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1. National Bio and Agro-defense Facility (NBAF)
2. Center for Grain and Animal Health Research (CGAHR)
   • Protecting Swine From Foreign Diseases
   • Wheat Quality and Competitiveness
   • Hessian Fly Research
3. National Animal Health Laboratory Network (NAHLN)
4. National Canola Research Program-Great Plains Region
5. National Plant Diagnostic Network (NPDN)
6. Title XII-USAID International Ag Development: The Importance of Feed the Future Food Security Innovation Labs
7. USDA-ARS Ogallala Aquifer Program

NATIONAL INITIATIVES
1. Association of Public and Land-Grant Universities (APLU)
2. College of Veterinary Medicine/Association of American Veterinary Medical Colleges
MEMORANDUM

DATE:        April 9, 2014
TO:          Members and Staff of the Kansas Congressional Delegation
FROM:        Kirk H. Schulz, President Kansas State University
RE:          Kansas State University Expression of Strength Document

On behalf of Kansas State University, I would like to thank each of you for your work in Washington on behalf of the citizens of Kansas. Your guidance and help has helped the University to launch and enhance programs and research efforts over the years. We particularly appreciate the support you have shown Kansas State University in the past.

This document is presented to you as expressions of university strengths. The university Vice-Presidents, Provost, Deans, and Directors believe these initiatives represent the strengths of the university and match current federal initiatives and programs. In addition these initiatives are in step with K-State 2025. This is the University’s strategic plan with the goal to be recognized nationally as a Top 50 Research University by 2025.

If you have questions about any of these requests, please contact Sue Peterson, Director of Governmental Relations, at 785-532-6221 or skp@k-state.edu. She will provide you with whatever information you may require. You may also access this document electronically on the K-State Governmental Relations website at www.k-state.edu/govrelations/federal/.
AGRICULTURE
Wheat Genetics Resource Center (WGRC):
A Global Leader in Wheat Genetics Research

Background
- Temperature increases are projected to decrease wheat yields by 20-30%
- Demand for wheat is expected to increase by 60% over the coming decades

The WGRC at Kansas State University and public/private partners will leverage wild wheat genetic diversity to ensure the stability and profitability of future wheat crops. Genetic diversity is the raw material for developing new and improved crop varieties. Research at the WGRC will address the challenges of hot and dry climate conditions through adaptive breeding, leading to job creation and billions of dollars in economic impact.

Description
Over the last 100 years, scientists have collected wild wheat species from the harshest environments on earth. Over the last 35 years, the WGRC has assembled a wild wheat species working collection now housed at Kansas State University and the Kansas Wheat Innovation Center in Manhattan, KS. Contained in these wild wheats are naturally developed traits ranging from pest resistance, heat and drought tolerance, and other climate-related adaptation traits to end-user health and nutritional characteristics. Although the WGRC has made pioneering contributions in collecting this treasure trove for wheat improvement programs, limited technology, resources, and expertise impede the ability to efficiently and fully mine these genetic resources.

Addressing this need, Kansas and Colorado farmers, private corporations, Federal and State agencies, Kansas State University and Colorado State University have leveraged expertise and resources to form the WGRC Industry/University Cooperative Research Center (WGRC I/UCRC), a National Science Foundation (NSF) Research Center. The first of its kind in the plant sciences, this Research Center’s mission is to access and apply wild wheat traits to wheat breeding programs across the US and the world.

WGRC NSF I/UCRC research will lead directly to the development of world-changing wheat varieties, reaching every corner of the globe.

Relevance
With operational and infrastructure investment, the Center will greatly accelerate the genetic resources conservation program, bridging fundamental research to commercial applications in a shorter period of time.

Partners in Job Creation, Economic Development, Cutting-edge Technology and Innovation

Center Resources and Objectives
1. Collect, conserve, and distribute wheat genetic resources: The WGRC gene bank currently maintains 20,000 lines, including 4,000 wild wheat species strains, native to the Middle East, that may be extinct, and 16,000 unique genetic stocks. These collections are continuously expanding as the WGRC acquires, develops, and distributes new genetic and genomic resources to facilitate wheat genetics, genomics, and breeding research.
2. Develop improved germplasm with emphasis on drought and heat tolerance: Novel traits are continuously identified and incorporated into improved germplasm. Fifty-seven improved germplasm lines containing novel pest resistance genes have been released and made available to the wheat breeders across the globe.
3. Training and outreach: Over the past 35 years, the WGRC has trained 13 MS, 23 PhD, and 22 Post-Doctoral students. WGRC has sponsored 72 visiting scientists with formal appointments and publishes the Annual Wheat Newsletter for dissemination of research results.

In addition, the WGRC will focus on the identification and application of drought and heat tolerant wheat traits for the Southern Great Plains and other drought prone regions in the US.

Agency Contact Information
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Great Plains Sorghum Improvement and Utilization Center

Background
This project is an effort to enhance the overall productivity and value of U.S. grain sorghum and improve its value as a food, feed, and bioenergy crop.

Description
The U.S. is a major producer of grain sorghum. Kansas and Texas are the largest producers, contributing to >80% of U.S. sorghum acreage and production. Despite the importance of this crop for farmers in dryland conditions, and the many new opportunities for sorghum utilization in the bioenergy, bioproducts, and food industries, particularly gluten-free foods, relatively little public or private resources are being invested in research on genetic improvement, production, or innovative uses of the various types of sorghum. The trend towards less research and technology transfer efforts on sorghum threatens the economic stability of sorghum producers and fails to capitalize on the unique opportunities afforded by this crop. This is reflected in the continual decline in sorghum acreage in the U.S. and, particularly, in key sorghum producing regions of Kansas and Texas. In 2013, sorghum was planted in 7.3 million acres, an increase of 1.0 million acres from 2012, but still lower than 8.3 million acres planted in 2008. The increase in 2013 was due to severe drought stress and relatively poor performance of corn compared to sorghum. Sorghum is more resilient to drought and high temperature stress compared to corn. More strategic research is needed to further increase the yield potential of sorghum under both irrigated and dryland conditions.

Kansas State University initiated the Center for Sorghum Improvement in 2001. In 2006, these efforts were expanded to a regional scale with the development of the Great Plains Sorghum Improvement and Utilization Center (GPSIUC). The GPSIUC extended the interdisciplinary concept to include K-State, Texas Tech University, and Texas A&M University, integrating the combined expertise and resources of these three universities. The focus of research was on genetic improvement, production systems to enhance water and nutrient use, innovative strategies to provide improved weed control, utilization of sorghum in human food products, animal feed, and as a bioenergy and industrial feedstock, plus marketing, and policy analysis in support of the US sorghum industry.

Relevance
Sorghum growers were surveyed nationally in 2005 and again 2009 to identify their primary sorghum needs. Based on grower’s responses, the following objectives were identified:
- Improve yield potential, production efficiency, and food, feed and bioenergy value of sorghum, through plant breeding and genetics.
- Develop new uses for sorghum in food and non-food applications, emphasizing the sorghum grain’s desirable characteristics, such as absence of gluten.
- Identify more efficient production strategies that will enhance water and nutrient use, particularly nitrogen, and provide new options for the control of weeds and pests, to increase sorghum yield and profits.
- Expand research on sorghum as a bioenergy crop uniquely adapted to drier regions of the U.S.
- Provide market and policy analyses, and develop educational programs for sorghum-based products and production systems to increase profitability of all segments of the U.S. sorghum industry.

The GPSIUC is continuing existing research and education programs, particularly in genetic improvement, production efficiency, and sorghum utilization. Sorghum is one of the most drought and heat tolerant crops in the world, offering potential advantages as a food, feed, and bioenergy crop to the rural economies of the Great Plains. The wide diversity of sorghum types (sweet, forage, silage, biomass, grain) offer tremendous opportunity, but these resources need to be evaluated to identify the best suited varieties to meet the specific needs of food, feed, biofuel, and industrial uses. The absence of gluten in sorghum grain offers opportunities for the development of new food products for people suffering from gluten intolerance.

Systems for production, harvesting, transportation, and storage of sorghum products, feedstocks, and co-products have to be developed to meet the needs of the bioenergy industry, while optimizing the use of our natural resources, especially water and nitrogen in our dry climate, and protecting the environment.

To meet the growing demand from private industry and academia, it is important to train graduate students as sorghum scientists. Expanding training and research on genetic improvement, production and utilization will result in technologies and information leading to an increase in sorghum productivity and profitability, and improving the U.S. sorghum’s industry global competitiveness.

Agency Contact Information
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Background/Description
The Food Animal Residue Avoidance and Depletion (FARAD) program is an integrated extension and applied research program that maintains the Food Animal Residue Avoidance Databank, which is designed to eliminate adverse drug and chemical residues from appearing in the edible tissues of food producing animals. FARAD helps keep food animals healthy and safe for human consumption through outreach activities that include a telephone hot-line (1-888-USFARAD), website for request by veterinarians for direct residue avoidance assistance (www.FARAD.ORG), and mobile applications for field use. FARAD is a veterinary tool designed to keep adverse levels of drugs and chemicals from contaminating milk, meat and eggs destined for human consumption. No other federal or private entity duplicates work carried out by FARAD. FARAD straddles the missions of USDA (agriculture research and extension) and FDA (food safety). FARAD is an integrated extension and applied research program that provides required, scientifically valid information on how to avoid drug, environmental and pesticide contaminant residues in milk, meat and eggs, thus helping to avert food safety crises. FARAD provides the scientific basis for determining the appropriate withdrawal period when drugs are used in an extra-label manner, a scenario often employed when veterinarians are trying to reduce antimicrobial resistance in animals they treat. The research component of this program involves development of mathematical models that predict withdrawal times and then can be used real time by veterinarians in field situations. FARAD publishes handbooks and journal digests of these data to increase availability to practitioners, as well as contributing technical manuscripts to the peer reviewed scientific literature of this field. FARAD is also used when food-producing animals are mistakenly exposed to environmental contaminants (pesticides or biotoxins, melamine, etc.), or for example to nuclear fall-out two years ago from the Fukushima reactor disaster in Japan. FARAD provides veterinarians with a legal mechanism for determining withdrawal intervals for extra-label drug use or contaminant exposures. Because it is often not economically viable for pharmaceutical companies to pursue a drug label claim for minor species, FARAD is the only source for food safety and drug withdrawal information for veterinarians treating these particular species (sheep, goats, reindeer, elk, ducks, pheasant, quail, rabbits, fish shrimp, and honeybees). Veterinarians often must use drugs approved for both animals and humans to address animal health and welfare and to enhance public safety. PL 103-396, Animal Medicinal Drug Use Clarification Act (AMDUCA), authorized in 1994, permits veterinarians to prescribe drugs in an extra-label manner to treat conditions for which there are no effective approved drugs. AMDUCA requires a scientifically-derived withdrawal period for drugs used in an extra-label manner. FARAD is the only approved source for such information and in fact enables much needed drug usage in food animal practice. FARAD serves as the veterinarian’s clearing house for residue data.

Relevance National/Regional
Three decades ago, the Residue Avoidance Program (RAP), was founded by the USDA Food Safety and Inspection Service (FSIS), targeting the area of chemical residues. The aim of the RAP was to reduce the rate of animal residue violations through education, rather than enforcement. As part of the RAP, the FARAD program was developed by pharmacologists and toxicologists at four land-grant universities in 1981. As of this date, Dr. Jim Riviere of the College of Veterinary Medicine at KSU is the national coordinator for this program with collaborators at the University of California-Davis, University of Florida and North Carolina State University. FARAD continues to serve as the primary resource for veterinarians to maintain a drug and chemical residue free food supply. With increased funding this year, a global veterinary drug residue database will be started to strengthen the databases, increase influence in the food safety community, while providing support for Kansas beef exporters.

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The Food Animal Residue Avoidance Databank is authorized in the Agriculture Act of 2014 (PL 113-79), Section 7307 [H7308] at $2.5 million. The program is scheduled to be funded for Fiscal Year 2014 at $1.25 million.
Tools for Protecting America’s Livestock Economy

Background
A critical concern of law enforcement and scientific communities is the willful introduction of foreign animal disease (FAD) as a means to crash the U.S. agricultural economy. Therefore, first responders, veterinarians, and diagnosticians require a set of tools for the early detection, prevention and surveillance of FAD. To meet these challenges, K-State formed a strategic partnership with Lawrence Livermore National Laboratory (LLNL). The goal is to develop and implement the next generation of detection and prevention tools for ASF, CSF and other FAD. One objective is to design detection assays that can be rapidly incorporated into standard diagnostic testing so that testing for FAD can be instantly implemented without disrupting continuity. This faster, better, cheaper approach will make the monitoring and testing for FAD a routine activity. The prevention of a disease typically involves the deployment of vaccines. However, for ASF there are no vaccines, and there will be no vaccines in the near future. The best way to prevent ASF is to make animals naturally resistant. The second overall goal of the partnership is to identify pig genes that confer resistance to ASF.

Description
As a land-grant institution, K-State leads the nation in developing the next generation of tools to protect livestock from foreign animal diseases, including ASF and CSF. The focal point for these activities is the Biosecurity Research Institute (BRI), a 113,000 ft² facility with the capacity to conduct infectious disease research on high consequence pathogens. Supporting the BRI is a cadre of scientists, diagnosticians and veterinarians who occupy the Kansas State Veterinary Diagnostic Laboratory (KSVDL) and the College of Veterinary Medicine (CVM). Recently, K-State joined forces with biological and computational scientists from LLNL, the premier national laboratory that applies multidisciplinary science and technology to anticipate, innovate, and deliver responsive solutions for national security needs. LLNL’s biosecurity program has a distinguished track record in developing and deploying advanced biodefense capabilities. Many of these technologies leap-frog traditional approaches. One example is the Lawrence Livermore Microbial Detection Array (LLMDA), a DNA test that can detect more than 5000 pathogens in less than 24 hours. The K-State and LLNL partnership focuses on three areas. The first is the development and implementation of a diagnostic platform that integrates the detection of endemic, emerging and foreign animal diseases into a single test. This faster, better, cheaper approach represents a transformation in the animal health arena.

A second area is the development of DNA chips that can rapidly identify and classify all variants of foreign animal disease pathogens, and to correlate pathogen genetic differences to disease outcome and geographical distribution. The third area is to identify pig genes that are involved in natural protection from infection, which will allow the breeding of pigs that are resistant to disease and/or show an improved response to vaccination.

Relevance
In January 2009, the Department of Homeland Security (DHS) selected Manhattan, Kansas as the location for the National Bio and Agro-defense Facility (NBAF) in January 2009. The mission of NBAF is to protect America’s livestock and agricultural economy from foreign and zoonotic animal diseases. NBAF is being built on the K-State campus, next to the BRI, KSVDL and CVM. Together, these will form one of the largest animal health complexes in the world, which will serve as a magnet for new companies and further economic development. A key discriminator in the selection of Kansas for NBAF was the opportunity to jump-start NBAF research in the BRI. On a broader scale, the BRI serves as the center hub in the wheel of a larger transformation across Kansas. The LLNL-K-State partnership enhances every aspect of the NBAF mission with opportunities to acquire additional funding for applied and basic research supported by both public and private entities. As a partner, the State of Kansas acquires reciprocal gains by retaining Kansas students in Kansas jobs, diversifying the Kansas economy, and transforming K-State’s land-grant mission to meet 21st century challenges.

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Pre-Harvest Food Safety and Security

Background/Description
The goal of this program is to develop strategies to identify and mitigate food-borne pathogens and antimicrobial resistance in beef production systems. Specifically, studies will focus on the ecology of Shiga toxin-producing *Escherichia coli* (STEC), both O157 and non-O157 serotypes, *Salmonella*, *Campylobacter*, and antimicrobial resistance elements in beef cattle and on the development and testing of on-farm mitigation strategies, with the ultimate goal of enhancing food safety and public health. Because of the economic importance of beef production and beef processing in Kansas, as well as Kansas State University's leadership in beef cattle research, it is logical for researchers to focus on food-borne pathogens and pre-harvest beef safety. The research outcomes will have major positive impacts on public health, animal well-being, and the economic prosperity of the state of Kansas and U.S.

Relevance National/Regional
The food supply in the United States is one of the safest in the world; however, food-borne illnesses do occur and frequently are associated with foods of animal origin. The College of Veterinary Medicine at K-State has an interdisciplinary research team to address scientific issues related to the four vital areas in pre-harvest food safety in beef cattle: STEC (O157:H7 and non-O157), *Salmonella*, *Campylobacter*, and antimicrobial resistance of food-borne and normal gut bacteria. The team with microbiology, molecular biology, epidemiology and production systems expertise, with collaborations with researchers from other departments at K-State, and input from key industry stakeholders is generating valid and industry-relevant outcomes. The long-term research goals are to understand the ecology of food-borne pathogens in cattle and their environment and develop effective and practical strategies for comprehensive reduction or elimination of food-borne pathogens at the farm level.

*Shiga toxin-producing E. coli (STEC):* Healthy cattle are the major reservoir of STEC, with the organisms residing primarily in the hindgut. These bacteria are shed in the feces, which then serve as a source of contamination of beef, produce, and recreational and drinking water. Research efforts in the past have focused primarily on STEC O157:H7. Recently, there is increased recognition that six other STEC serogroups, O26, O45, O103, O111, O121, and O145, are also major public health concerns. According to the CDC, the non-O157 STEC serogroups account for twice as many illnesses as STEC O157. However, not much is known about the ecology of the non-O157 STEC in cattle and their environment, partly because methodologies to isolate and detect non-O157 STEC have not been developed. Data on prevalence and factors affecting fecal shedding of these serogroups in the cattle population are needed before strategies for their control can be developed.

*Salmonella:* The presence of *Salmonella* in beef cattle production systems can cause serious adverse effects in cattle as well as humans. In cattle, *Salmonella* can affect morbidity, mortality, production efficiency, and the economic well-being of cattle producers. *Salmonella* is a common cause of gastroenteritis in humans with outbreaks and infections often linked to consumption of contaminated beef, water or other foods. The emergence and dissemination of multi-drug resistant *Salmonella* are also major concerns for public health. The research goals are to understand the ecology and epidemiology of *Salmonella* in cattle.

*Campylobacter:* The species of *Campylobacter* cause enteritis and in some instances abortion in cattle. However, the importance of *Campylobacter* as a food-borne pathogen that can cause sporadic cases and outbreaks of human *Campylobacter* infections. In the past, human infections have chiefly been attributed to poultry sources. Recently, cattle have been recognized as an important source of food contamination. The research goals are to understand the ecology and epidemiology of *Campylobacter* in cattle.

*Antimicrobial Resistance:* The use of antimicrobials in animal agriculture is considered a major contributor to the emergence and spread of antimicrobial resistance in the environment. The concern over antimicrobial resistance has important consequences for public health and food-animal industries, including restricted access to global markets. The goal is to monitor prevalence, amplification, and dissemination of antimicrobial resistance genes and bacteria that carry resistance genes in beef cattle.

The four issues outlined strengthen the need to understand the ecology and epidemiology of food-borne pathogens for effective pre-harvest intervention strategies so that cattle with fewer pathogens and lower antimicrobial resistance elements are presented for slaughter. Control strategies aimed at reducing the prevalence and concentration of these bacteria and their resistance elements in cattle feces, thus reducing the overall number of bacteria entering both food and environmental pathways, may be the most effective approach for reducing the overall risk of human infection and maximizing public health outcomes.

Agency Contact Information
USDA National Institute of Food and Agriculture
Jan Singleton, 202-401-1954
Description
Kansas State University (KSU) is home to a unique cadre of scientists from diverse disciplines with an impressive track record in research, outreach, academic and clinical service programs addressing the health, well-being, and sustainment of service members, veterans and their families (SMVF), including:

- Programs and community support networks for military-connected children and youth, through local 4-H Clubs, schools and OMK youth/family camps
- Research and training programs on violence prevention in military families, quality childcare and childhood social emotional health
- Clinical programs for military personnel, veterans and families
- Research on the long-term effects of deployment and war-trauma on marriages, child and youth development, employment, and financial planning
- Cooperative Extension services to families of military personnel
- Online graduate programs for professionals who serve military families
- Research on the effects of high-intensity functional exercise training on the body composition, fitness and health of active duty military personnel as well as on barriers to physical activity participation for disabled veterans

In addition to contributions made by researchers from colleges across the university, our military programs rely on strong collaborations with area military installations, the Kansas National Guard, Army Reserve, US Department of Veteran’s Affairs, the Department of Defense, and other state and national organizations.

Relevance National/Regional
For American military personnel who have served in war, federal programs have long been in place to address physical injuries from bullets and bombs and psychological injuries of wartime trauma. In relatively recent times, however, veterans returning from war have faced difficulties neither anticipated nor addressed by federal programs. These include chronic health problems resulting from exposure to environmental hazards (e.g., chemical defoliants in Vietnam and a complex mix of neurotoxins in the Persian Gulf War) and Traumatic Brain Injury (TBI) encountered during deployment, as well as long-term health impacts (e.g., PTSD) on SMVF populations. Increasingly for today’s professional military (both active and reserve components), the aftermath of wartime service has consequences not only for veterans’ well-being, but for their families and communities.

Our current partnerships with the U.S. Departments of Agriculture and Defense have been primarily focused on outreach rather than on research funding for the study of military families. These outreach initiatives support significant programming underway at K-State and across Kansas. Proposals to other federal agencies, such as the Department of Health and Human Services, will expand the reach of the College of Human Ecology and its units. Expanding partnerships to support additional investment in relevant research would enable Kansas State University, the College of Human Ecology and the Institute for the Health and Security of Military Families to capitalize on the expertise available here.

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Groundwater and Society: Developing Technologies to Conserve the Ogallala Aquifer

Background
A grand challenge for the 21st century is providing high quality water for Kansas, the USA, and the globe. Fresh water from surface and underground sources is increasingly in short supply in the Ogallala region of western Kansas. Aquifer and surface water depletion, limited precipitation, and population shifts to mid-sized communities in western Kansas have stretched community and regional water supplies. However, this region leads Kansas in crop production and comprises the core of the U.S. beef cattle feeding industry. The top eight Kansas agricultural counties are located over the Ogallala Aquifer and represent $4.7 billion in crops and livestock, or one-third of Kansas’ total agricultural revenue.

Developing more comprehensive understanding of the nexus of water, food, and society is crucial. As demand for water resources continues to increase, improved water management practices for crop and livestock production and water supply assurance for communities will be critical for sustaining economic viability and population base of the region. The latest tools and technologies are available to analyze the impacts of water-use policy decisions on economies and society and to engineer politically acceptable solutions.

Description
An interdisciplinary team of faculty members at Kansas State University studies risks and consequences of groundwater use and scarcity and develops new technologies to help citizens effectively manage water resources. As a Land Grant University, K-State has water-related expertise in agricultural sciences, social demography, resource economics, agricultural systems analysis, water resources engineering, policy analysis, and computer science and technology.

Research: Agricultural sciences, engineering and public policy dimensions of water and society provide information critical to decision-quality actions.

Education: Curriculum in water management, plant genetics, and computational models trains the next generation of water scientists and managers.

Extension and Outreach: Engagement with agencies and stakeholder organizations identify alternative methods to minimize groundwater scarcity challenges and assist water managers implement new practices.

Relevance
This team:
1) Informs citizens, planning agencies and policy

makers understand of technical aspects of water resource management and the economic, social and natural system impacts of policy strategies.
2) Develops more efficient irrigation technologies, improved scheduling procedures, and combined water and nutrient management. Research and extension efforts guide producers in efficient irrigation strategies for various types of irrigation systems, as well as transition towards limited irrigation and dryland practices.
3) Evaluates alternative food and feed grains, oil seeds, and energy crops for drought and heat tolerance, adaptation to no-till or strip-till production systems, and utility as feed for livestock or feedstock for liquid fuel production.
4) Develops and evaluates technology to utilize for wastewater-use from concentrated animal feeding operations. Technologies can decrease potential environmental impacts from wastewater re-use, such as runoff into streams and odor, while conserving fresh water.
5) Utilizes the latest technologies and computational forecasting tools to quantify and understand interactions and feedbacks between available water resources and societal needs and values. Collectively, this computational infrastructure can provide the scientific basis to support sound planning, state, county, and local analysis and decision-making to development of equitable and fair water policies.

