pacific NW, and Southern Montana DNRC Fire and Aviation Management Bureau Eglin Air Force Base Blackfoot and Clearwater Challenges Montana Climate Office Montana Assoc. of Geographic Information Professionals Association for Fire Ecology Northern Rockies Fire Science Exchange Network / Joint Fire Sciences Program Montana/Idaho Airshed Group

## Contact Information

### University of Montana Contact

LLoyd Queen  
 W.A. Franke College of Forestry & Conservation  
 CHCB 441 | 32 Campus Drive  
 University of Montana  
 Missoula, MT 59812  
 (406) 243-2000  
[lloyd.queen@umontana.edu](mailto:lloyd.queen@umontana.edu)  
[www.firecenter.umt.edu](http://www.firecenter.umt.edu)

### Federal Contact

Colin Hardy  
 Rocky Mountain Research Station  
 5775 US West Highway 10  
 Missoula, MT 59803  
 (406) 329-4978  
[Chardy01@fs.fed.us](mailto:Chardy01@fs.fed.us)

## Integrated Wildlife Analysis

### National Need

A growing number of species have been petitioned for listing as Threatened or Endangered under the Endangered Species Act (ESA). The decision to list or delist a species under the ESA is significant and often has far-reaching implications and it is imperative such decisions are based upon the best available science. For many species, the respective Western Association of Fish and Wildlife Agencies (WAFWA) member agencies have the best available data. However, it is difficult to compile and house data from various agencies and conduct range-wide species analyses that explicitly include the participation and input of biologists who collected the data.



### Addressing the Need

The Wildlife Biology Program at University of Montana (UM) recently developed tools to help WAFWA agencies more efficiently synthesize and analyze species data. These tools are leading to improved population analyses of sage-grouse, wolverine, and mule deer, as examples. UM proposes a WAFWA-led process that would help facilitate collaborative data analyses spanning multiple state jurisdictions that allows state and federal agencies to determine species analysis priorities within existing structures such as the Association of Fish and Wildlife Agencies (AFWA), WAFWA, and Joint Ventures, and the committee structures nested within. This process respects data ownership and provides provisions for data oversight and security that would be established through data sharing agreements. It doesn't require or prohibit participation by any WAFWA member agency, but instead creates a platform and workflow process that will improve our ability to accomplish collaborative data analyses spanning multiple states.



The UM proposal further sets forth a clear approach for involvement of WAFWA state wildlife agency biologists in a manner that is often lacking from other broad-scale species analyses. For example, at times in the past, data have been obtained by university or federal researchers via

### FY 2019 Request – \$2.0 Million

<b>Project Title:</b>	Rang-Wide or Regional Analysis of Species Data
<b>Appropriation Bill:</b>	Interior
<b>Service/Agency:</b>	Fish and Wildlife Service
<b>Account:</b>	Resource Management; Cooperative Landscape Conservation
<b>Requested Amount:</b>	\$2 Million above President's Request
<b>Language:</b>	Report

*The Committee recognizes that better tools and methods are needed to enable collaborative range-wide or regional analysis of wildlife species data spanning multiple state jurisdictions and provides \$2.0 million for an effort led by the Western Association of Fish and Wildlife Agencies to establish and evaluate a platform and workflow process to conduct range-wide species analyses that includes the participation and input of biologists and state agency representatives.*

open records requests, and analyses have been conducted without involvement or support of the agency employees who collected the data. The latter approach can lead to suboptimal analyses by failing to incorporate the professional insights and expertise of agency wildlife biologists who have studied the species in the field.

Universities have historically played an integral role in helping support the science needs of state and federal wildlife agencies. Thus, this request does not infer an exclusive WAFWA relationship with UM as WAFWA has strong relationships with many universities. Rather, it recognizes WAFWA support of the UM model for collaborative species analysis, and the considerable technical expertise and analytical capability of faculty within UM's Wildlife Biology Program, which is consistently ranked as one of the top wildlife programs in the nation. Most recently, the Wildlife Biology Program at UM was ranked as the #1 wildlife program in North America by Academic Analytics, based on the accomplishments of its faculty.



## **Contact Information**

### **University of Montana Contact**

Chad Bishop  
Director, Wildlife Biology Program  
W.A. Franke College of Forestry &  
Conservation  
University of Montana  
Missoula, MT 59812  
(406) 243-4374  
chad.bishop@umontana.edu  
[www.cfc.umt.edu/wbio](http://www.cfc.umt.edu/wbio)

## **Continuing Projects of National Importance**

### **Agriculture and Related Agencies**

- McIntire Stennis Cooperative Forest Research Program -- \$ 40.6 million

The McIntire Stennis program provides support to state-certified Schools of Forestry across the U.S. The program is funded under the USDA's National Institute for Food and Agriculture (NIFA). Funds are formula-based and must be matched on a one-to-one basis. Funds can be used for research and training across a broad variety of efforts including ecological restoration, catastrophe management, valuing ecological services, energy conservation, biomass and biobased materials, carbon sequestration and climate change, fostering healthy forests, and maintaining competitiveness in the forestry resource sector. These funds provide critical support to UM's College of Forestry and Conservation, founded in 1913 and one of the first programs accredited by the Society of American Foresters.

### **Interior**

- Forest Service/Joint Fire Science Research Program -- \$6.914 million (same as FY 16 enacted)

Joint fire Science is zeroed out in the FY 19 President's budget. Maintaining funding levels is critical as the program is designed to integrate multiple fire programs to give wildland fire managers new approaches, techniques, information and advanced tools to help them address rising fire suppression costs, deteriorating ecosystems, increasing fire hazards and other disturbances that affect water and environmental quality.

- Cooperative Wildlife Research Unit (CWRU) -- \$23.9 million (same as FY '17 budget request)

The USGS CRU program is zeroed out in the President's budget. UM houses the Montana Cooperative Wildlife Research Unit. Research emphases within the Unit include ecology and management of carnivores, applied landscape ecology, management of large game, interactions between forest management and wildlife, environmental influences on the demography and diversity of birds and related issues. CRUs generally have several positions assigned to a campus.

### **Established Program to Stimulate Competitive Research (EPSCoR)**

- NSF EPSCoR under CJS Appropriations -- \$170 million

Montana NSF EPSCoR is a statewide science infrastructure program funded by the National Science Foundation. EPSCoR builds capacity across the state in science and technology through investments in people, tools, and ideas. Montana currently has an NSF Track-1 EPSCoR of approximately \$4M per year to develop research infrastructure. The NSF EPSCoR program also funds Track-2 awards which include several NSF EPSCoR jurisdictions and recently announced a new Track 4 program. The state of Montana, with UM as the lead institution has a new Track 1 proposal before NSF EPSCoR which should be decided upon in February.

- NIH Institutional Development Award (IDeA) under LHHS Appropriations – \$380 million

The IDeA program is NIH's version of EPSCoR. There are two components to IDeA. One is the INBRE program which seeks to develop a network of researchers in the medical and biomedical fields and the other is the COBRE program which supports the development of research clusters. UM currently has a COBRE 3 award and was recently awarded a COBRE 2 award. UM recently submitted a COBRE 1 proposal to the NIH.

- DoD EPSCoR under Defense Appropriations -- \$15 million

The FY 18 National Defense Authorization Act authorized the Department of Defense to restore the DOD EPSCoR program (DEPSCoR), but no funds were appropriated. If DOD reinstated their EPSCoR program, then UM would be eligible and competitive. Funds are requested under Defense Wide RDT&E Line #3, PE 0601110D8Z.