While groundwater stores are vulnerable, water resources systems can be made more resilient in order to cope with the foreseeable future. Communities, businesses and agricultural interests worldwide are struggling to address problems in efficient water-use for efficient agricultural and industrial. This program provides science-based research to guide management and policy. Well planned conservation of water resources is critical to the economic viability and stability of western Kansas.

Western Kansas seeks long-term solutions to manage a depleting Ogallala and develop agricultural systems, engineering and policy solutions to sustain the aquifer for current and future generations. Water is a primary requirement for quality of life in drinking water, power generation, crop production, and industrial and municipal use). Without the water of the Ogallala Aquifer, Kansas communities will suffer.

Agency Contact Information
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US Dept. of Interior, USGS, 443-498-5505
Center of Excellence for Food Safety Research in Child Nutrition Programs

Background
The United States Department of Agriculture’s Food and Nutrition Services (FNS) provides support for feeding more than 31 million children school lunch each day in 100,000 schools and about 12.1 million breakfasts in 89,000 schools. The safety of these meals is of great importance, and there is strong Federal legislation to support food safety.

As part of an initiative of the Secretary of Agriculture, FNS established a Center of Excellence for Food Safety Research in Child Nutrition Programs at Kansas State University in 2011 to provide science-based support to improve the safety of foods provided through the FNS nutrition assistance programs, particularly those served in schools and child care settings.

Description
Faculty at Kansas State University has established the Center of Excellence and is conducting research to support food safety issues and concerns of FNS. The Center of Excellence provides researchers the opportunity to conduct food safety research that will have an immediate impact on child nutrition programs and the safety of food served. The goals of the Center of Excellence are to provide a multidisciplinary approach to basic and applied food safety research needs related to child nutrition programs and conduct applied studies to resolve food safety issues in schools and other child nutrition programs and convey those findings in a way that facilitates the transfer of knowledge to school food service directors and program operators, scientists, policy makers, educators, and practitioners.

The Department of Hospitality Management and Dietetics, in the College of Human Ecology, serves as the administrative home for the Center of Excellence. The Center currently has received funding for a three-year period at $2.4 million. Discussions are underway for funding for year four, which would fund the Center until April 2015. Continuation of the Center will depend on FNS priorities and funding availability. Further, FNS could decide to require us to compete for the grant after the fourth year of funding.

This cooperative agreement with FNS provides a funding mechanism for other projects. For example, in 2012-13 we worked with the food safety education group in USDA Food Safety and Inspection Service in planning and implementing a research project to evaluate the effectiveness of one of their educational campaigns. Funding of $500,000 was provided to the Center through an interagency agreement.

Relevance National/Regional
K-State offers food safety expertise along the entire continuum of the food chain that is unparalleled in any university across the nation. Research results generated by the Center of Excellence have national relevance. Research focuses on current food safety issues in practice. This applied research is used by FNS and the National Food Service Management Institute (funded by FNS) as the basis for developing educational programs. This strong relationship ensures that the research is translated in meaningful resources to have a positive impact on practice.

The Center developed an intensive immersion course on the food safety principles that undergird food safety that was pilot tested in 2013. The course will be delivered to school foodservice practitioners to develop their understanding of food science as it applies in their school districts and to develop preventive programs and respond to any crises that might occur. Staff from USDA regional offices and state agencies also will participate.

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EPICENTER: Laboratory for a network approach to predict and control the spread of infectious diseases

Background
Few events disrupt society and cause economic loss as severely as an out-of-control infectious disease. Terrorist activities or natural causes can produce an epidemic that may result in human deaths, the disposal of herds, and the destruction of crops. Fundamental to EPICENTER’s mission is the conviction that epidemic dynamics and intervention strategies must be derived taking into account the underlying complex networks which describe the multiple and dynamic interconnections among involved systems.

Description
EPICENTER, a laboratory within Kansas State University’s College of Engineering, provides resources to build, analyze, and simulate data-driven computational models for biomedical and biological systems represented as complex networks. Research at EPICENTER challenges scientific boundaries by addressing the impact of (1) heterogeneity, (2) interdependence, and (3) stratification of networks in spreading processes. These three characteristics abound in natural and man-made infrastructures and networks, and many fundamental questions still remain unanswered for interconnected and stratified-multilayer networks.

EPICENTER has successfully conducted several research projects since its inception seven years ago. Current projects include:

- **Data-driven predictive models of vector-borne diseases**: This project aims to develop innovative multi-scale computational models and tools for describing potential transmission cycles of zoonotic vector-borne pathogens that could be introduced into the U.S. Data generated by these models will be used to produce an operationally relevant predictive model estimating the timing and spatial extent of emerging vector-borne disease transmission risk to humans.

- **Integrated models of disease spread, supply chain logistics, and communication networks**: The objective of this project is to develop integrated models that capture the interdependencies between disease dynamics, supply chain logistics, and communication networks. For example, the spread of disease is influenced by the movement of animals, plants, and food products through the supply chain. Managing this movement effectively, in addition to deploying countermeasures such as vaccines, requires effective risk and crisis communication plans that engage multiple stakeholders. Stakeholders themselves constitute a network through which information is transmitted. The integrated modeling approach is expected to yield new insight to prevent, mitigate, and respond to infectious disease outbreaks.

- **Spreading processes over multilayer and interconnected networks**: The research goal is to establish rigorous mathematical tools and techniques to understand the role of multilayer and interconnected topologies in spreading processes. For example, a multilayer network is a physical contact network where a disease can propagate among individuals, together with an online information dissemination network where information can propagate among the same individuals. In zoonotic diseases, for example, interconnected networks are the network of animals and the network of humans where a virus can move from one network to the other.

Relevance National/Regional
The National Agricultural Biosecurity Center (NABC), the Institute for Computational Comparative Medicine (ICCM), the Center of Excellence for Emerging and Zoonotic Animal Diseases (DHS CEEZAD), the planned National Bio and Agro-Defense Facility (DHS NBAF), and EPICENTER are all located in Manhattan, Kansas, thus making Kansas the national leader in developing countermeasures to naturally-occurring and intentionally-introduced plant, animal, human, and zoonotic infectious diseases.

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Center for Rural Transportation Research and Education

Background
Kansas State University’s College of Engineering and Department of Civil Engineering currently mutually conduct a cooperative, multidisciplinary transportation research program. Since 1989, the College of Engineering has actively participated in the Kansas Department of Transportation (KDOT) Kansas Transportation Research and New Developments Program (K-TRAN). The K-TRAN program provides approximately $450,000/year in state funds to support applied transportation research projects involving faculty and students from civil, mechanical, industrial, and electrical engineering, as well as from economics, sociology, and geology. K-State also has been the contractor in a number of pooled funds programs where several state agencies pool their resources to fund multi-year research projects of mutual interest. In addition, the College of Engineering and the Department of Civil Engineering have a long history of excellence in the development and delivery of technology transfer programs in transportation and workforce development, including specialty conferences, distance education programs, workshops, and training courses. In 2006, K-State was designated a Tier II University Transportation Center (UTC) under the USDOT Research and Innovation Technology Administration’s (RITA) University Transportation Centers Program, with funding of approximately $450,000 per year through FY 2011. During the period 2005-2011, the K-State UTC generated over $2.3M in new research funding, awarded 42 scholarships and provided financial support for 42 GRA positions. The establishment of the K-State UTC allowed for consolidation of K-State’s transportation-related research and technology transfer programs to a single administrative unit. In addition, establishment of the UTC allowed expansion of the college’s transportation research program to include a substantial education component, including scholarships, assistantships, and travel grants to attract and retain highly qualified students. K-State will be competing for UTC funding in future RITA Grant Solicitations, but the university seeks additional/alternate funding to maintain K-State’s current transportation research programs and to elevate our transportation research program to national prominence.

Description
The research, education, and technology transfer activities of the Center will focus on identifying and deploying rural transportation systems and infrastructure innovations aimed at shortening transportation project delivery, enhancing transportation system safety, promoting economic development and protecting the environment.

Relevance National/Regional
The theme of the proposed Center for Rural Transportation Research and Education is the “Safety and Sustainability of Rural Transportation Systems and Infrastructure.” This theme and corresponding Center expertise for this theme encapsulate three areas of concern widely recognized as critical challenges facing the United States (U.S.): Safety, Sustainability, and Infrastructure. Funding is requested to allow K-State to expand its influence and contributions in order to find and implement solutions to problems related to the safety and sustainability of U.S. rural transportation systems and infrastructure. In addition, the Center can provide expertise to support other federally supported programs and centers currently in place at K-State. For example, transportation center expertise in transportation network modeling and simulation, emergency evacuation planning, and traffic control could be a valuable asset in advancing K-State’s agricultural bio-security programs. Other research focus areas will include rural economic development, alternative transportation project funding sources, use of agricultural by-products in roadway paving materials and rural highway dust abatement programs.

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Child Health and Physical Activity

Background
Childhood obesity is a major public health issue facing the United States and the world. Prevention of childhood obesity is not likely to be solved by a simple solution. Rather, scientific consensus documents suggest that the causes are multifaceted and best understood by applying a human ecological model across the lifespan in research and practice. The College of Human Ecology at Kansas State University is uniquely positioned to address this important public health problem because it is one of a handful of institutions that houses programs specializing in the study and practice of physical activity, human nutrition and dietetics, food sensory analysis, family systems and therapy, and child development.

Description
Scholarly work currently underway includes:

1) Investigation of ways to make health behavior change easier for parents and families to incorporate into their lifestyles;
2) Experiments that incorporate community stakeholders in the process of creating health promoting communities,
3) Analysis of how food and physical activity choices specifically affect health outcomes in children of all ages.
4) Multi-state extension education projects focused on reducing childhood obesity.

Kansas State University has research facilities structured (physically and organizationally) to study child health issues.

1) The Hoeflin Stone House Early Childhood Education Center where children are observed at play and at mealtime.
2) The internationally recognized Sensory Analysis Center investigates how different aspects of food (taste, texture, smell, etc.) affects children’s food choices to better understand how to make healthy options the preferred choice of children.
3) The Center of Excellence for Food Safety Research in Child Nutrition Programs, provides scientific solutions to child food safety problems -- especially food safety problems that are evident in school lunch rooms across the US.
4) The newly established Physical Activity and Nutrition Clinical Research Facility supports cause-effect studies of how lifestyle choices impact the health of children, their parents, and adults.

5) The Youth Physical Activity and Nutrition Motivation Laboratory studies community-based childhood obesity prevention interventions.

The collaborations of College of Human Ecology faculty have led to competitive grants totaling $12 million in funding to support childhood obesity, physical activity, nutrition, and community interventions to improve the health behavior of children.

Relevance National/Regional
The issue of child nutrition and health has national relevance due to its relationship with quality of life and cost of health care. Kansas State University is well positioned to conduct basic and applied research to support improvement of child nutrition and health.

We have the facilities needed to support clinical research of childhood nutrition, health, and obesity and we provide educational programs for school foodservice professionals and other community practitioners whose work impacts the health of children.

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Healthy Cattle, Healthy People, Healthy Planet: Beef Initiative

Background/Description
Kansas State University is recognized as a leader in beef cattle production and health management research, outreach and education. The Kansas State University Beef Cattle Institute is an international leader in beef cattle production education and outreach. The BCI has established the international online bilingual training center for beef producers, veterinarians, food processors and others involved in producing beef. The focus of this training is food safety, antimicrobial antibiotic avoidance, beef cattle health and well-being, employee training, employee retention, and beef cattle production practices. It is vital to understand the impact of management practices on subsequent safety from food-borne pathogens in the beef industry. This program could also enhance food security in the U.S. as an emergency notification system for all people involved in food animal production on foreign animal diseases. The BCI aims to develop an international training center to educate producers world-wide on the best management practices to raise affordable beef while promoting food safety, environmental stewardship and animal well-being.

We are seeking federal support to address emerging issues in the beef industry. The support will: 1) fund further development of an international bilingual training center to enhance beef food safety, minimize antimicrobial residues, improve the health and well-being of beef cattle and promote environmental stewardship through training of the rural workforce world-wide, 2) fund research to manage health and well-being of beef cattle through a living classroom, 3) provide support for effective communications with producers and consumers about best practices for beef production and prevention of the spread of food-borne pathogens, and 4) invest in the development of a program that could be adopted by other food animal industries in the U.S. and other countries world-wide.

Expected Outcomes: Support will provide a far reaching, cost effective program that will: 1) enhance food safety from farm to fork, 2) decrease antimicrobial residues in beef, 3) improve cattle health and well-being, 4) increase job opportunity for English and Spanish speakers in the beef industry, and 5) benefit consumers by providing cost effective training that improves food safety, antibiotic residue avoidance and cattle health without increasing the cost of production or the cost at the counter.

Relevance National/Regional
 Programs offered through the Beef Cattle Institute (BCI) translate and communicate critical animal health and well-being information to the livestock industry. A safe beef supply for the nation begins in the grasslands and extends through the supermarket.

Kansas is home of the second greatest concentration of beef cattle per square mile of any state in the U.S. The beef sector generates over $7 billion annually in cash receipts. The beef industry is absolutely central to the state and the regional rural economies.

Unparalleled challenges and opportunities face the beef industry in the coming decade. Food security, food safety, antimicrobial avoidance and beef cattle health and well-being are dependent on the development of such a center in the United States. Support of this request will provide international leadership for the world’s One Health Initiative… the confluence of animal health, human health and environmental health.

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Materials and Energy from Miscanthus Established to Improve Soil Quality

Background
Kansas State University (KSU) has active research and educational programs related to renewable materials and sustainable energy from biomass. This multidisciplinary research effort includes the Colleges of Agriculture, Arts and Sciences, and Engineering at KSU. The research programs are very important to the Kansas economy and for the reduction of greenhouse gas emissions and sustainable development. A growing need to increase the amount of productive land available for crop production for renewable materials and energy is emerging. Recently, interest in Miscanthus giganteus has been increasing because significant amounts of biomass can be produced with modest water requirements (miscanthus has excellent water use efficiency). It also can be grown on marginal lands not currently used for food production. KSU has NATO funding for a planning grant to collaborate with faculty in Slovakia, Ukraine, and Belarus for miscanthus research with contaminated soils. Several K-State faculty currently have active research programs with miscanthus, phytoremediation, and soil quality. KSU has past experience and well equipped laboratories for this research. Past funding has been from EPA, USDA, and KDHE.

Description
The current plant biomass research at KSU includes agronomic plant biomass production research, agricultural economics studies, research on contaminated mine land soil vegetation, and investigations of processes to produce products from biomass. The integration of systems that include biomass production, harvest, storage, processing, and product marketing has significant value because all aspects are necessary to develop and commercialize new products, such as camelina and miscanthus.

This request is for $5 million for miscanthus research to develop new knowledge while conducting field studies on soils with lead at Fort Riley, establishing miscanthus on abandoned mine land near Galena, Kansas, improving soil quality by growing miscanthus as a productive crop in southeast Kansas near Parsons, and investigating miscanthus as a productive crop in areas with limited or no irrigation water on soils not presently used for crops or pasture. A portion of the funds will be used to conduct research on uses for miscanthus, including combusting it in pellet form for heating in rural areas where natural gas is not available and mixing it with coal to produce steam and electricity. Miscanthus can also be used as forage for cattle, insulation material, bedding for animals, and for conversion to higher value products such as a liquid fuel or adhesive products.

A portion of the funds will be used to conduct a comprehensive review of published literature related to miscanthus in order to build on the research team's review, "Miscanthus as a Productive Biofuel Crop for Phytoremediation," published in Critical Reviews in Plant Science. Two seminars will be developed and presented on 1) the use of miscanthus for phytoremediation and soil improvement, and 2) miscanthus as a perennial crop for sustainable agriculture and biomass production. Each seminar will be conducted over the course of three days and will be videotaped and distributed worldwide.

Relevance National/Regional
Contaminated soils exist in Kansas, our region, and the world. The NATO project focuses research on contaminated military soils. If KSU is able to improve soil quality on lands that are presently idle such that productive crops can be produced, this will have economic value for society. A significant amount of land in southeast Kansas, southwest Missouri, and northeastern Oklahoma has been abandoned because of mining. The proposed research could potentially significantly improve the economy of Kansas and the United States by finding productive uses for abandoned and idle land.

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COMMERCE, JUSTICE, STATE
Background

Vast amounts of data are currently inundating researchers in many fields with few being spared a data deluge. A consistent, university-wide large-scale resource to provide high performance, efficient, flexible data access is a necessity. By providing this access, K-State will be available for future research opportunities while satisfying compliance and data governance requirements from federal funding agencies. Large datastores also are essential for education and economic development, but near-term shortfalls are projected of nearly 200,000 data scientists trained to take advantage of big data and convert it to $300B in economic growth.

Information is currently generated as massive, high-dimensional data sets with complex correlation structures and/or nontraditional formats, arriving with unprecedented velocity. Cutting edge research in the social sciences, life sciences, physical sciences, and education generates petabytes of data which are collected, transmitted, stored, processed, and analyzed in transformative ways, thus revolutionizing how scientists, engineers, business people, and educators approach complex problems. High-dimensional data are generated in diverse fields, including agriculture, astronomy, climate science, ecology, energy, genetic analysis, geospatial sciences, and plant and animal health. Often, these data are generated in real time and require rapid analysis. Other web-based sources for current massive data sets provide new realms of data to explore, such as on-line searches, social networking activities, and financial transactions, with potential for advantageous business decisions and informed policy making. ‘Big Data’ is the term given to data sets characterized above, and ‘Big Data Analytics’ refers to techniques for discovering patterns, unknown correlations, and large-scale inference methods for reliable variable selection and prediction.

Description

This initiative proposes development of an interdisciplinary Center for Data Analytics at Kansas State University-Manhattan, staffed primarily by data scientists from the Departments of Mathematics and Statistics in the College of Arts & Sciences, and faculty associated with K-State’s Institute for Computational Research in Engineering and Sciences (ICRES) in the College of Engineering. These faculty, in collaboration with campus researchers, provide the requisite skills for the design of big data studies, collection, storage, and retrieval of big data, modeling and analysis of such data, and interpretation of results. New tools for Big Data Analytics will be developed and disseminated to the broader community. A fundamental goal of the Center would be the development of innovative curricula for undergraduate and graduate students to engage in large-scale data-driven science and engineering. The Center could specifically contribute collective expertise to precision agriculture, bioinformatics, security, and enhancement of secondary education and provide significant advancements for federal and state initiatives on STEM workforce development.

Relevance National/Regional

The establishment of a Kansas Center for Data Analytics is well-aligned with K-State 2025 goals related to research, graduate, and undergraduate education, including research experiences for undergraduates. The Center will focus on university strengths and critical needs, particularly in biosciences and animal health at K-State. Creating the Center with cluster hires and/or joint appointments also will strengthen and expand research funding opportunities university-wide. In addition, the Center will facilitate corporate partnerships with industry in the Kansas-Missouri Animal Health Corridor. The K-State Olathe campus offers an convenient venue for engagement between professional development and/or business related to Big Data.

K-State’s ICRES has consistently developed and influenced cyber-infrastructure for research and education. With existing collaborations between leading national and international research organizations and the anticipated arrival of NBAF, ICRES has the potential to form alliances with and attract a multitude of cyber-enabled and bioinformatics companies to Manhattan. This project will be a catalyst for these endeavors, provide a vital research test bed, and establish a regional center to train the future cyber-enabled workforce.

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U.S. Army Command and General Staff College
Collaborative Cyber-security Master’s Degree Program Development

Background
Cyber-attacks represent a major threat endangering mission-critical systems, assets, and lives. Benefits of increased access to and sharing of information through the proliferation of computing devices and cyber-connectivity are offset by increased vulnerability to malicious cyber-attacks that compromise security, from personal information disclosure to critical national infrastructure. The Department of Defense currently has over 15,000 networks that are probed 250,000 times per hour by more than 100 known foreign intelligence services. Defending against escalating cyber threats requires comprehensive, universal education and training in information assurance and cyber-security. Several studies have indicated a shortage of cyber-training programs to meet the growing need for a professional security workforce to protect our national cyber-infrastructure.

Description
The United States Army Command and General Staff College (CGSC) and K-State have an enduring partnership which provides education opportunities for U.S. military service members and U.S. Army civilian employees at Ft. Leavenworth, including the following programs:
- Collaborative doctoral program in Security Studies offered jointly with CGSC’s School for Advanced Military Studies to develop critical thinkers capable of confronting strategic challenges of an increasingly complex global security environment.
- Master’s degree program in Operations Research conducted in conjunction with the U.S. Army Training and Doctrine Command Analysis Center.
- Doctorate and master’s degree in Security Studies and a doctorate in History targeted to CGSC faculty and students.
- Command Team Spouse Development Program for Brigade spouses offered through CGSC’s School for Command Preparation
- Graduate program in adult education offered at the master’s and doctoral level complements leadership development programs for military officers.

Partnership between CGSC and K-State has been sustained by a collaborative response to emergent military educational needs. K-State has a strong track record in research and cyber-security teaching, as including:
- In 2010, K-State was designated as a National Center of Excellence for Research in Security by National Security Agency (NSA) and Department of Homeland Security (DHS).
- For more than 15 years, K-State researchers have collaborated with Rockwell Collins, Lockheed Martin, Boeing, HP, Microsoft, and Idaho National Lab on techniques development to design large-scale, secure mission-control systems.
- K-State has developed tools to address several aspects of cyber warfare in order to develop security metrics for the National Vulnerability Database (NVD) maintained by NIST.

Recently, K-State researchers were awarded a grant by the NSF Scholarship for Service (SFS) Capacity Building program, leading to collaborative development of cyber-security curriculum for officers in the 10-month course at CGSC. In Fall 2013, K-State conducted four sessions on cyber-security as part of this 10-month course. The proposed program will advance cyber-security electives created by K-State for CGSC to offer a master’s degree in Cyber-security. The Foundations of Homeland Security course and supplementary courses will provide students an overview of broad security issues while fulfilling education needs of the Army and individual students based on cyber-security knowledge and experience.

Relevance National/Regional
K-State can reduce our nation’s vulnerability to cyber-attacks on mission-critical systems and assets by capitalizing on its expertise of technology development to build secure software systems. Collaborations with leading cyber-security companies and the anticipated arrival of NAFB allow K-State to encourage key cyber-and bio-security companies to build a strong regional center in order to train the future cyber-security workforce. K-State researchers have already established semi-annual security workshops (KanSEC) to promote cyber-security within other academic institutions in Kansas. The proposed program, also offered at the K-State Olathe campus, will achieve National Cybersecurity Initiative goals and provide a unique education opportunity that integrates military and civilian practitioners in the learning setting and promotes future military-civilian communication and coordination in this vital area.

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Integration of Research, Training, and Education in Biosafety and Biocontainment

Background
In the late 1990’s, Kansas State University made a programmatic commitment to the area of food safety and security. As a land grant institution with a major focus on food animal husbandry, KSU made food animal health and welfare a priority. The State of Kansas made a strong investment in KSU’s research priorities by funding the construction of the Biosecurity Research Institute (BRI). Further, the Department of Homeland Security has acknowledged KSU’s leadership within this area and named Manhattan as the home of the National Bio and Agro-Defense Facility (NBAF).

Description
A congressional investment in research would foster a robust training program in an area of national need, allowing the Kansas State University Graduate School to develop, deploy and manage a research and educational program for the biosafety and biocontainment research professional. This will address critical workforce development needs in a profession that has recently been scrutinized during congressional oversight.

This program will utilize the 10,000 square foot educational wing of the state-of-the-art BSL-3 Biosecurity Research Institute (BRI) at Kansas State University. The BRI offers a unique integrated training laboratory suite, including world-class image capture capabilities allowing the integrated training suite to serve as a filming studio. The vision of this initiative is to utilize the unique research activities and integrated training/education resources to develop synergistic programs to provide training to existing professionals, graduate level education and degree programs for graduate students, and fellowship opportunities for post-doctoral students.

The laboratory training program will provide scholarship opportunities for doctoral students seeking research careers in the biosciences, and will couple research activities with training in biocontainment practices and procedures. Similarly, a postdoctoral fellowship program will provide both short- and long-term training in containment research beyond the doctorate. These two activities will be integrated with a broader program to provide technical support staff, who will fill biocontainment workforce needs nationwide, with skills to work in the BSL-2, 3, and 3Ag environment safely and securely. The technical support overlay also includes training building maintenance and management professionals on the unique aspects of working in a biocontainment facility.

The demand and importance of these programs will significantly increase as the Olathe campus continues to develop and as the NBAF becomes operational in the Manhattan community.

This initiative also provides the framework to synergistically link and integrate the biosafety and biocontainment research/educational investments, infrastructure, resources, expertise, and missions of the K-State main campus, K-State Olathe campus, and the NBAF. This extension additionally lays the foundation for the development of collaborative graduate education programs with federal institutes such as NIH’s National Biosafety and Biocontainment Training Program (NBBTP).

Relevance Regional/National/International
Utilizing KSU’s world-class resources to educate tomorrow’s biosafety and biocontainment professions will provide our students with a competitive edge as they apply for technical or faculty positions. Additionally, the program would provide necessary training and experience for the future workforce at NBAF and biotech companies in the expanding animal health corridor.

With thousands of BSL-2 and BSL-3 laboratories in the United States, a graduate level research and educational program for biosafety and biocontainment professionals would provide valuable hands-on skills to ensure safe and secure operations.

Research and training agreements with the U.S. Department of Agriculture, the Department of Homeland Security, Australia’s Commonwealth Scientific and Industrial Research Organization, and Kenya’s International Livestock Research Institute provide unique opportunities for students, staff, and faculty to gain experience for NBAF and related projects that complement existing programs.

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Virtual Interactive Design Education

Background
In addition to the successful synthesis model of learning with problem-oriented studios in design-based education, traditional subject-oriented approaches are common in many of the specific knowledge areas. In traditional lecture-based approaches, students are treated as passive recipients with linear and fragmented teaching presentations that provide little opportunity for learning the holistic nature of their discipline. The Unified Learning Model (ULM) is based on three core principles: learning requires working memory allocation (attention); working memory’s capacity for allocation is affected by prior knowledge; and, working memory allocation is directed by motivation. These three principles guide a complete model of learning that synthesizes what is known from research in brain function, cognition, and motivation. Integration of serious gaming into these subjects and utilizing the ULM will provide the basic evidence to support institutionalization of an approach to education that is potentially transformative for student learning.

Description
Active project-based learning is proven more likely to meet educational objectives when compared to traditional lectures. Serious games (those in which education is the primary goal) may provide an effective virtual interactive environment employing contextually rich interactive simulations and promoting a holistic approach to design education. The cutting-edge synthesis of ideas and concepts from the cognitive, motivation, and neurobiological sciences within the ULM, combined with virtual serious games will provide an integrated project-based pedagogy throughout the curriculum, increasing critical thinking and practice of students.

Relevance
Contextually rich interactive simulations have proven effective at improving the educational experience in fields like health care and military operations. In a 2009 workshop, the National Academy Committee on Engineering Education recognized the need to enhance engineering curriculum through creative uses of instructional technologies. Tashiro (2009) found that further research was necessary to determine if serious games will become a valuable tool for education and professional development. While architectural and design education are known for their studio/problem-based approach to integrative professional education, the subjects supporting the studios are, in many instances, taught through passive and traditional means.

Project-based learning is student-centric model where students acquire knowledge through activity and experiential learning. This approach has proven to be an effective pedagogical model in higher education to develop thinking and creativity. Research is needed to determine if the synthesis of problem-based learning through a serious-game virtual interactive environment, coupled with the Unified Learning Model, can be more effective as a teaching and learning approach to the support areas of professional education in areas such as engineering, architecture, and design.

Sound pedagogical ideas must be merged with the astounding capabilities of new and emerging technologies in a new model of learning that provides opportunities for learning in project-based disciplines. Game-based learning may assist in building a diverse workforce and increasing opportunities for innovation while encouraging critical decision-making strategies. Simulations incorporated in the serious games can provide project-based experiential learning leading to better prepared graduates entering the workforce.

Simulations have been shown to improve skills and safety in medical techniques; and studies regarding generational attributes suggest incoming students learn more efficiently using simulation games. A recent report by a Blue Ribbon Panel of the National Science Foundation calls for an “overhaul our educational system to foster the interdisciplinary study that SBES requires.”

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Preparing STEM Teachers: Responding to New Challenges

Background
The National Science Board issued a report in 2010 strongly stating the need for quality education of the future STEM workforce. Key recommendations that relate directly to the preparation of teachers in STEM fields include: providing professional development opportunities for teachers, principals, counselors, and other key school staff; supporting research-based STEM preparation for teachers; and fostering peer-to-peer connections and collaborations with the scientific research community. Besides this call to action, here are three new challenges in preparing STEM teachers in the nation’s teacher preparation programs.

1. Unmet needs for endorsed and highly qualified math and science teachers. Over the next decade, schools will need 200,000 or more new math and science teachers nationally. In Kansas, the shortage of math and science teacher is expected to reach critical levels with the potential retirement of 36% of Kansas teachers eligible to retire in five years.

2. The reform of science and math standards in K-12 education (the Next Generation Science Standards, NGSS). NGSS updates content and represents a shift in the way STEM education has been conceptualized and implemented, necessitating a change in the approach to preparing science and mathematics teachers.

3. The adoption of Common Core State Standards, (CCSS). The new CCSS provide a clear understand of expected student outcomes, which provide new guidelines and expectations for preparing teachers.

Description
The College of Education (COE) at K-State is responding to these challenges by implementing activities to increase the number and quality of STEM teachers for Kansas schools:

• A dual degree program was approved in 2013 that enables undergraduate students to complete a STEM major and become a licensed middle/high school STEM teacher in four years.

• The college is implementing a Teacher Education Initiative, funded by the Kansas Board of Regents, focused on designing an enhanced Graduate Certificate in Teaching and Learning to recruit and prepare STEM graduates to become STEM teachers. In addition, this project is designing courses and providing professional development to support currently licensed teachers wishing to gain an additional license in science or mathematics.

• The Center for Intercultural and Multilingual Advocacy (CIMA) is providing professional development to ESL teachers to improve their capacity to teach math and science to ESL students.

• The math education faculty, the Department of Mathematics, and CIMA have developed several proposals to NSF for the development of culturally-responsive math instruction strategies, which include extensive professional development for Kansas’s math teachers.

• Math education and mathematics faculty have been conducting successful summer mathematics professional development institutes for Kansas teachers for the past 11 years.

Efforts planned for the near future are: recruiting veterans into STEM teacher certification programs; an endowed chair in science education; expansion of the STEM faculty in the college; focused efforts on recruiting STEM preservice teachers; workshops and webinars on NGSS; and collaboration with the College of Engineering related to engineering education.

Relevance
STEM teacher education relates to the College’s 2025 plan, Theme II, with a goal of increasing the number of STEM graduates by 50% in the next 10-15 years. These activities also relate to K-State 2025, Themes II and III.

Contacts
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Center for Attosecond Nanophotonics (CAN)

Background/Description

The J. R. MacDonald laboratory (JRML) in the K-State physics department is a large atomic, molecular, and optical (AMO) physics laboratory, supported by the US DOE and its predecessors since 1969. JRML was the first US laboratory to produce single attosecond (billionth of a billionth sec; comparable to the extremely short time taken by electrons in an atom to change energies) light pulses. Currently, the JRML group is known for its leadership in ultrafast laser science and is well positioned to be the nucleus for a leading attosecond nanophotonics center in the US. The AMO physics program is ranked 13th in the nation by U.S. News and World Report.

The Nanomaterials group at K-State has excellent synthetic and materials characterization capabilities. Scientists in this group have extensive experience in the synthesis of nanoparticles and their assembly, nanowires, and graphene. The major theme of this research is to create a new class of nanoparticle solids in which the nanoparticles act as the “atoms” of the material and thereby mimic atomic and molecular materials found in nature.

The synergistic overlap between these two strong subfields, namely AMO and Nanomaterials, offers promise for new discoveries by combining advanced photonics, nanoscience and soft matter systems. Moreover, it is collaboration unlike any other in the world. It is thus timely to extend the application of ultrafast and intense optical pulses to the new arena of nanoscale matter in the Center for Attosecond Nanophotonics. The Center will use light sources with unprecedented properties, applying them to nanoscale matter that research has shown to be a treasure box of new phenomena. This novel combination is certain to yield exceptional new physics given the extremes of intensity, time and length scales.

Building on an existing strong culture of solving practical problems and “producing products”, establishment of CAN will have a significant impact through technical advancements. To be more specific, the Center’s novel science will lead to next-generation opto-electronic technologies that could enable the propagation of electronic signals through solid state circuitry and high speed computing using light interfaced with electronics. The light sources that will be developed in the center can be applied for biomedical imaging and opto-genetics. An ultrafast near-field microscope detector for measuring electrons with nanometer spatial and attosecond temporal resolution will be developed. Two leading companies in high power ultrashort lasers such as KMLabs (Boulder, CO) and Thales (Paris, France) have already shown interest in collaboration with the scientists in the center. We envision establishment of spinoffs companies of new laser and imaging technology as a result of these collaborations.

At present, the JRM lab is limited by space and cannot accommodate the necessary physical environment for attosecond studies of nanoscale particles and structures (which require temperature stability, a vibration-free environment, etc.). While we are successful in acquiring multi-million dollar laser equipment through resources available from Federal funding agencies, expanding and upgrading of the laboratory infrastructure requires other Federal funding resources.

The proposed development of a federally funded world-class research center will cultivate a research and teaching environment that accommodates our niche research areas and the means to attract, retain and educate some of the brightest minds in physics. CAN’s fundamental research output can be translated into a powerful engine of innovation and entrepreneurship. Students and post-doctoral fellows involved with CAN will be encouraged to have an entrepreneurship focus and in collaborations with units such as the Institute for Commercialization will be introduced to various aspects of intellectual property, technology transfer, and the process of innovation. Trained this way, these innovators, who are by definition the foremost authorities on their discoveries, will facilitate and shorten the time needed for research outcomes to be transferred into a marketable product.

Agency Contact Information

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Great Plains Center for Urban Watersheds (GPCUW)
Joining sustainable water science, planning, and management

Description
The Great Plains Center for Urban Watersheds (GPCUW) is a nexus of research, application, and outreach focused on sustainable green infrastructure and urban stream restoration in the communities of Kansas, the Midwest and Great Plains. GPCUW research focuses upon sustainable stormwater management, natural stream channel design and restoration, and innovative water conservation techniques in the cities and towns of Kansas. GPCUW communication joins teaching, service learning, and outreach with entrepreneurial opportunities between Kansas State University, Kansas State, Olathe, and those involved with sustainable water infrastructure in Kansas communities. GPCUW facilitates the development of new technologies and refinement of current practices for sustainable water planning and management. GPCUW practices rigorous and sustained monitoring of stormwater management, stream restoration, and water conservation measures for this is how we learn, improve, invent, and move closer to sustainability.

Background
Kansas communities are facing water supply shortages, the necessity of replacing aging water infrastructure, and the need for cost-effective, sustainable water conservation measures. Seventy three percent of Kansas population (most of which is in eastern KS) relies on surface water for all or part of their water needs. Three of the five major river basins that supply water to the cities and towns of eastern Kansas show potential for shortages within the next fifteen years (perhaps sooner given current climate change and drought predictions). The remaining basins rely heavily upon reservoir storage which continues to decrease due to accelerated erosion and sedimentation. Thus the need for water conservation is real and pressing. Most Kansas communities are addressing the replacement of aging, water related infrastructure as a result of design life expiration or due to CSO’s (Combined Sewer Outflows), as well as searching for less expensive, longer lasting ways of handling stormwater in newly developing areas.

Cities, towns, environmental planners and engineers, architects and landscape architects are in great need of green, sustainable water solutions. Yet, little research has been conducted regarding green infrastructure, natural channel design restoration, or innovative water conservation strategies in the Midwest. Information from the eastern US and the Pacific Northwest is often employed to design measures and practices for the dramatically different climatic, geologic, and biotic conditions and regimes of Kansas. Few of these measures are being monitored to gauge efficacy or applicability. Currently there is little to no extension or outreach to assist communities, agencies, or private entities regarding green infrastructure and water conservation. The requisite interdisciplinary expertise and experience are here at Kansas State; the coordination, synergy and conveyance of GPCUW allows for the application of this expertise.

Relevance
In 2009 the American Reinvestment and Recovery Act allowed the Kansas Department of Health and Environment to fund 15 “Green Infrastructure” projects for a total of $35M. Of these, 13 were in cities across Kansas and provided for the installation of one or more green infrastructure technologies or measures such as “constructed wetlands, rain gardens, bioswales, infiltration basins, bioretention cells, water harvesting, and green roofs”. These innovative, green technologies are being implemented throughout Kansas and the Midwest yet there is no research hub focused upon gauging efficacy or developing the most place-appropriate and sustainable measures. The need for the Great Plains Center for Urban Watersheds – its work of developing new technologies and practices for sustaining the water resources of Kansas is as real and urgent as the issues it will address. The sharing of new knowledge through education, extension, service-learning and innovative public-private partnerships is the mission of a land grant university. GPCUW at Kansas State University and Kansas State-Olathe will focus and facilitate a more resilient and sustainable water future for the communities and people of Kansas, the Midwest and Great Plains.

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Networking, Communications, and Security for Critical Infrastructures

Background
Daily activities in society increasingly rely on interdependent critical infrastructures such as power grids, telecommunication networks, transportation networks, food networks, and water distribution networks. In contrast to isolated systems, interdependent networked systems demonstrate emergent behaviors caused by unpredictable, rare, non-linear interactions between numerous social, physical, and cyber components. Because infrastructure systems are so large, they are often decentrally controlled through cyber systems. However, even if decentralization and self-organization theoretically reduce failure risk, interdependencies can lead to disruptive and massive cascading failures. Interdependent and multilayer networks characterize important social and engineered infrastructures, and a full understanding of their behaviors through fundamental results is still needed.

As an example, the Smart Grid concept includes the application of advanced computer, communications, and power technologies to obtain a highly automated, responsive, and resilient, transmission and distribution infrastructure. At the distribution level, the Smart Grid integrates distributed renewable generation sources with energy storage and provides demand response management to customers through dynamic pricing. At the transmission level, communication architecture creates an intelligent infrastructure that can detect and mitigate faults faster than they can propagate, thus providing utility operators with improved efficiency and reliability. Although ongoing efforts to design the next-generation communication network within the Smart Grid framework are in progress, lack of flexibility and programmability of network equipment has impeded the possibility to experiment with new schemes. Consequently, power operators are reluctant to adopt untested solutions.

Description
This project has two main goals. The first goal is to study interdependencies between critical infrastructure networks and provide fundamental insights on the impact of these interdependencies on the reliability of the coupled system. The ultimate aspect of this goal is to increase reliability by developing analytical tools to measure and adapt system interdependencies. The second goal is to address key issues in order to allow rigorous experimentation and analysis of networking solutions in the real-world environment. As an example with the Smart Grid, actual large scale experiments incorporating resources from both the Smart Grid Lab at Kansas State University and networking resources of K-State and the Global Environment for Network Innovations (GENI) test bed can be utilized. To date, a hybrid simulator has been created that integrates continuous-time behaviors of the power system with discrete event behaviors of the communication network. This platform has demonstrated the performance impact of the communication network and the power system when the physical infrastructure is designed to maximize robustness. Furthermore, this platform was utilized to demonstrate that an OpenFlow communication network could perform equally or better than its Multiprotocol Label Switching (MPLS) counterpart. Finally, a Smart Grid prototype was deployed on the GENI network to demonstrate the ability of OpenFlow to provide services comparable to MPLS.

Relevance National/Regional
Numerous critical infrastructures rely on secure networking and communications in Kansas and in the nation. In the state of Kansas, power and networking companies have demonstrated endorsement by sponsoring K-State’s Electrical Power Affiliate’s Program (EPAP). Nationally, this research has received contributions from Raytheon BBN Technologies, KanREN, Internet2, and National LambdaRail.

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Center for Technology Development: Product and Technology Development for the Advanced Manufacturing Industry

Background
"America’s ability to make things underpins America’s ability to innovate, compete, and create good jobs. U.S. manufacturers perform 70 percent of all private-sector R&D and account for 60 percent of U.S. exports and the majority of U.S. industry patents. Over the last six decades, innovation-in new products or new processes—was central to three-quarters of the nation’s economic growth."

Many companies and universities do not have a systematic process to develop technologies and bring new products to market. This translational research capability is critical to leveraging research investments to drive a technology and innovation-based economy.

Kansas State University, however, has developed the following unique assets to support collaborative university-industry projects in advanced manufacturing technology and product development:

- An integrated business/technology development approach that facilitates collaborative industrial projects and partnerships. The Advanced Manufacturing Institute (AMI) has completed 2,500 technology development projects with 500 businesses.
- Nationally recognized tools to facilitate open innovation through opportunity recognition, innovation analytics, and network weaving.
- Distinguished faculty researchers and productive laboratories conducting advanced manufacturing related research across the university, including one faculty member currently serving as an NSF Program Director for an Advanced Manufacturing program.
- An EDA-funded innovation accelerator focused on animal health and food processing industries located on the K-State Olathe campus.

Relevance
In order to improve the competitiveness of U.S. manufacturers, federal agencies have directed to: 1) strengthen advanced manufacturing research and development; 2) support the education of a highly skilled manufacturing workforce; and 3) spur innovation in new products and processes.

Description
K-State will achieve these objectives by establishing the Center for Technology Development (CTD). The CTD will forge strategic university/industry partnerships that will accelerate industry-focused research and innovation, commercialize technology, and bring new products to market. The CTD will integrate K-State’s advanced manufacturing and technology development capabilities and will engage industrial companies in mutually beneficial projects that generate new technologies and products and help technology-based companies to grow.

The CTD will be a unique university, industry, and government partnership that will facilitate open collaboration between advanced manufacturing researchers, industrial scientists, and engineers. It will leverage faculty expertise and encourage collaboration between colleges, between K-State and industry, and between design and manufacturing.

Efforts will be concentrated in thrust areas that support university and government priorities. The CTD will use AMI’s industrial partnering experience and project management expertise to establish and manage collaborative technology development partnerships. The CTD will utilize advanced modeling and design verification tools, but also produce proof-of-concept artifacts and prototypes of devices and processes. Ideas will be transformed into reality, students will be engaged in creating and developing real products, applications for new technologies will be defined and developed, and university technologies and inventions will be developed and hardened for specific market uses.

Current efforts are focused on expanding faculty involvement in the CTD, enhancing advanced manufacturing and realization laboratories, developing best practices to identify opportunities and build partnerships, and expanding the geographic and industrial reach of the CTD.

The CTD will help K-State to realize its goal to become a top 50 Public Research University and engage K-State in building, “an advanced, globally competitive manufacturing sector...” The Center for Technology Development will significantly:

- increase the value of industrially sponsored research and intellectual property generated;
- develop an innovation workforce by expanding student involvement in the CTD;
- catalyze industrial partnerships to jointly develop new technologies and products.

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DEFENSE
National Center for Information Assurance and Security

Background
The world is rapidly becoming so highly networked that software pervades every aspect of society. Consequently, cyber-attacks are a major threat endangering mission-critical systems and lives and assets protected by those systems. Trillions of dollars and the well-being of millions of people currently depend on correct operation of software. Recent reports to the National Academy of Sciences urge the development of software with evidence of correctness ("correctness certificates") that can be automatically verified by a third party. In response to these challenges, the Department of Defense (DoD) has developed a “System Assurance Strategy” which emphasizes security throughout the life cycle of a project and requires DoD programs to account for system vulnerabilities. K-State researchers have consistently developed software design tools and technologies for the construction of safe, secure systems.

Description
The Center of Information Assurance and Security (CIAS) has a strong track record in research, teaching, and outreach, including:
- In 2010, CIAS was designated as a National Center of Academic Excellence for Research in Cyber Security (CAE-R) by National Security Agency (NSA) and Department of Homeland Security (DHS).
- Since 2001, CIAS researchers have collaborated with Rockwell Collins, Lockheed Martin, Boeing, HP, Microsoft, Honeywell, and Idaho National Lab on techniques developed to design large-scale, secure mission-control systems.
- CIAS has substantially contributed to building tools in order to secure United States national critical infrastructure:
  - The Laboratory for Specification, Analysis, and Transformation of Software (SAnToS) in CIAS has developed tools and technologies to formally verify security properties of large-scale mission-critical systems. Research results are used by leading industry vendors such as AdaCore and Secunet.
  - The Argus group in CIAS has developed tools to address a number of defensive aspects of cyber warfare. These tools are used by researchers to develop security metrics at National Institute of Standards and Technology (NIST), which maintains the National Vulnerability Database.
  - A team of CIAS researchers received a 2003 NASA Turning Goals into Reality (TGIR) award for work on techniques to verify software system functionality.
  - DoD and its prime contractors currently build complex, software-controlled, highly networked systems by integrating hundreds of suppliers and commercial off-the-shelf components. Current design techniques, acquisition procedures, and vulnerability assessment capabilities are inadequate and often result in security vulnerabilities and cost over-runs. CIAS researchers have developed tools to design and assemble large software systems at low cost in a timely manner.
  - CIAS researchers have received prestigious awards, including seven CAREER awards from the National Science Foundation.

The proposed project will enhance CIAS capabilities to address challenges facing the next generation of complex cyber-physical systems, including: (1) designing “zero-failure” mission-critical systems at low cost with less completion time, (2) develop cyber-defense solutions to protect U.S. critical infrastructures, and (3) partner with local, state, and national agencies and industry to educate the society at large in regards to handling cyber-security challenges. CIAS is able to uniquely address these challenges with the following specific efforts:
- A partnering with various federal agencies and private-sector companies will allow CIAS to develop methodologies and tools which encompass a holistic approach to cyber-physical system security
- CIAS will collaborate with companies specializing in cyber-security and bio-security to build a vibrant regional center, thereby encouraging companies in bio-security to expand into Manhattan.
- A shortage of cyber-security engineers has been consistently cited as a potential threat to U.S. national security. CIAS has consistently developed educational materials for security.

Relevance
K-State’s Center for Information Assurance and Security has an illustrious history of technology development to build secure software systems. Collaborations with industry leaders in cyber-security and the anticipated arrival of NBF will allow CIAS to form alliances with and attract cyber- and bio-security companies to Manhattan. This project will be a catalyst for establishing a regional center for cybersecurity.

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U.S. Army Command and General Staff College
Collaborative Cyber-security Master’s Degree Program Development

Background
Cyber-attacks represent a major threat endangering mission-critical systems, assets, and lives. Benefits of increased access to and sharing of information through the proliferation of computing devices and cyber-connectivity are offset by increased vulnerability to malicious cyber-attacks that compromise security, from personal information disclosure to critical national infrastructure. The Department of Defense currently has over 15,000 networks that are probed 250,000 times per hour by more than 100 known foreign intelligence services. Defending against escalating cyber threats requires comprehensive, universal education and training in information assurance and cyber-security. Several studies have indicated a shortage of cyber-training programs to meet the growing need for a professional security workforce to protect our national cyber-infrastructure.

Description
The United States Army Command and General Staff College (CGSC) and K-State have an enduring partnership which provides education opportunities for U.S. military service members and U.S. Army civilian employees at Ft. Leavenworth, including the following programs:
- Collaborative doctoral program in Security Studies offered jointly with CGSC’s School for Advanced Military Studies to develop critical thinkers capable of confronting strategic challenges of an increasingly complex global security environment.
- Master’s degree program in Operations Research conducted in conjunction with the U.S. Army Training and Doctrine Command Analysis Center.
- Doctorate and master’s degree in Security Studies and a doctorate in History targeted to CGSC faculty and students.
- Command Team Spouse Development Program for Brigade spouses offered through CGSC’s School for Command Preparation
- Graduate program in adult education offered at the master’s and doctoral level complements leadership development programs for military officers.

Partnership between CGSC and K-State has been sustained by a collaborative response to emergent military educational needs. K-State has a strong track record in research and cyber-security teaching, as including:
- In 2010, K-State was designated as a National Center of Excellence for Research in Security by National Security Agency (NSA) and Department of Homeland Security (DHS).
- For more than 15 years, K-State researchers have collaborated with Rockwell Collins, Lockheed Martin, Boeing, HP, Microsoft, and Idaho National Lab on techniques development to design large-scale, secure mission-control systems.
- K-State has developed tools to address several aspects of cyber warfare in order to develop security metrics for the National Vulnerability Database (NVD) maintained by NIST.

Recently, K-State researchers were awarded a grant by the NSF Scholarship for Service (SFS) Capacity Building program, leading to collaborative development of cyber-security curriculum for officers in the 10-month course at CGSC. In Fall 2013, K-State conducted four sessions on cyber-security as part of this 10-month course. The proposed program will advance cyber-security electives created by K-State for CGSC to offer a master’s degree in Cyber-security. The Foundations of Homeland Security course and supplementary courses will provide students an overview of broad security issues while fulfilling education needs of the Army and individual students based on cyber-security knowledge and experience.

Relevance National/Regional
K-State can reduce our nation’s vulnerability to cyber-attacks on mission-critical systems and assets by capitalizing on its expertise of technology development to build secure software systems. Collaborations with leading cyber-security companies and the anticipated arrival of NBAF allow K-State to encourage key cyber- and bio-security companies to build a strong regional center in order to train the future cyber-security workforce. K-State researchers have already established semi-annual security workshops (KanSEC) to promote cyber-security within other academic institutions in Kansas. The proposed program, also offered at the K-State Olathe campus, will achieve National Cybersecurity Initiative goals and provide a unique education opportunity that integrates military and civilian practitioners in the learning setting and promotes future military-civilian communication and coordination in this vital area.

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Biosecurity Research for Soldier Food Safety and Defense: Department of Defense  
U.S. Army Natick Soldier Systems Center

Description
Collaborative work between the U.S. Army Natick Soldier Systems Center (Natick) and National Agricultural Biosecurity Center (NABC) Kansas State University (KSU) is ongoing to validate technologies developed to date, and to determine appropriate food sampling strategies. Other work will focus on development of detection strategies, agent characterization, determining practical and effective sampling and testing strategies, along with characterizing the survival of high consequence pathogens in a variety of food matrices, and on the integrated control and database computer infrastructure needed to support detection arrays for biological contaminants.

Specifically:
1) Recent efforts continue to focus on validation of Natick-Defined Detection Systems for the detection of BSL-2/BSL-3 level bacteria and biological toxins from twelve defined food matrices. An integral part of the validation is developing and validating food sample preparation protocols for each detection system and determining accuracy and sensitivity levels of each system.

2) Utilize the Biosecurity Research Institute’s (BRI) BSL-3 Food Processing Capabilities to understand bioagent distribution during full-scale manufacturing operations.

3) Generate critical data on bioagents in defined food matrices for predictive modeling programs that can be used in risk and threat assessments.

A securely maintained biocontainment environment with the use of real-agent scenarios and real food-industry scale technologies is required for such research to understand real-world applicability. KSU has established a unique, one of a kind facility for ensuring food safety and defense within the BRI at Pat Roberts Hall.

Background
Central to U.S. military capability is the safety of our soldiers’ food supply. Key to food safety and defense is information regarding food products and the premises where food is manufactured, packaged, stored, transported, and consumed. Food risks heighten when supply routes lengthen and availability of certain food items relies upon local sourcing, when our soldiers are deployed overseas. Contamination of food could be either inadvertent (safety) or intentional (defense). The risk of the impact of biological contamination, particularly relevant to select agents, is poorly understood and agent characterization studies in food products and processes are of critical importance.

Integrating scientific concepts with appropriate technologies is required for rapid, non-invasive, remote detection systems (sensors) that can ensure quick response times for determination of food ration quality and safety. The development and validation of rapid screening procedures of foods for the U.S. military requires specific capabilities that transfer theoretical approaches to methodologies and technologies that can be evaluated and validated in comparative studies.

The U.S. Army Natick Soldier Systems Center’s Performance Enhancement and Food Safety Team is working to develop methods and equipment to detect real-time high threat biohazards in foods.

Relevance
Protecting the U.S. military’s food supply and associated supply chain infrastructure is of paramount importance. Technologies to rapidly, accurately and reliably detect food contaminants will positively impact soldier health, performance, and readiness.

These technologies, techniques, and resulting detection arrays have an impact beyond military use and can be deployed in the civilian food supply chain as well. All efforts associated with this work have been with dual use capabilities in mind.

Events of September 11, 2001, underscore the asymmetric nature of threats, both civilian and military. It is possible, and even likely, that biological agents may be used to target both the domestic and military food supply chains. Technology used to remain vigilant is both prudent and effective if applied early.

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Armed Forces Health and Food Supply Research: Intelligence Community

Description
The objective of this initiative is to establish and maintain open-source data acquisition, fusion, enhanced human and other intelligence collection support and the employment of novel analytical systems coupled with state-of-the-art laboratory research capabilities. The initiative may take advantage of Kansas State University’s (KSU’s) Biosecurity Research Institute (BRI) research infrastructure and capabilities, and may integrate activities of the BRI with the Intelligence community (IC). The objective is accomplished through the following activities:

Maintaining and enhancing support to Science & Technology (S&T) based human intelligence collection through continuing development of biological threat technical support briefs and the research and development of novel approaches to support the acquisition and analysis of critical intelligence information in the areas of interest outlined in this initiative.

Continue development and evaluation of tools to assess country capabilities to manage animal, zoonotic, plant and foodborne infectious disease and environmental toxin threats.

Maintain and enhance support for electronic search, selection, and inclusion of all-source health and food supply threat analysis and lessons learned for IC analysts.

Support and maintain information technology infrastructure and architecture and secure communications infrastructure needed to support the areas of interest outlined in this initiative.

Promote capabilities to conduct threat and vulnerability analysis of foreign disease agents in a biocontainment laboratory environment using foreign animal, plant, foodborne and zoonotic disease and chemical threat agents.

Background
The global deployment of U.S. personnel in response to prior terrorist events, coupled with the continuing worldwide deployment of U.S. forces in all regional theaters, exposes them to the full spectrum of natural or deliberate threats from infectious diseases, toxins and contamination of the food supply. The consequences of serious endemic infectious disease, bioterrorism or biological warfare (BW) against the U.S. and its allies are widely recognized and acknowledged. The U.S. Armed Forces’ reliance on key components of a host country infrastructure, which includes food supplies, the medical system and other relevant constituents, is a key vulnerability that presents an attractive target to those who wish to do harm in both Continental United States (CONUS) and Outside Continental United States (OCONUS). There are few high biocontainment level laboratories carrying out applied research on high consequence infectious or toxin-based zoonotic, animal and plant diseases in support of S&T intelligence activities pertaining to threats to U.S. and allied military personnel health, their food supplies and critical related elements of a foreign host nation’s infrastructure. The current effort provides intelligence support and analysis capabilities, plus the potential for biocontainment laboratory capabilities, to the IC in support of U.S. and allied forces, and supports the potential for zoonotic, animal and plant disease and food supply threat countermeasures research.

Relevance
In support of U.S. and allied operations worldwide, this initiative significantly enhances the collection, analysis and utilization of intelligence information regarding human, animal and plant diseases that occur naturally or are introduced as a result of bioterrorism or a state supported BW strike. In addition, this effort leads to a better understanding of how to reduce the multiple vulnerabilities to these diseases and agents using foundational country data for mission planning, including key components of an OCONUS host country’s infrastructure, including food supplies, medical systems and other relevant entities that U.S. forces may utilize or, alternatively, need to support. This initiative produces unique information technology (IT) approaches, systems or tools, and continuing and new approaches to support S&T and other intelligence collection and analysis modalities. Finally, this initiative enhances the IC’s ability to provide accurate threat analysis and intelligence assessments in support of OCONUS-based DoD mission plans and operations and the CONUS-based homeland defense mission.

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*past performance
Non-lethal Environmental and Technologies Research Program: Technology that helps military forces and non-combatants, and the environment

Background
Military and law enforcement personnel need non-lethal options to avoid unnecessary injuries and damage, during peacekeeping, humanitarian and combat missions in populated areas. Advanced control systems, and lower power, size and weight, is required for these and all military technologies in today’s increasingly extended military operations. $3.0M is requested in FY15 for KSU to perform a complimentary suite of projects addressing these issues, for the Joint Non-lethal Weapons Program (JNLWP), in partnership with the Institute for Non-lethal Defense Technologies at Penn State University.

Since 2001, the Non-lethal Environmental Evaluation and Remediation (NEER) Center at Kansas State University (KSU) has coordinated and performed over $15 M in environmental assessments and technology development research for the U.S. Marine Corps, who run the JNLWP for the Department of Defense (DoD), and for the other U.S. military services. In Kansas, this work has supported over 100 faculty, students, and staff at KSU, NanoScale Corporation, Inc., and other businesses, and has brought over $.75 M in research equipment to KSU.

Description
Proposed work for FY15 includes the following suite of projects to address urgent DoD Science and Technology needs. The work involves faculty and students in the Center for Hazardous Substance Research, and in the Computer & Information Sciences, Chemical Engineering, and Electrical & Computer Engineering Departments.

Environmental Assessments. KSU has completed environmental assessments on over 15 developing non-lethal technologies to help make sure they don’t impact human health and the environment. KSU will complete more assessments and provide subject matter experts, on demand, for defense project review boards and project teams for the JNLWP. $ 0.5M

Robots and Sensors. To support the use of robots for dangerous missions, this project will develop a control system that allows teams of multiple humans, robots, and sensors to work effectively in missions such as surveillance and exploration. In previous research, we developed a theory and demonstrated its use for single-user control of multiple, multi-robot teams. However, recent research with human teams has determined that they perform tasks better and coordinate activities more effectively when team member’s use shared mental models (SMMs) to track each other’s task-related states. Thus, to expand our existing theory to mixed teams of humans and robots, we propose using SMMs to allow robots and humans to share knowledge to improve overall team performance and coordination. Additional funds are required to continue this work with an industry partner.

Also proposed is modeling and analysis on the effect of communication delays and failures on the performance of multi-robot and multi-sensor based surveillance and networked control systems. $1.5M

Power and Energy Projects. Three projects are proposed: 1) Beta-voltaic batteries which could increase battery life from hours to years, at 1/3 the weight and volume of current batteries. These batteries may be especially useful in powering sensors in remote and/or long-term operations; 2) Power management and control in all-electric hybrid combat vehicles with the goal of more efficient, lighter power trains in combat vehicles, to reduce re-fueling logistical and manpower requirements. 3) Coordination of renewable energy sources and battery storage for fleet management from a techno-economic perspective. Additional funding is needed to advance these efforts. $1.0 M

Relevance National/Regional
Military and law enforcement operations must be conducted with minimum loss of life, and minimum collateral and environmental damage. Reducing weight, power, and logistical requirements is also key. The proposed research fills high-priority expertise and technology gaps identified by the JNLWP and the DoD, respectively. KSU has a strong history of successful partnerships with government, academia, and industry.

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Materials and Energy from Miscanthus Established to Improve Soil Quality

Background
Kansas State University (KSU) has active research and educational programs related to renewable materials and sustainable energy from biomass. This multidisciplinary research effort includes the Colleges of Agriculture, Arts and Sciences, and Engineering at KSU. The research programs are very important to the Kansas economy and for the reduction of greenhouse gas emissions and sustainable development. A growing need to increase the amount of productive land available for crop production for renewable materials and energy is emerging. Recently, interest in Miscanthus giganteus has been increasing because significant amounts of biomass can be produced with modest water requirements (miscanthus has excellent water use efficiency). It also can be grown on marginal lands not currently used for food production. KSU has NATO funding for a planning grant to collaborate with faculty in Slovakia, Ukraine, and Belarus for miscanthus research with contaminated soils. Several K-State faculty currently have active research programs with miscanthus, phytoremediation, and soil quality. KSU has past experience and well equipped laboratories for this research. Past funding has been from EPA, USDA, and KDHE.

Description
The current plant biomass research at KSU includes agronomic plant biomass production research, agricultural economics studies, research on contaminated mine land soil vegetation, and investigations of processes to produce products from biomass. The integration of systems that include biomass production, harvest, storage, processing, and product marketing has significant value because all aspects are necessary to develop and commercialize new products, such as camelina and miscanthus.

This request is for $5 million for miscanthus research to develop new knowledge while conducting field studies on soils with lead at Fort Riley, establishing miscanthus on abandoned mine land near Galena, Kansas, improving soil quality by growing miscanthus as a productive crop in southeast Kansas near Parsons, and investigating miscanthus as a productive crop in areas with limited or no irrigation water on soils not presently used for crops or pasture. A portion of the funds will be used to conduct research on uses for miscanthus, including combusting it in pellet form for heating in rural areas where natural gas is not available and mixing it with coal to produce steam and electricity. Miscanthus can also be used as forage for cattle, insulation material, bedding for animals, and for conversion to higher value products such as a liquid fuel or adhesive products.

A portion of the funds will be used to conduct a comprehensive review of published literature related to miscanthus in order to build on the research team's review, "Miscanthus as a Productive Biofuel Crop for Phytoremediation," published in Critical Reviews in Plant Science. Two seminars will be developed and presented on 1) the use of miscanthus for phytoremediation and soil improvement, and 2) miscanthus as a perennial crop for sustainable agriculture and biomass production. Each seminar will be conducted over the course of three days and will be videotaped and distributed worldwide.

Relevance National/Regional
Contaminated soils exist in Kansas, our region, and the world. The NATO project focuses research on contaminated military soils. If KSU is able to improve soil quality on lands that are presently idle such that productive crops can be produced, this will have economic value for society. A significant amount of land in southeast Kansas, southwest Missouri, and northeastern Oklahoma has been abandoned because of mining. The proposed research could potentially significantly improve the economy of Kansas and the United States by finding productive uses for abandoned and idle land.

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ENERGY AND WATER
Tools for Protecting America’s Livestock Economy

Background
A critical concern of law enforcement and scientific communities is the willful introduction of foreign animal disease (FAD) as a means to crash the U.S. agricultural economy. Therefore, first responders, veterinarians, and diagnosticians require a set of tools for the early detection, prevention and surveillance of FAD. To meet these challenges, K-State formed a strategic partnership with Lawrence Livermore National Laboratory (LLNL). The goal is to develop and implement the next generation of detection and prevention tools for ASF, CSF and other FAD. One objective is to design detection assays that can be rapidly incorporated into standard diagnostic testing so that testing for FAD can be instantly implemented without disrupting continuity. This faster, better, cheaper approach will make the monitoring and testing for FAD a routine activity. The prevention of a disease typically involves the deployment of vaccines. However, for ASF there are no vaccines, and there will be no vaccines in the near future. The best way to prevent ASF is to make animals naturally resistant. The second overall goal of the partnership is to identify pig genes that confer resistance to ASF.

Description
As a land-grant institution, K-State leads the nation in developing the next generation of tools to protect livestock from foreign animal diseases, including ASF and CSF. The focal point for these activities is the Biosecurity Research Institute (BRI), a 113,000 ft² facility with the capacity to conduct infectious disease research on high consequence pathogens. Supporting the BRI is a cadre of scientists, diagnosticians and veterinarians who occupy the Kansas State Veterinary Diagnostic Laboratory (KSVDL) and the College of Veterinary Medicine (CVM). Recently, K-State joined forces with biological and computational scientists from LLNL, the premier national laboratory that applies multidisciplinary science and technology to anticipate, innovate, and deliver responsive solutions for national security needs. LLNL’s biosecurity program has a distinguished track record in developing and deploying advanced biodefense capabilities. Many of these technologies leap-frog traditional approaches. One example is the Lawrence Livermore Microbial Detection Array (LLMDA), a DNA test that can detect more than 5000 pathogens in less than 24 hours. The K-State and LLNL partnership focuses on three areas. The first is the development and implementation of a diagnostic platform that integrates the detection of endemic, emerging and foreign animal diseases into a single test. This faster, better, cheaper approach represents a transformation in the animal health arena.

A second area is the development of DNA chips that can rapidly identify and classify all variants of foreign animal disease pathogens, and to correlate pathogen genetic differences to disease outcome and geographical distribution. The third area is to identify pig genes that are involved in natural protection from infection, which will allow the breeding of pigs that are resistant to disease and/or show an improved response to vaccination.

Relevance
In January 2009, the Department of Homeland Security (DHS) selected Manhattan, Kansas as the location for the National Bio and Agro-defense Facility (NBAF) in January 2009. The mission of NBAF is to protect America’s livestock and agricultural economy from foreign and zoonotic animal diseases. NBAF is being built on the K-State campus, next to the BRI, KSVDL and CVM. Together, these will form one of the largest animal health complexes in the world, which will serve as a magnet for new companies and further economic development. A key discriminator in the selection of Kansas for NBAF was the opportunity to jump-start NBAF research in the BRI. On a broader scale, the BRI serves as the center hub in the wheel of a larger transformation across Kansas. The LLNL-K-State partnership enhances every aspect of the NBAF mission with opportunities to acquire additional funding for applied and basic research supported by both public and private entities. As a partner, the State of Kansas acquires reciprocal gains by retaining Kansas students in Kansas jobs, diversifying the Kansas economy, and transforming K-State’s land-grant mission to meet 21st century challenges.

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Networking, Communications, and Security for Critical Infrastructures

Background
Daily activities in society increasingly rely on interdependent critical infrastructures such as power grids, telecommunication networks, transportation networks, food networks, and water distribution networks. In contrast to isolated systems, interdependent networked systems demonstrate emergent behaviors caused by unpredictable, rare, non-linear interactions between numerous social, physical, and cyber components. Because infrastructure systems are so large, they are often decentrally controlled through cyber systems. However, even if decentralization and self-organization theoretically reduce failure risk, interdependencies can lead to disruptive and massive cascading failures. Interdependent and multilayer networks characterize important social and engineered infrastructures, and a full understanding of their behaviors through fundamental results is still needed.

As an example, the Smart Grid concept includes the application of advanced computer, communications, and power technologies to obtain a highly automated, responsive, and resilient, transmission and distribution infrastructure. At the distribution level, the Smart Grid integrates distributed renewable generation sources with energy storage and provides demand response management to customers through dynamic pricing. At the transmission level, communication architecture creates an intelligent infrastructure that can detect and mitigate faults faster than they can propagate, thus providing utility operators with improved efficiency and reliability. Although ongoing efforts to design the next-generation communication network within the Smart Grid framework are in progress, lack of flexibility and programmability of network equipment has impeded the possibility to experiment with new schemes. Consequently, power operators are reluctant to adopt untested solutions.

Relevance National/Regional
Numerous critical infrastructures rely on secure networking and communications in Kansas and in the nation. In the state of Kansas, power and networking companies have demonstrated endorsement by sponsoring K-State’s Electrical Power Affiliate’s Program (EPAP). Nationally, this research has received contributions from Raytheon BBN Technologies, KanREN, Internet2, and National LambdaRail.

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Center for Wind Energy Research and Education

Background
Many technical aspects of wind generation are under investigation to achieve the federal grand challenge of 50% of the total electricity generation from renewable resources. To advance this goal fundamental research is required for (i) enhancing wind turbine efficiency and durability, (ii) improving wind energy forecasting for optimal operation of the power grid, (iii) integrated planning and control for higher reliability and stability of the power grid, and (iv) advanced power electronics interfaces for higher stability, and (v) integration of smart grid technologies for higher resiliency of the system with high wind generation. Moreover, recent studies reveal that many power engineers will become eligible for retirement in the near future, which will create a shortage of highly educated workforce for the power industry. In response to this need, training students in wind energy and power engineering must be given the utmost priority.

Description
Energy production increases with improved turbine efficiency and durability. Turbines operating at peak efficiency with minimal maintenance and near failure-free operation have lower payback periods and reduced annual operating expenses. The proliferation of wind generation has been aided in the past by federal tax credits, something that cannot be relied on to be available in the future. Efficiency and long term reliability must be increased in order for wind turbines to compete directly with natural gas.

Uncertain and intermittent nature of wind and generation is the biggest bottleneck in increasing its share in the generation portfolio. This bottleneck impedes planners’ ability to account for capacity available from renewable resources and hinders operators’ ability to respond to rapid fluctuations in generation. The ability to accurately forecast the availability of generation resources in the short term as well as in the long term is crucial for design and operation of power systems. Unlike fossil-fuel-based generators, whose output can be controlled by adjusting the fuel input, the output of renewable generation depends on the prevailing conditions. Therefore, accurate models are needed for temporal and spatial forecasting of renewable generation over different time horizons ranging from a quarter-hour to a day and beyond. The forecasts and associated probabilities would allow the planners and operators to develop risk-based strategies to optimally utilize renewable resources.

Location of renewable generation is limited by geographic features. In many cases, good wind sites either do not have adequate transmission facilities or the locations are not suitable for interconnection due to grid stability concerns. To facilitate such integration, comprehensive planning is needed, addressing the generation portfolio, new transmission lines, reactive power resources, and energy storage facilities while accounting for cost as well as emissions, and system stability and reliability. Optimization of all these variables is important to manage costs and maximize renewable energy use.

In addition to having a few large power plants, distributed wind generation provides additional opportunities for exploiting the wind energy potential. The distributed generation calls for new strategies for using the wind turbines to provide reliability and resiliency support for the power grid.

Power electronics devices play key roles in renewable generation units because they are employed as the interface devices between them and the power grid. These inverters should be able to reconfigure quickly to adjust to changing system conditions arising from sudden fluctuations in renewable generation.

Finally, a larger wind infrastructure requires an educated populace who can design, assemble, install, and operate wind turbines, and operate power grid with high penetration of wind generation. To educate this populace, Kansas K – 12 and higher education institutions must be ready to provide the instruction and practical experience workers in this area need.

The creation of this center will require financial support for faculty and students to partner with NREL to gain additional experience and to utilize research platforms at NREL to test new turbine systems for efficiency and reliability. Support is also needed to build a Kansas research and education infrastructure to attract and support industry. At KSU, KU, and WSU an experienced team exists and is ready for these research and educational challenges.

Relevance National/Regional
The merits of this wind turbine research thrust include greater US turbine economy, small community turbine investment opportunity, exploitation of Kansas’ wind resources, Kansas becoming a regional power exporter, replacing the coal-fired plant’s water use with agricultural uses, and further development of Kansas’ wind energy expertise.

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Performance and Innovation in Building Envelopes

Background
Innovation in building envelopes is essential to reducing building energy use and embodied energy. While the HVAC-R research field has been a subject of focus for engineers and scientists, direct collaboration between architects, engineers, and manufacturers is necessary to confront the multimodal performance challenges of the building envelope. The proposed project represents a model of innovation built upon the broad applied knowledge of the architectural discipline and that is expanded by way of collaborative inquiry among engineers, scientists, and manufacturers using the most advanced technologies for fabrication and testing.

Description
The project involves graduate architecture students engaging practicing architects and consultants to explore a particular environmental issue (i.e. thermal transfer or daylight control) impacting performance in the building envelope. In parallel, the research team collaborates with a manufacturer of building components to understand how these environmental performance issues can be addressed in manufacturing and building product development.

The project is currently in its pilot year (AY 2013-14), working specifically on the use of ventilated building cladding to reduce summer heat gain in buildings. Graduate architecture students from Kansas State University are conducting the research in collaboration with BNIM, a nationally recognized practice, and Zahner, a leading manufacturer of innovative envelope systems. Students have used computer analysis and instrumented mockups, built with the support of Zahner, to develop, test, and integrate innovative building skins that can reduce cooling season energy use. Leading architects from BNIM are participating directly as research guides and experts in the integration of envelope systems.

Relevance
The project aims to advance innovation in sustainable technology by addressing the complex and interconnected issues that define the performance of buildings: integrating issues of physics and energy transfer, resistance to weather and climate, structural performance, embodied energy of materials, and the comprehensive impact of architecture for building users and owners. Architectural decisions are driven frequently by aesthetics and economics on the other hand. This research project recognizes the deeply integrated nature of performance in the building envelope and the need for interdisciplinary, out-of-the-box innovation linked with emerging technologies for manufacturing and testing to solve this pressing issue in the sustainability of buildings.

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Nuclear Engineering Distance Education and Training – A Multi-University Program in Support of the United States National Need for Nuclear Trained Engineers

Background
Kansas State University (KSU) leads the University Engineering Alliance (UEA) which will develop and expand educational and training opportunities in nuclear engineering for students and professionals. Furthermore, the UEA has been collaborating with the United States Navy to develop a distance M.S. program for Navy officers and professionals, as described at: www.universityengineeringalliance.org.

Funding of $950,000 would allow KSU to jump-start the UEA Nuclear Education Program which will provide the network and courses needed to significantly expand access to nuclear engineering education and provide a more comprehensive M.S. program for Navy personnel.

Description
The UEA, begun in 2008, is led and administered by Kansas State University with active participation from approximately 10 mid-continent engineering colleges. The organization provides distance education (DE) in nuclear engineering (NE) to students at universities that do not have NE programs. A number of students have already taken advantage of the program. The UEA is the only consortium in the United States that provides such educational opportunities. This multi-university engineering alliance serves as a model for other programs as an efficient, cost-effective method to address specific, critical education needs. Initial focus was on the original Big 12 region, but the program can expand nationwide to provide a cost-effective approach to nuclear education for the country. The current program will also likely expand to other critical topics, including other energy programs and the environment. Funding would provide KSU necessary funds to transition the ongoing effort into a successful, self-sustaining program.

In 2005, KSU initiated a discussion with engineering schools in the Big 12 Conference regarding the benefit of providing nuclear engineering courses throughout the conference. Four of the 12 schools had nuclear engineering programs and agreed to provide courses to other schools through distance education. Nuclear engineering courses would be offered by Kansas State University, University of Kansas, University of Missouri-Columbia, University of Texas-Austin, and Iowa State University. All schools agreed that such a program would significantly benefit engineering students from all participating universities. As a result, UEA was formed and recently completed eight semesters of serving students. Success to date is due in part to modest support from the U. S. Department of Energy and Department of Education.

Relevance National/Regional
In the current decade, demand for nuclear engineers has increased rapidly. Unfortunately, with the limited number of remaining programs, graduation rates cannot sufficiently keep pace with retirements or meet increasing demand. Navy personnel seek educational opportunities, so the distance M.S. program is very attractive and beneficial to them.

Utilities around the world recognize the need for nuclear power. Other countries have seized the momentum to the extent that a majority of current nuclear vendors are foreign. The situation is particularly alarming since the U.S. must maintain a strong deterrent nuclear weapons program, handle international nuclear proliferation issues, and regulate inevitable growth in nuclear power and the management of nuclear waste. The U.S. also must continue to develop nuclear medical advances and industrial applications. The U.S. Navy has a fleet of more than 100 nuclear powered submarines and aircraft careers, so a serious national need exists to educate engineers in regards to nuclear issues.

Beginning new NE programs is time consuming and expensive because reactors cost tens of millions of dollars and nuclear faculty members are difficult to find. Leveraging existing programs via distance education is the most rational solution. Funding would allow the University Engineering Alliance to reach its full potential and ultimately expand to a national program.

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(NEI is not part of DOE but would shepherd this program through the agency)
HOMELAND SECURITY
Real-Time Monitoring of Biosafety Level (BSL) 3 & 4 Exhaust Flow Purity

Background
Hazards due to industrial accidents, nuclear plant accidents, or accidental releases of biological or chemical agents from a laboratory can be prevented or minimized if precautionary measures are established and necessary equipment and trained personnel are available to respond. The majority of spaces that require strict airflow filtering use High-Efficiency Particulate Absorption (HEPA) filters. Filters used in Nuclear, Biological, and Chemical (NBC) applications currently require manual periodic inspection; unfortunately this method detects the potential release of dangerous substances only after the release occurs.

The proposed effort will leverage a current collaboration involving the Institute for Environmental Research (IER) and the Biosecurity Research Institute (BRI) which are both located at Kansas State University.

The Institute for Environmental Research (IER) is an interdisciplinary research center focused on interactions between humans and their environment. It is comprised of 6,500 square feet of laboratory space encompassing eight computer-controlled environmental chambers and an environmentally controlled, 11-row mockup of a wide-body aircraft cabin for use in studying air distribution, air quality, contaminant transport, and decontamination. IER faculty and staff have particular expertise in airflow, filtration, particulate detection, and novel experimental design.

The BRI at Pat Roberts Hall is a unique biocontainment research and education facility. Comprised of 113,000 square feet of lab, education, and administrative space, this BSL-3, ABSL-3, and BSL3-Ag facility offers abundant research and education opportunities in bioscience. The BRI supports collaborations among Kansas State University researchers and with other academic, federal, and private researchers. BRI faculty and staff have particular expertise in livestock, insect, and plant pathogens that threaten food supplies and health.

Description
The proposed research and development effort aims to design and prototype a system to monitor, capture, and remediate biological hazards caused by accidents or equipment failure and link this system to air handling controls for rapid shutdown of air flow through the laboratory.

In conjunction with on-call research from other disciplines, including physics, computer science, agriculture, mechanical, and chemical engineering, the IER and BRI will focus on known principles of optical detection using laser light combined with current and emerging particle-counting technologies while maintaining airflow system integrity. Novel, highly tunable ionic liquid coated HEPA filters will be developed for the specific capture and remediation of the target compounds. Envisioned is a low cost, low maintenance system that is easily retrofitted on the downstream side of current air handling equipment in NBC (particularly BSL-3 & 4) containment facilities.

Additional funding in the amount of $1.0 M is needed to advance these efforts.

Relevance National/Regional
Hazards are real or potential conditions that can cause injury, illness, or death; damage to or loss of equipment or property; or damage to the environment. Hazards can be intentionally or inadvertently caused by hostile forces or the accidental release of chemical or biological agents (e.g., natural disaster, accidental release by governmental or commercial sectors).

Due to their explosive, chemical, or biological natures, hazardous materials cause safety, public health, or environmental concerns that require concentrated effort to detect, manage, mitigate, and remediate. The new National Bio Agro-Defense Facility (NBAF) is currently being constructed in Manhattan, Kansas. Its collocation with Kansas State University provides unparalleled opportunity to advance the science and safe operation of facilities used for experimentation with and storage of hazardous substances, particularly biological pathogens. The capability this effort will provide currently does not exist, consequently providing increased safety and surety in biosecurity laboratory operations.

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5.1
Integration of Research, Training, and Education in Biosafety and Biocontainment

Background
In the late 1990’s, Kansas State University made a programmatic commitment to the area of food safety and security. As a land grant institution with a major focus on food animal husbandry, KSU made food animal health and welfare a priority. The State of Kansas made a strong investment in KSU’s research priorities by funding the construction of the Biosecurity Research Institute (BRI). Further, the Department of Homeland Security has acknowledged KSU’s leadership within this area and named Manhattan as the home of the National Bio and Agro-Defense Facility (NBAF).

Description
A congressional investment in research would foster a robust training program in an area of national need, allowing the Kansas State University Graduate School to develop, deploy and manage a research and educational program for the biosafety and biocontainment research professional. This will address critical workforce development needs in a profession that has recently been scrutinized during congressional oversight.

This program will utilize the 10,000 square foot educational wing of the state-of-the-art BSL-3 Biosecurity Research Institute (BRI) at Kansas State University. The BRI offers a unique integrated training laboratory suite, including world-class image capture capabilities allowing the integrated training suite to serve as a filming studio. The vision of this initiative is to utilize the unique research activities and integrated training/education resources to develop synergistic programs to provide training to existing professionals, graduate level education and degree programs for graduate students, and fellowship opportunities for post-doctoral students.

The laboratory training program will provide scholarship opportunities for doctoral students seeking research careers in the biosciences, and will couple research activities with training in biocontainment practices and procedures. Similarly, a postdoctoral fellowship program will provide both short- and long-term training in containment research beyond the doctorate. These two activities will be integrated with a broader program to provide technical support staff, who will fill biocontainment workforce needs nationwide, with skills to work in the BSL-2, 3, and 3Ag environment safely and securely. The technical support overlay also includes training building maintenance and management professionals on the unique aspects of working in a biocontainment facility.

The demand and importance of these programs will significantly increase as the Olathe campus continues to develop and as the NBAF becomes operational in the Manhattan community.

This initiative also provides the framework to synergistically link and integrate the biosafety and biocontainment research/educational investments, infrastructure, resources, expertise, and missions of the K-State main campus, K-State Olathe campus, and the NBAF. This extension additionally lays the foundation for the development of collaborative graduate education programs with federal institutes such as NIH’s National Biosafety and Biocontainment Training Program (NBBTP).

Relevance Regional/National/International
Utilizing KSU’s world-class resources to educate tomorrow’s biosafety and biocontainment professions will provide our students with a competitive edge as they apply for technical or faculty positions. Additionally, the program would provide necessary training and experience for the future workforce at NBAF and biotech companies in the expanding animal health corridor.

With thousands of BSL-2 and BSL-3 laboratories in the United States, a graduate level research and educational program for biosafety and biocontainment professionals would provide valuable hands-on skills to ensure safe and secure operations.

Research and training agreements with the U.S. Department of Agriculture, the Department of Homeland Security, Australia’s Commonwealth Scientific and Industrial Research Organization, and Kenya’s International Livestock Research Institute provide unique opportunities for students, staff, and faculty to gain experience for NBAF and related projects that complement existing programs.

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EPICENTER: Laboratory for a network approach to predict and control the spread of infectious diseases

Background
Few events disrupt society and cause economic loss as severely as an out-of-control infectious disease. Terrorist activities or natural causes can produce an epidemic that may result in human deaths, the disposal of herds, and the destruction of crops. Fundamental to EPICENTER’s mission is the conviction that epidemic dynamics and intervention strategies must be derived taking into account the underlying complex networks which describe the multiple and dynamic interconnections among involved systems.

Description
EPICENTER, a laboratory within Kansas State University’s College of Engineering, provides resources to build, analyze, and simulate data-driven computational models for biomedical and biological systems represented as complex networks. Research at EPICENTER challenges scientific boundaries by addressing the impact of (1) heterogeneity, (2) interdependence, and (3) stratification of networks in spreading processes. These three characteristics abound in natural and man-made infrastructures and networks, and many fundamental questions still remain unanswered for interconnected and stratified/multilayer networks.

EPICENTER has successfully conducted several research projects since its inception seven years ago. Current projects include:

- **Data-driven predictive models of vector-borne diseases**: This project aims to develop innovative multi-scale computational models and tools for describing potential transmission cycles of zoonotic vector-borne pathogens that could be introduced into the U.S. Data generated by these models will be used to produce an operationally relevant predictive model estimating the timing and spatial extent of emerging vector-borne disease transmission risk to humans.

- **Integrated models of disease spread, supply chain logistics, and communication networks**: The objective of this project is to develop integrated models that capture the interdependencies between disease dynamics, supply chain logistics, and communication networks. For example, the spread of disease is influenced by the movement of animals, plants, and food products through the supply chain. Managing this movement effectively, in addition to deploying countermeasures such as vaccines, requires effective risk and crisis communication plans that engage multiple stakeholders. Stakeholders themselves constitute a network through which information is transmitted. The integrated modeling approach is expected to yield new insight to prevent, mitigate, and respond to infectious disease outbreaks.

- **Spreading processes over multilayer and interconnected networks**: The research goal is to establish rigorous mathematical tools and techniques to understand the role of multilayer and interconnected topologies in spreading processes. For example, a multilayer network is a physical contact network where a disease can propagate among individuals, together with an online information dissemination network where information can propagate among the same individuals. In zoonotic diseases, for example, interconnected networks are the network of animals and the network of humans where a virus can move from one network to the other.

Relevance National/Regional
The National Agricultural Biosecurity Center (NABC), the Institute for Computational Comparative Medicine (ICCM), the Center of Excellence for Emerging and Zoonotic Animal Diseases (DHS CEEZAD), the planned National Bio and Agro-Defense Facility (DHS NBAF), and EPICENTER are all located in Manhattan, Kansas, thus making Kansas the national leader in developing countermeasures to naturally-occurring and intentionally-introduced plant, animal, human, and zoonotic infectious diseases.

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Department of Homeland Security Office of Health Affairs: Lessons Learned for Food and Agriculture Emergency Response

Description
Lessons Learned Information Sharing (LLIS) / Food, Agriculture, and Veterinary Defense (FAVD)
- Review of agriculture related After Action Report/Improvement Plans (AAR/IP) as they are published on the llis.gov website and creation of abstracts detailing lessons learned from agriculture emergency response exercises or incidents.
- Provide lessons learned abstracts for access and use by agriculture emergency response planners.
- Lessons learned from the AAR/IP’s reflect gaps identified in emergency response training exercises or actual events and are cross-matched with existing training programs offered by DHS. Deficits in training availability are identified and reported to DHS.

Planning and Curriculum for Food and Agriculture Emergency Response
- Review and assess FEMA produced draft documents to determine their value in the development of guidance to ensure a risk-informed planning process by stakeholders involved in agriculture emergency response.
- Develop a detailed Livestock Emergency Response Plan (LERP) Appendix template for use by stakeholders.
- Integrate format and curriculum of the existing Food Emergency Response Plan (FERP) template with the recently developed Livestock Emergency Response Plan (LERP) template.

Background
Department of Homeland Security (DHS) – Office of Health Affairs (OHA) has identified two key Food, Agriculture, and Veterinary Defense (FAVD) needs, each of which is being addressed through projects performed by NABC at Kansas State University.

Lessons Learned Information Sharing (LLIS):
Review and analysis of AAR/IP’s from training exercises or agriculture-based incidents are integral to the continuous evolution of agricultural emergency response. Lessons learned serve no purpose if their value is left buried within the text of an exercise or incident report. Once lessons learned have been identified and made available to agriculture emergency response planners, identified needs may be addressed by matching them to training available within existing educational programs of DHS.

Planning and Curriculum for Food and Agriculture Emergency Response:
Currently, no uniform planning process for the development of emergency operation plans for the defense of food and agriculture exist. FAVD branch within DHS/OHA seeks to promote a common understanding of the fundamentals of risk-informed planning and decision making. Such an understanding will allow for the development of integrated, coordinated, and synchronized emergency operation plans, through the use of a uniform planning process, across the Food and Agriculture Sector by National, State, local, tribal and territorial government entities.

Relevance
Lessons Learned Information Sharing (LLIS) / Food, Agriculture and Veterinary Defense (FAVD):
The needs of the agricultural community in response to an emergency situation often mirror the urban response. However, there are also many needs and solutions that are unique to an agricultural setting. Information available from NABC lessons learned analysis will allow agriculture emergency response managers to review lessons from tabletop and field exercise AAR/IP’s and then incorporate them into their own emergency response plans.

Planning and Curriculum for Food and Agriculture Emergency Response:
A common format and instructional curriculum for risk-informed planning and decision making will allow for the development of integrated, coordinated, and synchronized emergency operation plans across the Food and Agriculture Sector by National, State, local, tribal and territorial government entities.

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Groundwater and Society: Developing Technologies to Conserve the Ogallala Aquifer

Background
A grand challenge for the 21st century is providing high quality water for Kansas, the USA, and the globe. Fresh water from surface and underground sources is increasingly in short supply in the Ogallala region of western Kansas. Aquifer and surface water depletion, limited precipitation, and population shifts to mid-sized communities in western Kansas have stretched community and regional water supplies. However, this region leads Kansas in crop production and comprises the core of the U.S. beef cattle feeding industry. The top eight Kansas agricultural counties are located over the Ogallala Aquifer and represent $4.7 billion in crops and livestock, or one-third of Kansas' total agricultural revenue.

Developing more comprehensive understanding of the nexus of water, food, and society is crucial. As demand for water resources continues to increase, improved water management practices for crop and livestock production and water supply assurance for communities will be critical for sustaining economic viability and population base of the region. The latest tools and technologies are available to analyze the impacts of water-use policy decisions on economies and society and to engineer politically acceptable solutions.

Description
An interdisciplinary team of faculty members at Kansas State University studies risks and consequences of groundwater use and scarcity and develops new technologies to help citizens effectively manage water resources. As a Land Grant University, K-State has water-related expertise in agricultural sciences, social demography, resource economics, agricultural systems analysis, water resources engineering, policy analysis, and computer science and technology.

Research: Agricultural sciences, engineering and public policy dimensions of water and society provide information critical to decision-quality actions.
Education: Curriculum in water management, plant genetics, and computational models trains the next generation of water scientists and managers.
Extension and Outreach: Engagement with agencies and stakeholder organizations identify alternative methods to minimize groundwater scarcity challenges and assist water managers implement new practices.

Relevance
This team:
1) Informs citizens, planning agencies and policy makers understand of technical aspects of water resource management and the economic, social and natural system impacts of policy strategies.
2) Develops more efficient irrigation technologies, improved scheduling procedures, and combined water and nutrient management. Research and extension efforts guide producers in efficient irrigation strategies for various types of irrigation systems, as well as transition towards limited irrigation and dryland practices.
3) Evaluates alternative food and feed grains, oil seeds, and energy crops for drought and heat tolerance, adaptation to no-till or strip-till production systems, and utility as feed for livestock or feedstock for liquid fuel production.
4) Develops and evaluates technology to utilize for wastewater-use from concentrated animal feeding operations. Technologies can decrease potential environmental impacts from wastewater re-use, such as runoff into streams and odor, while conserving fresh water.
5) Utilizes the latest technologies and computational forecasting tools to quantify and understand interactions and feedbacks between available water resources and societal needs and values. Collectively, this computational infrastructure can provide the scientific basis to support sound planning, state, county, and local analysis and decision-making to development of equitable and fair water policies.

While groundwater stores are vulnerable, water resources systems can be made more resilient in order to cope with the foreseeable future. Communities, businesses and agricultural interests worldwide are struggling to address problems in efficient water-use for efficient agricultural and industrial. This program provides science-based research to guide management and policy. Well planned conservation of water resources is critical to the economic viability and stability of western Kansas.

Western Kansas seeks long-term solutions to manage a depleting Ogallala and develop agricultural systems, engineering and policy solutions to sustain the aquifer for current and future generations. Water is a primary requirement for quality of life in drinking water, power generation, crop production, and industrial and municipal use). Without the water of the Ogallala Aquifer, Kansas communities will suffer.

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Great Plains Center for Urban Watersheds (GPCUW)
Joining sustainable water science, planning, and management

Description
The Great Plains Center for Urban Watersheds (GPCUW) is a nexus of research, application, and outreach focused on sustainable green infrastructure and urban stream restoration in the communities of Kansas, the Midwest and Great Plains. GPCUW research focuses upon sustainable stormwater management, natural stream channel design and restoration, and innovative water conservation techniques in the cities and towns of Kansas. GPCUW communication joins teaching, service learning, and outreach with entrepreneurial opportunities between Kansas State University, Kansas State, Olathe, and those involved with sustainable water infrastructure in Kansas communities. GPCUW facilitates the development of new technologies and refinement of current practices for sustainable water planning and management. GPCUW practices rigorous and sustained monitoring of stormwater management, stream restoration, and water conservation measures for this is how we learn, improve, invent, and move closer to sustainability.

Background
Kansas communities are facing water supply shortages, the necessity of replacing aging water infrastructure, and the need for cost-effective, sustainable water conservation measures. Seventy three percent of Kansas population (most of which is in eastern KS) relies on surface water for all or part of their water needs. Three of the five major river basins that supply water to the cities and towns of eastern Kansas show potential for shortages within the next fifteen years (perhaps sooner given current climate change and drought predictions). The remaining basins rely heavily upon reservoir storage which continues to decrease due to accelerated erosion and sedimentation. Thus the need for water conservation is real and pressing. Most Kansas communities are addressing the replacement of aging, water related infrastructure as a result of design life expiration or due to CSO’s (Combined Sewer Outflows), as well as searching for less expensive, longer lasting ways of handling stormwater in newly developing areas.

Cities, towns, environmental planners and engineers, architects and landscape architects are in great need of green, sustainable water solutions. Yet, little research has been conducted regarding green infrastructure, natural channel design restoration, or innovative water conservation strategies in the Midwest. Information from the eastern US and the Pacific Northwest is often employed to design measures and practices for the dramatically different climatic, geologic, and biotic conditions and regimes of Kansas. Few of these measures are being monitored to gauge efficacy or applicability. Currently there is little to no extension or outreach to assist communities, agencies, or private entities regarding green infrastructure and water conservation. The requisite interdisciplinary expertise and experience are here at Kansas State; the coordination, synergy and conveyance of GPCUW allows for the application of this expertise.

Relevance
In 2009 the American Reinvestment and Recovery Act allowed the Kansas Department of Health and Environment to fund 15 “Green Infrastructure” projects for a total of $35M. Of these, 13 were in cities across Kansas and provided for the installation of one or more green infrastructure technologies or measures such as “constructed wetlands, rain gardens, bioswales, infiltration basins, bioretention cells, water harvesting, and green roofs”. These innovative, green technologies are being implemented throughout Kansas and the Midwest yet there is no research hub focused upon gauging efficacy or developing the most place-appropriate and sustainable measures. The need for the Great Plains Center for Urban Watersheds – its work of developing new technologies and practices for sustaining the water resources of Kansas is as real and urgent as the issues it will address. The sharing of new knowledge through education, extension, service-learning and innovative public-private partnerships is the mission of a land grant university. GPCUW at Kansas State University and Kansas State-Olathe will focus and facilitate a more resilient and sustainable water future for the communities and people of Kansas, the Midwest and Great Plains.

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6.2
Materials and Energy from Miscanthus Established to Improve Soil Quality

Background
Kansas State University (KSU) has active research and educational programs related to renewable materials and sustainable energy from biomass. This multidisciplinary research effort includes the Colleges of Agriculture, Arts and Sciences, and Engineering at KSU. The research programs are very important to the Kansas economy and for the reduction of greenhouse gas emissions and sustainable development. A growing need to increase the amount of productive land available for crop production for renewable materials and energy is emerging. Recently, interest in Miscanthus giganteus has been increasing because significant amounts of biomass can be produced with modest water requirements (miscanthus has excellent water use efficiency). It also can be grown on marginal lands not currently used for food production. KSU has NATO funding for a planning grant to collaborate with faculty in Slovakia, Ukraine, and Belarus for miscanthus research with contaminated soils. Several K-State faculty currently have active research programs with miscanthus, phytoremediation, and soil quality. KSU has past experience and well equipped laboratories for this research. Past funding has been from EPA, USDA, and KDHE.

Description
The current plant biomass research at KSU includes agronomic plant biomass production research, agricultural economics studies, research on contaminated mine land soil vegetation, and investigations of processes to produce products from biomass. The integration of systems that include biomass production, harvest, storage, processing, and product marketing has significant value because all aspects are necessary to develop and commercialize new products, such as camelina and miscanthus.

This request is for $5 million for miscanthus research to develop new knowledge while conducting field studies on soils with lead at Fort Riley, establishing miscanthus on abandoned mine land near Galena, Kansas, improving soil quality by growing miscanthus as a productive crop in southeast Kansas near Parsons, and investigating miscanthus as a productive crop in areas with limited or no irrigation water on soils not presently used for crops or pasture. A portion of the funds will be used to conduct research on uses for miscanthus, including combusting it in pellet form for heating in rural areas where natural gas is not available and mixing it with coal to produce steam and electricity. Miscanthus can also be used as forage for cattle, insulation material, bedding for animals, and for conversion to higher value products such as a liquid fuel or adhesive products.

A portion of the funds will be used to conduct a comprehensive review of published literature related to miscanthus in order to build on the research team's review, "Miscanthus as a Productive Biofuel Crop for Phytoremediation," published in Critical Reviews in Plant Science. Two seminars will be developed and presented on 1) the use of miscanthus for phytoremediation and soil improvement, and 2) miscanthus as a perennial crop for sustainable agriculture and biomass production. Each seminar will be conducted over the course of three days and will be videotaped and distributed worldwide.

Relevance National/Regional
Contaminated soils exist in Kansas, our region, and the world. The NATO project focuses research on contaminated military soils. If KSU is able to improve soil quality on lands that are presently idle such that productive crops can be produced, this will have economic value for society. A significant amount of land in southeast Kansas, southwest Missouri, and northeastern Oklahoma has been abandoned because of mining. The proposed research could potentially significantly improve the economy of Kansas and the United States by finding productive uses for abandoned and idle land.

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LABOR, HHS, EDUCATION
Child Health and Physical Activity

**Background**
Childhood obesity is a major public health issue facing the United States and the world. Prevention of childhood obesity is not likely to be solved by a simple solution. Rather, scientific consensus documents suggest that the causes are multifaceted and best understood by applying a human ecological model across the lifespan in research and practice. The College of Human Ecology at Kansas State University is uniquely positioned to address this important public health problem because it is one of a handful of institutions that houses programs specializing in the study and practice of physical activity, human nutrition and dietetics, food sensory analysis, family systems and therapy, and child development.

**Description**
Scholarly work currently underway includes:

1) Investigation of ways to make health behavior change easier for parents and families to incorporate into their lifestyles;
2) Experiments that incorporate community stakeholders in the process of creating health promoting communities,
3) Analysis of how food and physical activity choices specifically affect health outcomes in children of all ages.
4) Multi-state extension education projects focused on reducing childhood obesity.

Kansas State University has research facilities structured (physically and organizationally) to study child health issues.

1) The Hoeflin Stone House Early Childhood Education Center where children are observed at play and at mealtime.
2) The internationally recognized Sensory Analysis Center investigates how different aspects of food (taste, texture, smell, etc.) affects children’s food choices to better understand how to make healthy options the preferred choice of children.
3) The Center of Excellence for Food Safety Research in Child Nutrition Programs, provides scientific solutions to child food safety problems -- especially food safety problems that are evident in school lunch rooms across the US.
4) The newly established Physical Activity and Nutrition Clinical Research Facility supports cause-effect studies of how lifestyle choices impact the health of children, their parents, and adults.

5) The Youth Physical Activity and Nutrition Motivation Laboratory studies community-based childhood obesity prevention interventions.

The collaborations of College of Human Ecology faculty have led to competitive grants totaling $12 million in funding to support childhood obesity, physical activity, nutrition, and community interventions to improve the health behavior of children.

**Relevance National/Regional**
The issue of child nutrition and health has national relevance due to its relationship with quality of life and cost of health care. Kansas State University is well positioned to conduct basic and applied research to support improvement of child nutrition and health.

We have the facilities needed to support clinical research of childhood nutrition, health, and obesity and we provide educational programs for school foodservice professionals and other community practitioners whose work impacts the health of children.

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Breaking the Barriers: Aging in Place

Background
As the demographics of the United States and indeed the world increasingly shift toward the elderly population, a need to understand implications of the built environment upon the quality of life of older individuals and provide accessible and affordable solutions exist. While strides toward increased attention to the conditions designed in existing and new congregate care, assisted living, and other specific facilities aimed at housing those with decreased functioning due to age or disease is on the rise; affordable alterations to the inventory of current housing for those same individuals with lower economic means is relatively stagnant.

Description
Rather than expecting humans to adapt to their environment, changing their behavior or actions due to the fixed nature of the building housing them; this project aims to redesign existing living environments toward the needs of its aging inhabitants and allowing effective aging-in-place measured through quality of life and economic models.

Medical terminology can be confusing and overwhelming to the general public. Initial steps of comprehending the characteristics associated with each aging ailment and translating medical literature regarding ailments to design features implemented with low cost has been accomplished. Building upon that understanding and utilizing a trans-disciplinary model of process, and including rapid prototyping, multiple models of interventions can be envisioned, tested and brought to fruition, creating an aesthetically-pleasing, ailment-specific, safe living space. In the end, a few well-designed changes can mean the difference between residents staying put or forced to move to special care facilities (and incurring the significant impact to their personal financial condition and subsequent need to employ Medicare financial support).

Many adults wish to maintain their independence, often in the homes in which they’ve lived for many years. Social services and senior home care services are available in most communities to support mature adults aging in place. However, these familiar environments themselves often create physical barriers for those suffering from specific age-related ailments. To overcome these barriers, design of the environment to support and enable people as they age (whether their choice stems from financial or personal situations) to remain in their home is the impetus of the approach presented here and exemplified through the research, design, prototyping, and testing of products seamless to the home environment.

Relevance
Most people age 75+ have at least one joint affected by arthritis. In 2003-2005, 50% of adults 65 years or older reported an arthritis diagnosis and that percentage has continued to rise. Women are impacted 2-3 times more than men by Rheumatoid Arthritis. Most hearing loss begins between 40-50 years. Over twenty-eight percent of those individuals age 65 and older have a measurable hearing impairment and by age 85, 50% of individuals have a hearing impairment. One-in-two women and one-in-eight men 50-plus years of age will have an osteoporosis-related fracture. Depth perception begins to decline during the 50’s, and a 60-year-old person may require 2 to 3 times as much light as a 20 year old; with the amount of light required doubling for each 13 years after the age of 20.

While available alternatives of retirement housing, independent living, congregate care, assisted living, skilled nursing, specialized nursing facilities, and nursing homes, are plentiful in many urban areas of the country, many individuals and families prefer to age-in-place within their existing community. Arthritis, cardiovascular diseases, diabetes, hearing impairment, mental disorders, muscular loss, neurological diseases, osteoporosis and vision impairment are nine ailments determined to impact the built environment for those wishing to age-in-place, and which this project mitigates through products and interventions.

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Preparing STEM Teachers: Responding to New Challenges

Background
The National Science Board issued a report in 2010 strongly stating the need for quality education of the future STEM workforce. Key recommendations that relate directly to the preparation of teachers in STEM fields include: providing professional development opportunities for teachers, principals, counselors, and other key school staff; supporting research-based STEM preparation for teachers; and fostering peer-to-peer connections and collaborations with the scientific research community. Besides this call to action, here are three new challenges in preparing STEM teachers in the nation’s teacher preparation programs.

1. Unmet needs for endorsed and highly qualified math and science teachers. Over the next decade, schools will need 200,000 or more new math and science teachers nationally. In Kansas, the shortage of math and science teacher is expected to reach critical levels with the potential retirement of 36% of Kansas teachers eligible to retire in five years.

2. The reform of science and math standards in K-12 education (the Next Generation Science Standards, NGSS). NGSS updates content and represents a shift in the way STEM education has been conceptualized and implemented, necessitating a change in the approach to preparing science and mathematics teachers.

3. The adoption of Common Core State Standards (CCSS). The new CCSS provide a clear understand of expected student outcomes, which provide new guidelines and expectations for preparing teachers.

Description
The College of Education (COE) at K-State is responding to these challenges by implementing activities to increase the number and quality of STEM teachers for Kansas schools:

• A dual degree program was approved in 2013 that enables undergraduate students to complete a STEM major and become a licensed middle/high school STEM teacher in four years.

• The college is implementing a Teacher Education Initiative, funded by the Kansas Board of Regents, focused on designing an enhanced Graduate Certificate in Teaching and Learning to recruit and prepare STEM graduates to become STEM teachers. In addition, this project is designing courses and providing professional development to support currently licensed teachers wishing to gain an additional license in science or mathematics.

• The Center for Intercultural and Multilingual Advocacy (CIMA) is providing professional development to ESL teachers to improve their capacity to teach math and science to ESL students.

• The math education faculty, the Department of Mathematics, and CIMA have developed several proposals to NSF for the development of culturally-responsive math instruction strategies, which include extensive professional development for Kansas’s math teachers.

• Math education and mathematics faculty have been conducting successful summer mathematics professional development institutes for Kansas teachers for the past 11 years.

Efforts planned for the near future are: recruiting veterans into STEM teacher certification programs; an endowed chair in science education; expansion of the STEM faculty in the college; focused efforts on recruiting STEM preservice teachers; workshops and webinars on NGSS; and collaboration with the College of Engineering related to engineering education.

Relevance
STEM teacher education relates to the College’s 2025 plan, Theme II, with a goal of increasing the number of STEM graduates by 50% in the next 10-15 years. These activities also relate to K-State 2025, Themes II and III.

Contacts
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Preparing Future STEM Faculty from Underrepresented Groups

Background
Kansas State University is committed to recruiting students from under-represented groups for undergraduate and graduate degrees. Progress has been made in recent years at the undergraduate level and to a more limited extent in doctoral programs in the STEM disciplines. Despite the progress K-State has made to create a more inclusive educational environment, disparities remain and will continue to grow with changing demographics unless major initiatives are implemented. K-State has the demonstrated infrastructure to support this initiative. Currently K-State coordinates eight undergraduate research experiences during the summer that recruit a substantial number of students from the target populations; supports a developing scholars program to provide first generation and minority students research experience; a McNair scholars program that provides research and academic support services for the same target group of students; and successful multi-year mentoring programs for female faculty members and students in the STEM disciplines. Thus, we have a core group of faculty members who would support this initiative by serving as mentors to selected doctoral students.

Description
Nationally a significant gap exists between the numbers of doctoral graduates from underrepresented groups and the demand for these graduates to fill positions in higher education, industry, and government. This gap is especially great in the STEM disciplines. With an increasingly diverse population, it is imperative that universities educate more students from underrepresented groups to fill this gap and serve as role models and leaders in the future. New and dynamic models for career development programs are needed to train the next generation of faculty members who can serve as role models for both undergraduate and graduate students in institutions of higher education and as researchers and leaders in industry and government.

A comprehensive program, “Preparing Mentors in the STEM Disciplines to Educate the Future Workforce in Science and Technology,” will prepare participants for the multifaceted roles (teaching, research, mentoring/advising, service and outreach) of junior faculty in the STEM disciplines that they will be expected to perform while serving as role models for the next generation of minority students. An emphasis will be placed on involvement in interdisciplinary research projects. Specialized workshops will also be provided to facilitate current faculty members in more effectively mentoring both undergraduate and graduate students in the STEM disciplines. The outcome of this initiative is to begin addressing the major gap in supply and demand for faculty from minority populations in all STEM disciplines.

Relevance National/Regional
The United States is becoming increasingly diverse; however, this diversity is not reflected in the STEM workforce and higher education. The Commission of Professions in Science and Technology (December 2008) reported that approximately one third of the U.S. population between the ages of 18-24 are underrepresented minorities. The U.S. Bureau of Labor predicts that 50% of the college-aged population will be students from underrepresented groups by 2050. For both women and underrepresented minorities, participation declines as the degree level increases. For example, only 26% of the STEM doctorates are awarded to women and 6% to individuals from underrepresented groups. This results in a void in faculty mentors for under-represented minorities. Previous research has found that these students identify most with faculty who look like them and share common backgrounds. Diversity in higher education is essential in ensuring balance, providing new perspectives, and reaching students at all levels.

Agency Contact Information
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National Science Foundation
EPICENTER: Laboratory for a network approach to predict and control the spread of infectious diseases

Background
Few events disrupt society and cause economic loss as severely as an out-of-control infectious disease. Terrorist activities or natural causes can produce an epidemic that may result in human deaths, the disposal of herds, and the destruction of crops. Fundamental to EPICENTER’s mission is the conviction that epidemic dynamics and intervention strategies must be derived taking into account the underlying complex networks which describe the multiple and dynamic interconnections among involved systems.

Description
EPICENTER, a laboratory within Kansas State University’s College of Engineering, provides resources to build, analyze, and simulate data-driven computational models for biomedical and biological systems represented as complex networks. Research at EPICENTER challenges scientific boundaries by addressing the impact of (1) heterogeneity, (2) interdependence, and (3) stratification of networks in spreading processes. These three characteristics abound in natural and man-made infrastructures and networks, and many fundamental questions still remain unanswered for interconnected and stratified/multilayer networks.

EPICENTER has successfully conducted several research projects since its inception seven years ago. Current projects include:
- **Data-driven predictive models of vector-borne diseases**: This project aims to develop innovative multi-scale computational models and tools for describing potential transmission cycles of zoonotic vector-borne pathogens that could be introduced into the U.S. Data generated by these models will be used to produce an operationally relevant predictive model estimating the timing and spatial extent of emerging vector-borne disease transmission risk to humans.
- **Integrated models of disease spread, supply chain logistics, and communication networks**: The objective of this project is to develop integrated models that capture the interdependencies between disease dynamics, supply chain logistics, and communication networks. For example, the spread of disease is influenced by the movement of animals, plants, and food products through the supply chain. Managing this movement effectively, in addition to deploying countermeasures such as vaccines, requires effective risk and crisis communication plans that engage multiple stakeholders. Stakeholders themselves constitute a network through which information is transmitted. The integrated modeling approach is expected to yield new insight to prevent, mitigate, and respond to infectious disease outbreaks.

- **Spreading processes over multilayer and interconnected networks**: The research goal is to establish rigorous mathematical tools and techniques to understand the role of multilayer and interconnected topologies in spreading processes. For example, a multilayer network is a physical contact network where a disease can propagate among individuals, together with an online information dissemination network where information can propagate among the same individuals. In zoonotic diseases, for example, interconnected networks are the network of animals and the network of humans where a virus can move from one network to the other.

Relevance National/Regional
The National Agricultural Biosecurity Center (NABC), the Institute for Computational Comparative Medicine (ICCM), the Center of Excellence for Emerging and Zoonotic Animal Diseases (DHS CEEZAD), the planned National Bio and Agro-Defense Facility (DHS NBAF), and EPICENTER are all located in Manhattan, Kansas, thus making Kansas the national leader in developing countermeasures to naturally-occurring and intentionally-introduced plant, animal, human, and zoonotic infectious diseases.

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Background
At no time in history has our world been faced with the complexity and vast array of environmental and health care problems, and yet been so connected to each other. The intricate web of connection forges an imperative responsibility to find solutions to many of the issues propagated by industrialized nations. Conservation of the environment and the stewardship of these resources in the design of our communities and buildings is a fundamental contribution to society and economic development.

New knowledge is presented every day regarding the fragile and delicate relationship between the natural and designed environment with humans. Areas include the sensory impact on early childhood development; childhood obesity and obesity in general (at epidemic proportions in this country); the influence of the interior environment on musculoskeletal issues, indoor air quality, productivity, and reduced absenteeism, each are areas ripe with potential to impact individuals through design.

Evidence-based design is raising the awareness of the impact of design in all areas, and the opportunity to contribute to the body of knowledge – in interior architecture, product design, and furniture design – is profound. With the pursuit of new knowledge come new opportunities for fresh collaborative ventures and exploration. As an example of evidence-based design on designers’ access to quality information to affect design, in a ten-year period (1998 – 2008), the number of credible peer-reviewed articles regarding healthcare design grew from 84 to over 1,200.

Description
The war in the Middle East has caused much suffering and pain for all parties involved, although the tragic loss of life is not the only direct aftermath of these wars. Bond (2012), notes that over the past decade of conflict, tens of thousands of America’s wounded have been injured in combat. The success stories of battlefield medicine advances is the increased rate of survival from injuries that in previous conflicts, resulted in death. The survival rate for U.S. service members wounded in Iraq has reached 90%, higher than in any previous war. (p. 30). Given this large number of survival rate, it is not surprising that these veterans come back with severe injuries. Unfortunately, not all injuries are visible or physical. The Department of Veterans Affairs lists chronic fatigue syndrome, depression, fibromyalgia, hearing difficulties, hepatitis A, B and C, Leishmaniasis (also known as the "Baghdad boil"), malaria, memory loss, migraines, sleep disorders and tuberculosis as potential deployment health conditions the Iraq and Afghanistan veterans may endure.

Relevance
The Pentagon's Defense and Veterans Brain Injury Center reports having diagnosed 229,106 cases of mild to severe traumatic brain injury from 2000 to the third quarter of 2011, including both Iraq and Afghan vets. These wounded veterans have special medical needs that the civilian health care system is insufficiently trained to handle. The growing number of returning wounded, often with catastrophic injuries, tests the health response of the Department of Defense (DoD) facilities infrastructure. These wounded warriors not only need assistance in healing physically, but also need help in integrating back into the society they left behind when they went to fight the war.

Current work collaborates with wounded warriors, medical staff from Fort Riley, and rehabilitation specialists to investigate, propose, and initially evaluate innovative solutions to the design of rehabilitation facilities and their impact on the healing of wounded warriors and their integration back into society.

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Preparing Future Educators in the International Arena

Background
To prepare students to live, learn and work in the global community, K-State’s College of Education (COE) engages in substantive international graduate programming, research, outreach and service that involve our students and faculty. The College is establishing global partnerships with educational organizations and governmental units. These activities provide opportunities for our faculty and students to engage in educational activities in other countries through service learning, study abroad, international teaching, and research. International activity by COE faculty and students is an essential ingredient in the K-State Internationalization Strategic Action Plan.

Description
The College of Education is preparing future educators who will be prepared to serve in international educational settings; conduct research related to international issues in education; create classroom experiences for their students that promote the understanding and appreciation of global perspectives. This goal is accomplished through these types of activities:

1. International experiences for faculty and graduate/undergraduate students.
2. Teacher preparation and degree opportunities for students in other countries,
3. Undergraduate and graduate education of international students,
4. Inclusion of international issues and perspectives in COE curricula and research,
5. Recruitment of international students for campus, distance, and our-of-country degree and certificate programs.

The following are examples of COE activities related to preparing future educators in the international arena:
• The COE’s current initiatives have resulted in an increased number of international students applications from four in 2010-2011 to 28 in 2012-2013.
• The COE produced a documentary video project, A Walk in My Shoes, that shared the educational and cultural experiences of six international graduate students in the COE.
• Special education faculty and students work with special needs children, their teachers and parents in Lushoto, Tanzania, where faculty provide professional development related autism to teachers in the Irente Rainbow School.
• The Go Teacher Program is an international partnership between K-State’s COE and the Ecuadorian Ministry of Education, and SENESCYT, the governing body of higher education in Ecuador.

This program provides English language development and ESL/EFL coursework to teachers from Ecuador. To date this initiative has brought over 345 teachers from Ecuador to study at K-State. Many Go Teacher alumni are applying to COE MS and PhD programs.
• Faculty and students have participated in service-learning projects, research and study abroad in Mexico, China, Ecuador, Guatemala and Sudan. A college-wide study abroad initiative will give educators an international perspective and to foster international connections, essential to education in the 21st century. The Marilyn and Bill Taylor Study Abroad Program helped provide over 140 study abroad experiences, and a Study Abroad Student Organization has been established in the College.
• A COE reading specialist provided teacher professional development reading teachers and educators in Grenada and Ethiopia.
• Award winning research and the development of context-based curricula in Sudan are conducted by a COE graduate student who has visited the country many times. She has spoken at the United Nations about her research and is part of UN and Sudanese government activities related to bringing education in remote regions of South Sudan.
• To promote international understanding and perspectives, faculty have coordinated international outreach and education programs that reach the university community and the citizens of Kansas through exhibits, accessible digital media and university programs such as: an exhibit dedicated to Jan Karski, Polish Resistance fighter who tried to stop the Holocaust; exhibit and play Life in a Jar: The Irena Sendler Project, which originated in a rural Kansas school and brought Sendler, who saved hundreds of children during the holocaust, from obscurity to nomination for a Nobel Peace Prize.
• Faculty research includes “Learner resistance to cultural issues: Facilitation strategies and techniques”, “Exploring cross-cultural knowledge through concept mapping: An exploratory, mixed methods study of the experiences of Ecuadorian educators in the U.S.”, and “Acculturation and study abroad: Creating climates of understanding and tolerance”.

Resources and infrastructure are needed to continue to establish, maintain and expand these relationships and activities.

Relevance. These activities relate directly to the College and K-State 2025 plan, Themes II, III, IV; and to the K-State 2025 Internationalization Plan.

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Investigating Place Using Digital Toolset

**Background**
Historically, the process of design, construction, and post-occupancy observation and evaluation has formed the basis of informing future decisions in design for the built environment. Efficiencies in time and resources are projected through the use of parametric and information modeling of projects, performance and simulation-based design, digital fabrication, and algorithmic design and interface development.

Emerging technologies and computational tools continue to alter the process of design, methods of project delivery, and manufacturing techniques that profoundly impact design and architectural innovations. Building information modeling (BIM), environmental information modeling (EIM), alongside performance-oriented simulations and increased automations in decision-based prototyping increase the capacity for optimizing designs toward specific economic, social, and environmental goals; offering a unique opportunity to respond to and influence particular areas that are critical to ongoing research and developments across disciplines.

**Description**
This project builds upon the existing experiences and research of multiple trans-disciplinary faculty to develop a digital toolset as a process-oriented approach to the investigation of place design. The toolset builds upon the understanding of how place, history, climate, and ideals of occupants may be combined with simultaneous investigations of materiality, object and space to propose cohesive environments that can be subsequently envisioned and modeled for effective evaluation and iteration. Parametric modeling as a means to develop space and product that can respond to given criteria can additionally simulate systems for design thinking. Simulations of variabilities within interior and exterior spaces are structured with variable decision points that allow a particular product to be “custom fit” to a space and project on a large scale the idea of “mass-personalization.” This advocates for a revolution similar to that of the industrial revolution; where the entire way of life at every scale was reconstructed and reorganized, from product design and production to consumption and recycling.

This project develops a formative and evaluative toolset to address attributes and how proposed designs can help support these attributes.

**Relevance**
Parametric design systems provide a means for developing design thinking while also engaging the ability to explore, discover, optimize and achieve user-oriented parametrically-defined design solutions as well as engaging in materialization and fabrication processes; speculating on how these activities will fold into a design process that explores the role of “user” with new eyes. As the age of information passes in to the age of choice, designers are developing models that enable users to participate in the design process. While the models vary in complexity, from those that simply engage aesthetic to those that drive sustainable agendas, the user can now set the parameters that the models act against.

Products can be explored that become part of a holistic system but are adapted to different sites and functions, creating a sense of identity per space while achieving unity and connection throughout a community. Not only in design education, but as a model for complex systems-oriented decision matrices, this approach has far-reaching implications for multiple fields.

Development of this stage of the project will lead to evaluation metrics that can be employed throughout an investigation to render immediate feedback and implications. Initially, the project is seen as a model to inform education; subsequently, as a decision paradigm for complex environments.

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Culturally Responsive Teaching and Learning

Background
After reading Generation on a Tightrope, faculty and graduate students in K-State’s College of Education (COE) discussed the book’s premise that colleges and universities are ill-equipped to deal with 21st century realities and prepare an increasingly diverse student population for a successful future. For the COE, “students” mean our undergraduate and graduate students; but it also means their current and future students / learners of all ages in K-12 schools, postsecondary institutions, and informal educational settings. The group recognized the important and continuing work of the College in preparing our students for this increasingly “diverse and changing world”; and they also recognized the significant work done in the College demonstrating that COE is a national and international leader in addressing culturally responsive teaching and learning through our programs and our research. The College of Education’s longstanding commitment to diversity can be seen throughout the collective work of its departments, centers, and programs since the early 1990s. Guiding these initiatives is the College mission of “Preparing educators to be knowledgeable, ethical, caring decision makers in a diverse and changing world.”

Description
The COE is creating educational programming and conducting social science research related to pedagogical practices that are culturally relevant and are informed by the context of the learner and the educator through a number of programs, projects and research endeavors:

• The Midwest Equity Assistance Center (MEAC) provides technical assistance, professional development and information about race, gender and national origin equity to educational agencies in the region and is the predominant regional source of best practices for culturally responsive education. This includes the new C4 Database that houses exemplary lesson plans that integrate both the National Diversity Standards and the Common Core Standards. In collaboration with the Kansas Department of Education, MEAC is working to review the Accreditation System for bias and sensitivity related to diversity.

• The Center for Intercultural and Multilingual Advocacy (CIMA) implements programs and conducts research that has national and international significance. CIMA originated the BESITOS program model that has supported 95 bilingual/bicultural students to graduation and placement in ESL education. Of these, 35 have gone on to graduate school with 21 to date completing and serving in Kansas. CIMA has supported over 500 migrant students in obtaining GED’s, and has served over 98 migrant students in post-secondary education. Several CIMA programs have won national and international awards. In addition, CIMA researchers have produced highly ranked books and peer-reviewed publications such as: Accelerating literacy for diverse learners: Strategies for the common core classrooms, K-8; Assessment accommodations for classroom teachers of culturally and linguistically diverse students (2nd ed.); Mastering ESL and bilingual methods: Differentiated instruction for the culturally and linguistically diverse student (3rd ed.); and Biography-driven culturally responsive teaching; “Cognitive development, global learning, and academic progress: Promoting teacher readiness for CLD students and families” in the Journal of Curriculum & Instruction; and “From remediation to acceleration: Recruiting, retaining, and graduating future culturally and linguistically diverse (CLD) educators” in the Journal of College Student Retention: Research, Theory & Practice; “The development of a model for culturally responsive science and mathematics teaching” in Cultural Studies of Science Education Journal.

• The College is a partner in the Kansas Louis Stokes Alliances for Minority Participation (LS-AMP) funded by NSF. This fund awards four colleges at K-State who partner with community colleges in Kansas designated as Hispanic Serving Institutions (HSI). This pipeline project promotes the recruitment, retention and graduation of underrepresented minorities in STEM. College faculty will provide expertise and professional development for their partners related to culturally responsive practices in recruitment, retention, and teaching.

• Commitment to and inclusion of culturally responsive teaching and learning is demonstrated by the programming and pedagogical practices throughout the college. For example, Educational Leadership offers a graduate certificate in Teaching English as a Second Language for Adult learners and provides classes such as “Leadership for a Diverse Populations” for their students. Such courses are part of all degree programs in the College.

Relevance
Our current and planned work in this area aligns with all Themes of the College’s 2025 plan as well as to the mission of the College. These activities also relate to K-State 2025, Themes I, II and III.

Contacts
U.S. Department of Education: Office of Elementary and Secondary Education (Deb Delisle); Office of English Language Acquisition (OELA) (Libia S. Gil)
Developing Educational Leadership in K-12 Schools, Districts and 2-Year Postsecondary Schools and Colleges

Background
In an era dominated by higher standards and greater accountability for America’s schools, the K-State response is to prepare great leaders at all levels who know how to implement change. The College of Education (COE) at K-State is utilizing partnerships for educational leadership development that will have wide and lasting impact in Kansas and across the nation. The programs and the activities in the College are lead by the Department of Educational Leadership, which includes preparation of K-12 school leaders as well as faculty who specialize in adult education. This group uses a partnership model for collaborating with schools and other educational organizations to provide leadership training that touches the lives of thousands of learners and hundreds of schools. We believe that partnering for a new generation of leaders produces better results by focusing on the different leadership needs associated with different community and school contexts. This foundational premise accounts for the success of current programs and informs the design of future programs.

Description
The COE at K-State is creating models and implementing educational and professional development activities to increase the number and quality of educational leaders in Kansas schools at all levels. These include:

- Educational Leadership Academies in Junction City, KS and other large school districts working with economically and socially diverse populations have provided graduate education and leadership development opportunities for school principals across the state. K-State’s academies have operated since 1987 and have drawn national praise, having prepared over 500 school leaders at principal and superintendent levels.
- The Kansas Educational Leadership Institute (KELI) emerged from collaborative planning by six major Kansas professional entities interested in developing and supporting leadership for Kansas schools and districts in the 21st century. Partners in this effort are: Kansas Association of School Boards, Kansas State Department of Education, Kansas School Superintendents Association, Kansas Leadership Center, Kansas State University, and United School Administrators. KELI supports 26 first year Kansas superintendents a year. These superintendents participate in seminars, a mentoring program, and leadership coaching and academic work. The KELI mission and model are unique in the country.
- COE has a long history of collaboration to provide educational leadership opportunities at Fort Leavenworth with the Command and General Staff College (CGSC). The Adult Education Program has awarded 787 graduate degrees in a cohort Master’s program to officers at the CGTSC during their 25-year history. The program has also awarded 10 doctorates to faculty and faculty developers at CGSC.
- Initial work with Manhattan Area Technical School (MATC) and other 2-year colleges is exploring a multi-year collaborative program for developing educational leadership capacity among school faculty and administrators.
- K-State faculty, graduate students and school partners are collaborating on research that demonstrates the efficacy of our school leadership models and programs. More funding is being sought to provide support for the extensive and rigorous research and evaluation that is needed to promote this K-State model into a nationally recognized and adopted exemplary practice.
- Among the new avenues being considered for educational leadership development in Kansas include professional development and mentoring for a new generation of 2-year and technical college leaders based on the successful Academies and KELI models. This venture will be piloted at MATC and, pending documentation of success, be replicated throughout the state with other similar 2-year institutions (about 25). The College’s Adult Education Program would spearhead this effort in collaboration with the Educational Leadership Program and the institutions involved.

Relevance
Preparing successful educational leadership is the primary mission of the College’s Educational Leadership Program and relates to the College’s 2025 plan, Themes III (provide quality graduate education that prepares students for leadership), and IV, (increase service to communities through systematic engagement). These activities also relate to K-State 2025, Themes III and IV.

Agency Contacts
U.S. Department of Education: Fund for the Improvement of Postsecondary Education in the Office of Postsecondary Education (Brenda Dann-Messier), the Office of Career, Technical and Adult Education (Brenda Dann-Messier) and the Office of Elementary and Secondary Education (Deb Delisle)
MILITARY CONSTRUCTION, VETERANS
Institute for the Health and Security of Military Families

Description
Kansas State University (KSU) is home to a unique cadre of scientists from diverse disciplines with an impressive track record in research, outreach, academic and clinical service programs addressing the health, well-being, and sustainment of service members, veterans and their families (SMVF), including:

- Programs and community support networks for military-connected children and youth, through local 4-H Clubs, schools and OMK youth/family camps
- Research and training programs on violence prevention in military families, quality childcare and childhood social emotional health
- Clinical programs for military personnel, veterans and families
- Research on the long-term effects of deployment and war-trauma on marriages, child and youth development, employment, and financial planning
- Cooperative Extension services to families of military personnel
- Online graduate programs for professionals who serve military families
- Research on the effects of high-intensity functional exercise training on the body composition, fitness and health of active duty military personnel as well as on barriers to physical activity participation for disabled veterans

In addition to contributions made by researchers from colleges across the university, our military programs rely on strong collaborations with area military installations, the Kansas National Guard, Army Reserve, US Department of Veteran’s Affairs, the Department of Defense, and other state and national organizations.

Relevance National/Regional
For American military personnel who have served in war, federal programs have long been in place to address physical injuries from bullets and bombs and psychological injuries of wartime trauma. In relatively recent times, however, veterans returning from war have faced difficulties neither anticipated nor addressed by federal programs. These include chronic health problems resulting from exposure to environmental hazards (e.g., chemical defoliants in Vietnam and a complex mix of neurotoxins in the Persian Gulf War) and Traumatic Brain Injury (TBI) encountered during deployment, as well as long-term health impacts (e.g., PTSD) on SMVF populations. Increasingly for today’s professional military (both active and reserve components), the aftermath of wartime service has consequences not only for veterans’ well-being, but for their families and communities.

Our current partnerships with the U.S. Departments of Agriculture and Defense have been primarily focused on outreach rather than on research funding for the study of military families. These outreach initiatives support significant programming underway at K-State and across Kansas. Proposals to other federal agencies, such as the Department of Health and Human Services, will expand the reach of the College of Human Ecology and its units. Expanding partnerships to support additional investment in relevant research would enable Kansas State University, the College of Human Ecology and the Institute for the Health and Security of Military Families to capitalize on the expertise available here.

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TRANSPORTATION,
HUD
Small Unmanned Aircraft Systems Standards Validation

Background
In February 2012, the FAA Modernization and Reauthorization Act (FMRA) was passed by Congress requiring the FAA to integrate Unmanned Aircraft Systems (UAS) into the National Airspace System (NAS) by September 2015. Successful integration of UAS requires many technological and regulatory hurdles to be addressed. One of these hurdles is demonstrated airworthiness of unmanned systems to operate in a congested airspace environment.

On August 29th, 2013, Kansas State University – Salina signed a Memorandum of Agreement (MOA) with the FAA to validate the industry consensus standards for small UAS (sUAS) – defined as aircraft weighing less than 55 lbs. The validation of the industry consensus standards developed by the ASTM F38 Committee on Unmanned Aircraft Systems will demonstrate the capability of these standards to address airworthiness concerns for sUAS. This effort is titled as the sUAS Standards Validation Project.

Description
K-State Salina and the FAA are working together to validate the industry consensus standards for sUAS by applying for a restricted category airworthiness certificate for an example sUAS using the ASTM standards as the certification basis. This process requires a detailed review of all documentation relating to the aircraft design and equipment along with justification for why the aircraft is safe to operate in the NAS.

K-State Salina is working closely with the FAA’s UAS Integration Office (D.C.) and the Small Airplane Directorate (Kansas City) in reviewing and determining the acceptability of the ASTM standards for sUAS as a certification basis. The currently approved scope of work includes only the planning and initial documentation portions of aircraft certification, however there is an expectation that this project will continue into a second phase if funding is available.

Relevance
The integration of UAS into the NAS is expected to bring a multi-billion dollar market to life with new opportunities for a myriad of commercial applications of unmanned systems. Currently, the use of UAS is currently restricted to only recreational, research, and governmental functions. If the ASTM standards can serve as a certification basis, then commercial UAS operations ranging from precision agriculture to pipeline inspection would be authorized by having an aircraft with a FAA airworthiness certificate.

Additionally, the FAA is anticipating the release of a Notice of Proposed Rulemaking (NPRM) for a new regulation covering sUAS in 2014. This proposed rule will reference the industry consensus standards developed by the ASTM F38 Committee as the approved aircraft design criteria. However, the FAA is unwilling to issue a Notice of Availability (NOA) that cites the ASTM standards unless those standards have first been validated by an independent organization. The current research at K-State Salina will provide the independent verification that the FAA needs to issue the NOA.

Furthermore, it is expected that the sUAS Standards Validation Project will identify portions of the ASTM standards that are too robust, and therefore difficult to comply with; or too weak and thus unlikely to ensure an appropriate level of safety. The work at K-State Salina will likely result in significant revision of the internationally developed ASTM standards that will effect a large existing and potential market.

The FAA has expressed a desire, pending adequate funding, for turning the sUAS Standards Validation Project into a much larger scope effort that would begin with a “clean sheet” aircraft design that is taken through flight testing and ultimately certified as the first commercially operable, non-military sUAS. However, current federal fiscal uncertainty have stalled progress on this desired scope increase.

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Center for Rural Transportation Research and Education

Background
Kansas State University’s College of Engineering and Department of Civil Engineering currently mutually conduct a cooperative, multidisciplinary transportation research program. Since 1989, the College of Engineering has actively participated in the Kansas Department of Transportation (KDOT) Kansas Transportation Research and New Developments Program (K-TRAN). The K-TRAN program provides approximately $450,000/year in state funds to support applied transportation research projects involving faculty and students from civil, mechanical, industrial, and electrical engineering, as well as from economics, sociology, and geology. K-State also has been the contractor in a number of pooled funds programs where several state agencies pool their resources to fund multi-year research projects of mutual interest. In addition, the College of Engineering and the Department of Civil Engineering have a long history of excellence in the development and delivery of technology transfer programs in transportation and workforce development, including specialty conferences, distance education programs, workshops, and training courses. In 2006, K-State was designated a Tier II University Transportation Center (UTC) under the USDOT Research and Innovation Technology Administration’s (RITA) University Transportation Centers Program, with funding of approximately $450,000 per year through FY 2011. During the period 2005-2011, the K-State UTC generated over $2.3M in new research funding, awarded 42 scholarships and provided financial support for 42 GRA positions. The establishment of the K-State UTC allowed for consolidation of K-State’s transportation-related research and technology transfer programs to a single administrative unit. In addition, establishment of the UTC allowed expansion of the college’s transportation research program to include a substantial education component, including scholarships, assistantships, and travel grants to attract and retain highly qualified students. K-State will be competing for UTC funding in future RITA Grant Solicitations, but the university seeks additional/alternate funding to maintain K-State’s current transportation research programs and to elevate our transportation research program to national prominence.

Description
The research, education, and technology transfer activities of the Center will focus on identifying and deploying rural transportation systems and infrastructure innovations aimed at shortening transportation project delivery, enhancing transportation system safety, promoting economic development and protecting the environment.

Relevance National/Regional
The theme of the proposed Center for Rural Transportation Research and Education is the “Safety and Sustainability of Rural Transportation Systems and Infrastructure.” This theme and corresponding Center expertise for this theme encapsulate three areas of concern widely recognized as critical challenges facing the United States (U.S.): Safety, Sustainability, and Infrastructure. Funding is requested to allow K-State to expand its influence and contributions in order to find and implement solutions to problems related to the safety and sustainability of U.S. rural transportation systems and infrastructure. In addition, the Center can provide expertise to support other federally supported programs and centers currently in place at K-State. For example, transportation center expertise in transportation network modeling and simulation, emergency evacuation planning, and traffic control could be a valuable asset in advancing K-State’s agricultural bio-security programs. Other research focus areas will include rural economic development, alternative transportation project funding sources, use of agricultural by-products in roadway paving materials and rural highway dust abatement programs.

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AGENCY INITIATIVES
Congressional Action Requested
Support is requested for the President’s FY15 budget request of $310 million for construction of the National Bio and Agro-defense Facility (NBAF). In FY14, $404 million in laboratory construction funds were appropriated in the federal Omnibus Bill and the State of Kansas approved an additional match of $202 million when the construction contract is signed. Based on information in the President’s FY14 budget, the $310 million should allow construction to proceed.

Description
NBAF is crucial to protect America’s agricultural infrastructure and economy and it will replace the antiquated Plum Island Animal Disease Center that has been in existence for sixty years. The NBAF mission is to conduct research on foreign animal diseases and zoonotic diseases in livestock, the latter being transmitted from animals to people. NBAF will be a federal biocontainment laboratory conducting research, testing, development, and evaluation for threat detection, vulnerability assessment, and formulation of mitigation strategies as well as development of disease countermeasures and vaccine licensing support.

Background
With a request for proposals in January of 2006, DHS undertook a national, three-year site selection process that ultimately led to the K-State Manhattan Campus Site being named the Preferred Alternative for NBAF as published in the Federal Register on December 12, 2008. As required by law, the NBAF Record of Decision was signed 30 days later, on January 12, 2009, and it published in the Federal Register on January 16, 2009. Site preparation work began in late 2010 and over $18 million was expended by the NBAF general contractor; site work is essentially completed. Title to the 46,828 acre site was transferred from the State of Kansas to DHS on December 28, 2012 and the $80 million contract for construction of the NBAF central utility plant (CUP) was signed by the general contractor on February 21, 2013. Construction on the CUP began in June 2013 and remarkable progress has been made on that 87,000 ft² facility.

Relevance
According to the Preferred Alternative Selection Memorandum: “the Steering Committee determined that the Manhattan Campus Site clearly possessed more strengths and fewer weaknesses than any other alternative and best met the purpose and need to site, construct, and operate NBAF.” A National Academy of Sciences report published on July 13, 2012 entitled, Meeting Critical Laboratory Needs for Animal Agriculture: Examination of Three Options concluded about NBAF that: (1) “It is imperative to establish research, diagnostic, and surveillance laboratory capabilities commensurate with the size and value of U.S. animal agriculture…;” and (2) it is imperative to build BSL-4 large-animal space in the United States.” NBAF will meet both of those national security criticalities.

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<th>NAF PROJECT FUNDING COMMITMENTS</th>
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(1) Includes $404 Million in the FY 2014 Omnibus Bill
(2) In the President’s FY 2015 Budget for DHS
Protecting swine from foreign diseases

Description
The Arthropod-Borne Animal Disease Research Unit (ABADRU), in the Center for Grain and Animal Health Research, is conducting research on animal diseases including Rift Valley Fever, Vesicular Stomatitis, and Blue Tongue that threaten US livestock. Collaborative research including Kansas State University (KSU) scientists in the Colleges of Agriculture and Veterinary Medicine has recently been initiated on several swine diseases including African Swine Fever and Classical Swine Fever that pose a serious risk to producers and the entire industry because of the trade impacts that outbreaks could cause if these diseases are introduced into the US. This initiative will strengthen on-going research to develop diagnostic and control measures for these diseases. In addition, several critical research gaps will be addressed including determining the potential North American arthropod vectors and the host-vector-parasite relationships involved in African Swine Fever transmission, and the understanding the epidemiology and progression of both diseases.

The requested funds ($2 mill. permanent increase to base funds) will be used to hire two scientists in ABADRU along with support staff to conduct this research.

Relevance
- The US produces 31 million tons of pork annually, valued at more than $14 billion. Exotic diseases of swine threaten domestic production as well as an important export market. These funds are needed to increase research efforts on African Swine Fever and other exotic swine diseases.

With these funds ABADRU and its KSU partners will:
- Evaluate the competence of potential native arthropod vectors to transmit disease to domestic and feral swine, and determine their possible role should the disease be introduced to the US.
- Determine the important geographic, climatological, and ecological factors that could influence the establishment and spread of this disease.
- Develop and evaluate disease diagnostic, surveillance and control measures to protect US swine from this disease.

Agency Contact
USDA-ARS Center for Grain and Animal Health Research (CGAHR)
Arthropod-Borne Animal Disease Research Unit, Manhattan, KS

Agency Director
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USDA-ARS Center for Grain and Animal Health Research (CGAHR)

Wheat Quality and Competitiveness

Description
The Hard Winter Wheat Quality Laboratory (HWWQL), part of the Grain Quality and Structure Research Unit, is the largest of the four USDA-ARS Wheat Quality Laboratories and provides leadership, expertise and service to the US industry for improving quality and marketability of hard winter wheat.

The Engineering and Wind Erosion Research Unit (EWERU) has responsibility to develop new technology for measuring, selecting and predicting wheat quality. These programs have suffered from long-term decline in funding, staffing, and antiquated equipment.

Immediate action must be taken to provide adequate funding and resources, or research critical to the economic health of the US wheat industry will be curtailed.

The requested funds will be used to increase program funds to both HWWQL and EWERU ($650,000 permanent increase to base funds for each program).

Relevance
- The Hard Winter Wheat Quality Laboratory was established by Congress in 1937 to determine the end-use quality of experimental wheat lines. The HWWQL evaluates 100% of the winter wheat commercially released in the US that is used in a $70 billion bakery and snack food industries. A similar volume of HWW is exported.

- The HWWQL and EWERU need program funds to support the development of:
  - Rapid assessments of wheat quality to more accurately predict protein, starch, processing and end-product quality.
  - Rapid, accurate and non-destructive evaluation on single kernel basis, of color, hardness, protein and starch quality.
  - Novel end-use qualities and trait combinations using molecular and conventional biochemical approaches.

The National Wheat Improvement Committee, National Association of Wheat Growers, North American Millers’ Association, and US Wheat Associates strongly recommend additional funding for a multidisciplinary initiative to improve wheat quality and competitiveness, and security in our domestic and export markets. To successfully compete in the world wheat market, U.S. wheat must have superior end-use qualities and offer exceptional value to millers and bakers. This initiative would support research at the HWWQL that has a national mandate to conduct research and provide support for the entire wheat industry, including breeders, growers, millers, bakers, and exporters.

Agency contact
USDA-ARS Center for Grain and Animal Health Research (CGAHR)
Grain Quality and Structure Research Unit and Engineering and Wind Erosion Research Unit, Manhattan, KS

Agency Director
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USDA-ARS Center for Grain and Animal Health Research (CGAHR)

Hessian Fly Research

Description
The Hard Winter Wheat Genetics Research Unit, in the Center for Grain and Animal Health Research, in close cooperation with Kansas State University (KSU), conducts research to control the Hessian Fly. This pest attacks wheat across the US and is especially prevalent in the Southern Great Plains. It is typically found in 70% of wheat fields in Kansas, Oklahoma and north Texas. Most older, resistant varieties have been defeated by new biotypes of the Hessian fly.

New genetic sources of resistance and rapid, effective screening methods are needed to achieve more durable resistance. Also needed is a greater understanding of the mechanistic basis of insect virulence and host resistance. New sources of resistance and knowledge of this pest are critical to protecting US wheat producers.

The requested funds ($250,000 permanent increase to base funds) will be used to expedite research on this high priority constraint.

Justification
- The Hessian fly project is under-funded in relation to the mission that it fulfills.

The National Wheat Improvement Committee, National Association of Wheat Growers, and US Wheat Associates strongly recommend additional funding for this initiative to improve Hessian Fly resistance in wheat.

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Hard Winter Wheat Genetics Research Unit,
Manhattan, KS

Agency Director:
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National Animal Health Laboratory Network (NAHLN)

Description
The National Animal Health Laboratory Network [NAHLN] provides an automated high throughput diagnostic protocol to facilitate rapid and accurate examination of samples from diseases of importance to food animal security. A major paradigm for the success of a great nation is its ability to provide food and water resources to its citizens. An essential element in this process is the health and wellbeing of our food animals, with NAHLN on the forefront on diagnosing and preventing the spread of important limitations to our food supply and our ability to export food supplies to our global partners.

Kansas State University has participated with NAHLN in significant ways, including both the Kansas State Veterinary Diagnostic Laboratory [KSVDL] and the National Agricultural Biosecurity Center [NABC]. These include the development, enhancement and delivery of targeted technical training support programs, with: (1) exercises and reviews of best practices from NAHLN labs; (2) expanded animal health diagnostic screening capabilities regionally; (3) increased testing capacity of the KSVDL by conducting research on new methodologies; and (4) development of training strategy framework for NAHLN laboratories by assessing lessons-learned.

Background
Homeland Security Presidential Directive – 9 (HSPD-9), Defense of United States Agriculture and Food, states that America’s agricultural and food sector is vital to our economy and is one of the key underpinnings of national security and thus it must be protected from disruption by natural, accidental, or deliberate events. HSPD-9 also directed a number of federal agencies to work together to provide a unified strategy to protect our agriculture sector and to improve coordination with and among the states. More specifically, the directive states that these agencies should “…develop nationwide laboratory networks for food, veterinary, plant health, and water quality that integrate existing Federal and State laboratory resources, are interconnected, and utilize standardized diagnostic protocols and procedures.” Historically, the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) has served as the vanguard to protect America’s pre-harvest resources. Before HSPD-9, APHIS enjoyed a positive, but less structured relationship with the Veterinary Diagnostic Laboratories located across the US. The NAHLN represents a cooperative effort between two USDA agencies: APHIS and the National Institute of Food and Agriculture (NIFA), and the American Association of Veterinary Laboratory Diagnosticians (AAVLD). The NAHLN is a multifaceted network comprised of sets of laboratories that focus on different diseases, using common testing methods and software platforms to process diagnostic requests and share information.

The National Agricultural Biosecurity Center (NABC) at Kansas State University (KSU) was established to help protect the U.S. agricultural infrastructure and economy from endemic and emerging biological threats. Beginning in 2006, NABC entered into a strategic relationship with the NAHLN.

Relevance
At the Federal level, USDA’s National Veterinary Services Laboratories (NVSL) serves as the national veterinary diagnostic reference and confirmatory laboratory. NVSL coordinates activities, participates in methods validation, and provides training, proficiency testing, assistance, materials, and prototypes for diagnostic tests.

The State/University laboratories in the NAHLN perform routine diagnostic tests for endemic animal diseases as well as targeted surveillance and response testing for foreign animal diseases. State/University laboratories also participate in the development of new assay methodologies.

Networking these resources provides an extensive infrastructure of facilities, equipment, and personnel that are geographically accessible no matter where disease strikes. The laboratories have the capability and capacity to conduct nationwide surveillance testing for the early detection of an animal disease outbreak. The ability to test large numbers of samples rapidly during an outbreak and then to demonstrate freedom from disease after eradication is critical.

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National Canola Research Program - Great Plains Region

Background/Description
The National Canola Research Program is a national, competitively funded research program, funded through USDA NIFA.

Even though it involves canola, the goal is to enhance winter wheat quality and yield. Producers in the Great Plains need profitable and reliable winter broadleaf crops that can be grown in rotation. Kansas State University research has shown increases between 18% and 51% in wheat yield the first year following winter canola. Additionally, growing canola in rotation reduces or eliminates the need for tillage, decreases soil erosion, improves water infiltration, and enhances sustainability.

A high-value market exists for the heart-healthy oil and high-protein meal derived from canola seed. The USA imports over 80% of the canola oil consumed domestically. Production in the major spring canola growing areas has nearly peaked because of competition with other crops. Therefore, more winter canola must be grown to meet U.S. demand. As a result, winter canola planted acres have increased substantially in the Great Plains. Total acres exceeded 250,000 in the 2012/13 crop year and about 400,000 acres were seeded in the 2013/14 crop year. Federal crop insurance is available and regional seed crushing facilities have emerged. More adapted cultivars are needed to increase production to meet demand.

The long-term goal of this multi-state, multidisciplinary project is to facilitate the adoption of winter canola as a viable rotation crop in the southern Great Plains. To promote acreage and production increases in the region, the project will focus on the high priority areas of development and testing of superior cultivars, improved methods of production, and transfer of new knowledge to producers. The objectives of the project are: 1) Develop and evaluate high-yielding, regionally adapted winter canola cultivars. Priority traits include: winter survival, tolerance to sulfonylurea herbicide carryover, tolerance to post-emergence applications of glyphosate herbicide, yield potential, quality of the grain and extracted oil, blackleg disease and pest resistance, and forage quality. 2) Improve canola cropping systems by addressing agronomic management issues. Production studies will address: crop establishment, simulated grazing of forage, crop rotation, harvest management, on-farm testing, and crop modeling. 3) Extend production and marketing technologies through extension and outreach programs. Methods of delivery may include field days, field tours, risk management schools, extension and journal publications, professional society meetings, radio and television, and social media.

Relevance
Early demonstrations and production management studies with canola in the 1980s often failed because the winter cultivars used were not well adapted. As a result, Kansas State University started a canola breeding and research program focused on developing cultivars adapted specifically to the Great Plains. It is the only public canola breeding program in the region.

Many wheat producers view rotation with winter canola as a sustainable and effective method for managing hard-to-control, grassy annual weed species. Thus, breeding cultivars resistant to glyphosate herbicide will expand rotation and non-selective weed control options. Harvested wheat fields are one of the few areas open for planting winter canola in the fall. However, 50% of winter wheat acres in the region are treated with sulfonylurea herbicides. Many of these herbicides have a residual life of nearly two years and canola is extremely sensitive to the carryover. Kansas State is breeding cultivars tolerant to carryover from sulfonylurea herbicides. New cultivars will increase the number of fields where canola can be produced.

Five adapted cultivars have been released by the breeding program since 2010. ‘Riley’ possesses a total oil content that is 40%. It is estimated that increasing oil content of U.S. cultivars by just 1% would be worth an additional $5 million per year. ‘Griffin’ is the first cultivar that will be marketed as dual-purpose for forage and grain production. The program released its first glyphosate tolerant cultivars in 2013.

Most states do not have statewide canola cultivar testing programs and few researchers focus on winter canola. Thus, regional variety testing and agronomic trials are an important component of this project. The National Winter Canola Variety Trial (NWCVT) is also coordinated by Kansas State and this trial is planted at 40 locations in 20 states. NWCVT data facilitates the release of new cultivars in areas where they can be profitably marketed. Coordination of the NWCVT demonstrates a strong ability to manage a collaborative program with national impact.

Partners - Through the National Canola Research Program, Kansas State cooperates with five universities in the Great Plains region and 20 others nationally. Many commercial and experimental cultivars are evaluated for domestic and international enterprises.

Agency Contact Information
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National Plant Diagnostic Network (NPDN)

Background
The agricultural and natural plant systems that we rely upon for food, feed, timber and fiber are under increasing pressures from a long list of biological invasions associated with the massive imports of plants and plant products. These biological invasions are threatening domestic production systems and our agricultural export industries. The National Plant Diagnostic Network (NPDN), part of the Food and Agricultural Defense Initiative, addresses these national agricultural biosecurity imperatives through enhanced detection and diagnostic capability for new diseases and pests. NPDN operates in all 50 states and four US territories through five regional centers, and reports detections to the NPDN National Data Repository. Also, NPDN develops and implements education/training programs for agricultural biosecurity in the biocontainment environment at Pat Roberts Hall at Kansas State University.

Description
The U.S. is dependent upon exports to stimulate an economic recovery. Plants and plant products contribute one half to two thirds of U.S. agricultural exports worth over $60 billion annually. The European Union, Australia, and Canada are all creating plant diagnostic networks based on the NPDN model. The USDA is investing $35 million/year to enhance plant biosecurity infrastructure in other nations (our competitors), while at the same time, funding for NPDN was reduced to less than $3 million annually; thus weakening our competitive position globally. The volume of plant and plant product imports is so large that we only inspect 1-2%; border inspection and interception alone will not protect US agriculture. Without effective plant biosecurity infrastructure for early detection and accurate diagnostics to inform rapid and appropriate response, both agricultural production and exports are at risk.

There are over 40 million people on food assistance in the U.S. Increased food costs resulting from import/export disruptions will increase the number of people requiring food assistance in the U.S. This will lower the standard of living in the U.S. and impair our ability to address the global food security challenge.

Relevance
The National Plant Diagnostic Network (NPDN) is a major component of our national plant biosecurity infrastructure. It is listed as critical infrastructure by USDA and by the Department of Homeland Security. To protect U.S. agriculture from the threats of bioterrorism and from unintentional introductions, this infrastructure must be strengthened. NPDN labs provided the diagnostic support for the Asian Soybean Rust early warning system for soybean producers and alleviated the enormous burden on APHIS’ diagnostic labs during the response to the spread of Phytophthora ramorum throughout the U.S. in 2005. NPDN is a necessary part of our national plant biosecurity infrastructure providing nationwide reach and impact.

The Plant Diagnostic Information System (PDIS), a lab management software system developed at KSU, is in use in 30 states. K-State provides leadership for the national exercise scenario program to facilitate preparedness of local, state, and federal personnel in outbreak management. Due to funding cuts, the national exercise preparedness program is at risk. All GPDN states—Colorado, South Dakota, Oklahoma, North Dakota, Nebraska, Texas, Wyoming, Montana, and Kansas—have participated in K-State organized training workshops on advanced diagnostic techniques, first detector training, and secure communications. Those programs have been dramatically reduced but need to be funded.

K-State and GPDN continue to provide leadership in setting a vision for the network. That leadership is recognized as evidenced by many invitations to speak at national and international meetings, including Keynote presentations and Plenary Lectures at International Meetings. Although significant advances were made in enhanced diagnostic capability, we are still deficient in our national detection capability.

Agency Contact Information
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TITLE XII – USAID International Ag Development: The Importance of Feed the Future Food Security Innovation Labs

Background
As of fall 2012, the USAID Collaborative Research Support Programs (CRSPs) are now called Feed the Future Food Security Innovation Labs (FTF SILs), as part of the Feed the Future Food Security Innovation Center (FSIC), under the amendment “Title XII - Famine Prevention and Freedom From Hunger” to the Foreign Assistance Act of 1961.

Description
USAID announced the Feed the Future Food Security Innovation Center (FSIC), at the BIFAD meeting in October 2012. The establishment of the FSIC responds to two key recommendations from the BIFAD-commissioned CRSP review: to develop an overarching and coordinated strategy for engaging U.S. universities in agriculture and food security research and to include the CRSPs as a central component; and to leverage the impact of CRSP investments by strengthening links across universities, U.S. government, global programs, foundations, and other donors.

As part of standing up the FSIC, and to help signal this important change in how USAID research programs are developed and managed, AID is adopting a uniform title for the new FSIC programs. In the case of the CRSPs, the new name is FTF Food Security Innovation Labs.

The FSIC is led by the Bureau for Food Security's Chief Scientist and receives strategic guidance from the Board on International Food and Agriculture Development (BIFAD). The FSIC is also a strategically aligned with the USAID Higher Education Solutions Network (HESN).

What is different about the FSIC? Instead of managing by type of partner (university, international center), USAID will manage by thematic program area - the FSIC supports seven interlinked research and capacity programs. These programs will sustainably transform agricultural production systems, ensure access to nutritious and safe foods, create enabling and supportive policies and address the emerging challenges of climate change and natural resource scarcity.

The seven programs reflect the Feed the Future Research Strategy and the focused research agenda within that which USAID has prioritized. Each of the seven program areas has U.S. universities as fundamental partners, with explicit connections as well to the CGIAR Consortium Research Programs (CRPs), the private sector, and others. USAID envisions powerful combinations emerging.

The seven program areas of the FSIC are:

- The Program for Research on Climate Resilient Cereals
- The Program for Research on Legume Productivity
- The Program for Advanced Approaches to Combat Pests and Diseases
- The Program for Research on Nutritious and Safe Food
- The Program for Markets and Policy Research and Support
- The Program for Sustainable Intensification
- The Program for Human and Institutional Capacity Development

Relevance
Kansas State University is currently leading three USAID Feed the Future Security Innovation Labs for:
1) Collaborative Research on Sorghum and Millet,
2) Applied Wheat Genomics, and

Kansas State University is writing a project proposal, due on May 15, 2014, to compete for and, hopefully, secure the new, proposed USAID Feed the Future Innovation Laboratory for Sustainable Intensification.

Kansas State University also will continue its work with other existing and new USAID Feed the Future Food Security Innovation Labs, as it continues its leadership in global food systems.

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USDA-ARS Ogallala Aquifer Program

Background
This program is conducting research and outreach activities to protect the Ogallala Aquifer and retain the economic integrity of the Southern Great Plains region, including the Texas High Plains, and portions of Oklahoma, New Mexico, Kansas, and Colorado, all states that are dependent on the survival of the Ogallala Aquifer.

Description
The Ogallala Aquifer in Western Kansas and the Texas High Plains is declining at an unacceptable rate with aquifer with average depletion rates of 1 to 3 feet per year. Agricultural irrigation use accounts for nearly 90 percent of the groundwater withdrawals in the region. Water availability, cost, and policy, together with technology development and adoption rates, will shape the rural landscape in the coming decades. To ensure the sustainability of rural communities in this region, continued investments are needed in irrigation management and agronomic research concerning water use efficiency, improved hydrologic assessments of water availability and sustainability, socioeconomic considerations and wise public policy regarding water rights, and public outreach engaging all stakeholders.

The Ogallala Aquifer has provided water for the regional development of a highly significant agricultural economy. Ninety percent of groundwater withdrawals are used for irrigation. This region produces about 4 percent of the nation’s corn, 25 percent of the hard red winter wheat, 23 percent of the grain sorghum, 28 percent of the cotton and 42 percent of the fed beef. Local grain production is used primarily as feed grains for intensive beef, dairy, and swine production. The Ogallala Aquifer is a finite resource with aquifer recharge being much less than withdrawals. Research into the complex nature of water availability, uses, technological improvements, and pricing will drive the discussions and decisions relative to water policy.

Relevance
This initiative will:
- Investigate and improve water management within existing cropping systems.
- Develop and evaluate integrated crop and livestock systems that reduce dependence on underground water resources.
- Assess groundwater resources in the Ogallala Aquifer and their relationships with climate.
- Enhance the knowledge base of producers, water professionals, and policy makers.
- Develop and evaluate water-saving technologies for concentrated animal feeding operations and industries.
- Evaluate the implications of alternate water policy options.

The partners will continue developing innovative conservation measures for the Ogallala Aquifer resource through a multi-state university and federal program. The group will develop, evaluate, and transfer technologies that will allow efficient water utilization while conserving and protecting the Ogallala Water Aquifer. The consortium also will develop and establish the program as the resource for data and knowledge in the development of fair and effective water policy.

Partners
USDA-Agricultural Research Service (lead agency)
Texas AgriLife Research
Texas AgriLife Extension Service
Kansas State University Research and Extension
West Texas A&M University
Texas Tech University

The Ogallala Aquifer Program team won the 2013 U.S. Department of Agriculture Secretary’s Honor Award in the category of enhancing economic vitality and quality of life in rural America. The award is the most prestigious departmental honor given by the secretary.

Agency Contact Information
USDA NIFA
CPRL USDA Ag Research Service
David Brauer, 806-356-5769
NATIONAL INITIATIVES
Overview of FY2015 Request

America’s land-grant universities and related institutions provide much of the research, education, and public outreach that sustains U.S. food, fiber, and renewable fuel production while addressing many urgent and important local, regional, national, and global problems.

Financial support for this world-renowned enterprise comes from both public and private sources, but the most significant funding source is the federal-state partnership managed by the National Institute of Food and Agriculture (NIFA)—USDA’s extramural science agency—and funded by NIFA and state and local governments.

Like many other federal entities, the NIFA budget was reduced by nearly eight percent in FY2013, when sequestration’s across-the-board cuts took effect on March 1, 2013.

Fortunately, the Bipartisan Budget Act of 2013 cleared the way for enactment of the FY2014 Consolidated Appropriations Act with sufficient budgetary headroom to permit restoration of the funding cut from most NIFA programs.

That bill also increased NIFA’s Agriculture and Food Research Initiative (AFRI), USDA’s flagship competitive grants program, by $39.4 million (compared to FY2013) and provided nominal increases to the six NIFA programs which underwrite the capacity (infrastructure) of 1862, 1890, and 1994 land-grant universities.

As shown in Table 1, the Association of Public and Land-grant Universities supports AFRI funding at $360 million. We also support funding for the six capacity priorities that support research, education, and extension efforts at America’s land-grant universities and related institutions at not less than their FY 2014 levels. Finally, we urge Congress to continue to make NIFA funding a high priority.

For more information and updated documents, visit: www.land-grant.org/documents.html

For additional information, please email Hunt Shipman (hshipman@cgagroup.com) or Jim Richards (jrichards@cgagroup.com). Phone: 202.448.9500

<table>
<thead>
<tr>
<th>TABLE 1. CORE NIFA PRIORITIES</th>
<th>FY 2015</th>
</tr>
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<tbody>
<tr>
<td>Agriculture and Food Research Initiative</td>
<td>$360,000 M+</td>
</tr>
<tr>
<td>Smith-Lever 3(b)-(c)</td>
<td>300,000 M+</td>
</tr>
<tr>
<td>Hatch Act</td>
<td>243,701 M+</td>
</tr>
<tr>
<td>Evans-Allen</td>
<td>52,485 M+</td>
</tr>
<tr>
<td>1890 Institutions Extension</td>
<td>43,920 M+</td>
</tr>
<tr>
<td>McIntire-Stennis Cooperative Forestry</td>
<td>33,961 M+</td>
</tr>
<tr>
<td>1994 Institutions Research and Extension</td>
<td>6,247 M+</td>
</tr>
</tbody>
</table>
Feeding 9.6 Billion by 2050

The U.S. Census Bureau maintains digital clocks which display net population growth both domestically and worldwide. Those clocks show a net gain of one person in the United States every 15 seconds and another person worldwide about every half second.

To put this in perspective, if the world population clock were an automobile odometer, the car would be hurtling along at a velocity of \( \approx 7,200 \text{ miles per hour} \) or roughly Mach 9.4!

At present rates, the global population will reach 9.6 billion by 2050 and experts believe that agricultural productivity must double from current levels to feed a global population of that magnitude. One private-sector group that has been out front on this issue is Global Harvest Initiative (GHI).

Each year GHI publishes a Global Agricultural Productivity (GAP) Report\(^\circ\) “to mark the progress made toward sustainably doubling agricultural output to meet the 2050 demand for food, fiber, fuel, and other industrial products derived from agriculture.” This annual report also “highlights key policies required to encourage more investment and innovation, and to build efficient, sustainable agricultural value chains.”

We believe that GHI’s 2013 GAP Report\(^\circ\) could help inform the congressional debate over funding for the National Institute of Food and Agriculture and is worth reading in its entirety. We would highlight the following key policy recommendation:

*Investment in agricultural research and development (R&D) is a principal driver of agricultural productivity growth… The private sector is a growing source of R&D funding, but greater public-sector investment is critical for innovation, basic research and making research findings and technologies widely available. Integrative research brings together multi-disciplinary teams of scientists from the government, academia, and the private sector to create synergies, accelerate progress, and improve cost effectiveness. New technologies must then be adapted to meet local needs and conditions so the benefits of these innovations are extended to farmers and producers across the value chain. The extension and commercialization of these new technologies should be pursued through collaborative public-private partnerships. Investments in agricultural R&D make significant contributions to sustained growth in agricultural productivity, alleviating poverty and improving food security. [Emphasis added.]*

QUICK LINKS:
- www.globalharvestinitiative.com
- ERS data from charts: www.1.usa.gov/1cpYkDW

Reprinted from GHI’s 2013 GAP Report,\(^\circ\) these two charts demonstrate the profound difference that total factor productivity has made in the developed world over the past 50 years. "Total factor productivity is the ratio of agricultural outputs (gross crop and livestock output) to inputs (land, labor, fertilizer, machinery and livestock). When TFP rises, more output can be produced from a fixed amount of inputs. TFP growth can result from increased effectiveness of inputs, more precise use of inputs, or the adoption of improved production practices."
Background
Veterinary medicine is an integral and indispensable component of our public health system as well as our agriculture and agricultural biosecurity systems. In addition to their obvious role in maintaining animal health, veterinarians also protect human health by preventing and controlling infectious diseases, ensuring the safety and security of our food supply, promoting healthy environments, and providing health care for animals. Because of the threat that infectious diseases pose to both human and animal health, there is an immediate and urgent need to build national capacity in training of veterinarians with expertise in food animal medicine, public health and agricultural biosecurity. Rural veterinarians, engaged in food animal practice, are our nation’s first line of defense in recognizing a foreign animal disease. It has become increasingly important for schools and colleges of veterinary medicine to provide high quality training programs in agricultural biosecurity, within the instructional program for veterinary medical students, and at a higher level, for graduate veterinarians who seek advanced training in agricultural biosecurity. Such additional instructional programs are difficult to implement within the severe constraints of veterinary medical schools and colleges, placing a premium on programs that can assist the educational institutions in meeting a greatly expanded national need.

There are only 30 veterinary medical colleges in the country, and they do not have enough capacity to meet all of these needs. All of these schools are at the maximum number of students they can accept due to space limitations for teaching, diagnostics, and research. Laboratories, teaching hospitals, veterinary research facilities, and animal diagnostic areas are built specifically for use with animals including laboratory animals, livestock species, and wildlife. This is space built with unique safety, restraint, and handling requirements that are not commonly found on American campuses.

In addition to the projected need based on current assumptions about veterinary medicine, even more veterinarians will be needed due to other factors such as greater encroachment on animal habitat, resulting in increased human interaction with wild and exotic animals; changing climates and ecosystems, deforestation, dam building and irrigation, leading to greater numbers of arthropod vectors of disease and greater contact between these vectors and humans; more and faster global travel and displaced human and animal populations, leading to rapid and wide dispersal of infectious diseases; and changing human behavior, such as consuming exotic foods and keeping exotic pets, which increases the risk of exposure to newly emerging infectious diseases.

To be successful, programs that seek to recruit and retain veterinarians in careers in food animal practice, public health and agricultural biosecurity must compete effectively with programs recruiting veterinarians to many other career options. A new graduate from an accredited U.S. veterinary medical school or college typically enters the profession with over $152,000 of educational debt load. Consequently, graduates very logically examine the salary expectations, both at entry and over the long term, of a potential career choice, recognizing their need to repay their student loans even as they seek to establish a family and maintain a reasonable life style. With such financial pressures and analyses, a career in food animal practice and agricultural biosecurity often pales in comparison to the salary potential of other, more lucrative career options. Consequently, measures to relieve a significant portion of debt load, contingent upon entering and remaining in a career in food animal practice and agricultural biosecurity, are very important for the recruitment and retention of veterinarians to this area of national need.

The support of effective strategies to recruit and retain an adequate number of veterinarians in food animal practice, and to facilitate their training in agricultural biosecurity, are key elements in maintaining the security of our food supply and of our agricultural economy.

Measures to facilitate the recruitment and retention of veterinarians in food animal practice, while simultaneously expanding the training of veterinarians in agricultural biosecurity are keys to maintaining the security of animal agriculture, our agricultural economy, and our food supply.

Description
The Senate-passed Farm Bill (S. 954) and the House-passed Farm Bill (H.R. 2642) last year both contained provisions important to veterinary medicine. A key section established a competitive veterinary services grant program to develop, implement, and sustain veterinary services (S. 954, Sect. 7103 and H.R. 2642, Sec. 7104). Authorized at $10 million annually, this section would amend the National Agricultural
Research, Extension and Teaching Policy Act of 1977 to direct the Secretary of Agriculture (USDA) to carry out a program with qualified entities to develop, implement and sustain veterinary services in the states. This grant would allow recipients to: a) establish or expand veterinary practices or establish mobile veterinary facilities, b) recruit veterinarians, technicians, and students, c) attend training programs in food safety or food animal medicine, d) establish or expand accredited education, internship, residency and fellowship programs, e) assess veterinarian shortage situations, and f) support continuing education and extension, including tele-veterinary medicine and other distance-based education.

The Veterinary Medicine Loan Repayment Program (VMLRP) Enhancement Act would amend the Internal Revenue Code to make VMLRP awards exempt from gross income and employment taxes. Awards are currently taxed at 39% although those taxes are paid by USDA directly to the treasury on behalf of the award recipient. Tax exemption for VMLRP awards would result in one additional veterinarian for every three based on current appropriations.

Support is requested for: 1) passage of a new 5-year Farm Bill that includes extensions of currently authorized programs of import to veterinary medical education and the veterinary profession, namely the Animal Health and Disease Research/1433 Formula Funds; Centers of Excellence, Food Animal Residue Avoidance Databank (FARAD), and the Competitive, Special and Facilities Research Grant Act, as well as new authority for a competitive veterinary services grant program to develop, implement, and sustain veterinary services (Veterinary Services Investment Act, S. 1053 in the 112th Congress), 2) tax exemption for awards made under the Veterinary Medicine Loan Repayment Program (VMLRP), HR 1125/S. 553, and 3) passage of appropriations legislation that maintains or increases funding for the VMLRP, Animal Health and Disease Research/1433 Formula Funds, Agriculture and Food Research Initiative, FARAD, the National Animal Health Laboratory Network as well as for the National Institutes of Health (NIH).

Aspirations for the appropriations for Fiscal Year 2015 should be to maintain current funding levels for such critical programs as the Animal Health and Disease Research/1433 Formula Funds, Veterinary Medicine Loan Repayment Program, Agriculture and Food Research Initiative, the Agriculture Research Service (ARS), and the National Institutes of Health.

Relevance
Agriculture, and specifically animal agriculture, is vital to the Kansas economy. Training, recruiting, and retaining enough veterinarians to meet the needs of agriculture and of agricultural biosecurity are important concerns of agriculture and related organizations. They are also natural issues of concern to the College of Veterinary Medicine at Kansas State University, one of only 30 such schools in the United States. As one of only 27 states with a College of Veterinary Medicine, Kansas would clearly benefit by increased federal investment in the training of veterinarians in agricultural biosecurity and food animal practice, as well as in their subsequent recruitment and retention.

The proposed federal investment would augment, not replace or diminish the importance of funding from the state of Kansas. It will, however, multiply the impact of state funds and enhance the ability of Kansas State University and the College of Veterinary Medicine to meet the needs of the state and nation. Leaders from the Kansas Congressional delegation have lent their support to these important legislative efforts.

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