

**Report on Areas of
Research, Scholarly and Creative Activities, and Discovery (RSCAD) Strength**

Date 9/1/2014

A. Area of Strength:	Water
B. Scope and Context:	Includes areas of rural, urban and industrial applications. Rural applications include irrigation and water supply. Urban applications include water quality, integrated watershed and storm water infrastructure. Industrial applications include minimization of water use in industrial processes including power plants and petroleum processing.
C. Current or Emerging Strength:	<input type="checkbox"/> Current <input type="checkbox"/> Emerging <input checked="" type="checkbox"/> Both
D. Criteria of Strength (1, 3, 5, etc.):	1, 2, 4, 6, 7, 8, 9, 11, 13, 14, 15, 16, 18, 19, 20 (Links to Global Food Systems (GFS) Initiative)
E. Narrative:	Water has been identified as a state, national and world challenge including the nexus between water, food/land and energy. Activities in the college have been divided into three areas: rural, urban and industrial. Rural activities teaming with the College of Agriculture have an established track record with additional activities. Urban applications are increasing their activities including collaborative activities with the Olathe based Urban Water Institute. The industrial area has had increased interest in the last two years especially with electric utilities and energy companies (such as ExxonMobil, Phillips 66 and ConocoPhillips)
F. Keywords/Tag words:	

A. Area of Strength:	Big Data/High Performance Computing
B. Scope and Context:	Includes three areas of big data including infrastructure, analytics and applications. Also includes software analysis for high performance computing.
C. Current or Emerging Strength:	<input type="checkbox"/> Current <input type="checkbox"/> Emerging <input checked="" type="checkbox"/> Both
D. Criteria of Strength (1, 3, 5, etc.):	1, 2, 3, 4, 6, 8, 9, 12, 15, 16, 18
E. Narrative:	Engineering provides an essential foundation for university level big data and data analytic activities with BeoCat and other CIS support. Research opportunities in the big data area include the infrastructure, analytics and applications. Infrastructure includes the computational resources that are necessary for analytics and applications. Engineering faculty including CIS and operations research work with faculty outside the college on developing techniques to analyze, evaluate and data mine large data sets for useful information and trends. Engineering faculty collaborate with faculty in most of the colleges across campus related to various big data applications including biology and business. Engineering faculty have been involved in the development of graduate level distance education activities to help provide advanced training for industry.

F. Keywords/Tag words:	
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A. Area of Strength:	Cybersecurity
B. Scope and Context:	Includes language-based security, cybersecurity, computer security and information assurance. These areas include securing information and systems across the broad spectrum of computing systems, network systems, applications, and information storage.
C. Current or Emerging Strength:	<input checked="" type="checkbox"/> Current <input type="checkbox"/> Emerging <input type="checkbox"/> Both
D. Criteria of Strength (1, 3, 5, etc.):	1, 2, 4, 5 (DHS, NSA), 9, 11, 16, 17, 18
E. Narrative:	Center for Information and Systems Assurance (CISA) has been redesignated as a National Center of Academic Excellence in Information Assurance/Cyber Defense Research. The designation is from the U.S. Department of Homeland Security and the National Security Agency and is effective from 2014 to 2019. CISA works on the analysis of computer system attacks and security metrics, and its focus is on the defense part of cybersecurity. Another group within CISA works to develop and construct secure software systems that enable secure information flow within computer and network systems. Additional emerging areas within the electric power industry in collaborations with the Smart Grid lab could be an additional industrial opportunity.
F. Keywords/Tag words:	

A. Area of Strength:	Nuclear Engineering
B. Scope and Context:	Including nuclear reactor activities and applications, nuclear sensors and computational support of nuclear engineering applications
C. Current or Emerging Strength:	<input type="checkbox"/> Current <input type="checkbox"/> Emerging <input checked="" type="checkbox"/> Both
D. Criteria of Strength (1, 3, 5, etc.):	1, 2, 4, 6, 9, 12, 15, 16, 17
E. Narrative:	Engineering has unique facilities related to nuclear engineering. The K-State TRIGA Mk II Reactor provides services for education, research, and training, and outreach. The reactor is licensed to operate at up to 1250 kWth. The Semiconductor Materials and Radiological Technologies (S.M.A.R.T.) Laboratory is a unique facility dedicated to the research and development of new and innovative radiation detector technologies. Two recent hires include faculty with strength in simulation, modeling and computational support of nuclear activities.
F. Keywords/Tag words:	

A. Area of Strength:	Advanced Materials, Manufacturing and Processes
B. Scope and Context:	Includes nano-, bionano-, ceramic, composite and semiconductor materials for various applications. For advanced manufacturing, activities include design,

	prototype development and fabrication of new devices and systems required to advance manufacturing as well as improvements of existing devices and systems and tech transfer.
C. Current or Emerging Strength:	<input type="checkbox"/> Current <input type="checkbox"/> Emerging <input checked="" type="checkbox"/> Both
D. Criteria of Strength (1, 3, 5, etc.):	1, 2, 4, 6, 9, 11,15, 17, 18, 19
E. Narrative:	<p>Advanced material and their applications are studied across Engineering including nano- and bionano-technology, composites, ceramics and semiconductor materials. Applications include high energy density materials, advanced wide band gap semiconductors, chemical and biological and chemical sensors.</p> <p>The Advanced Manufacturing Institute (AMI) occupies a 22,000 square foot building located near the K-State campus. The facility is a combination of offices, engineering design labs and a fully equipped prototype shop where custom components can be designed and fabricated at a single location. Additionally AMI has an Olathe extension that works with industries in the KC area. An emerging area relates to the advanced machinery systems especially for agricultural applications.</p> <p>Engineering has faculty involved in processing of biological materials for various products and applications.</p>
F. Keywords/Tag words:	

A. Area of Strength:	Energy and Power
B. Scope and Context:	Includes areas of catalysis and alternative fuels, electric power systems and power electronics, wind applications and integration, and thermal systems.
C. Current or Emerging Strength:	<input checked="" type="checkbox"/> Current <input type="checkbox"/> Emerging <input type="checkbox"/> Both
D. Criteria of Strength (1, 3, 5, etc.):	1, 2, 4, 6, 8, 9, 12,16, 18, 19
E. Narrative:	<p>Engineering has a wide variety of activities in the areas of energy and power. Activities in the energy area include advancing catalytic processes and alternative fuels as well as advancing thermal efficiency in engines.</p> <p>A traditionally strong area in engineering includes electric power systems with a strong industrial collaboration, Electrical Power Affiliates Program with eight industry partners and the Smart Grid Laboratory, state-of-the-art protection, controls and communications laboratory. Recent funding and support in power electronics includes interfaces for renewable resources.</p> <p>Wind energy continues to be a relevant and unique area for the state of Kansas and Kansas State. Faculty work in areas of wind turbine design, development and maintenance, wind energy integration and education.</p>
F. Keywords/Tag words:	

A. Area of Strength:	Transportation
B. Scope and Context:	Includes areas of highways and their systems including safety, railroad materials and logistics and unmanned aerial vehicle systems.

C. Current or Emerging Strength:	<input type="checkbox"/> Current <input type="checkbox"/> Emerging <input checked="" type="checkbox"/> Both
D. Criteria of Strength (1, 3, 5, etc.):	1, 2, 4, 8, 15, 17, 18
E. Narrative:	<p>Engineering has strong ties to the Kansas Department of Transportation and US Department of Transportation in areas related to highway safety, logistics, materials and structures. The Civil Infrastructure Systems Laboratory (CISL) is one of only six such facilities in the nation, capable of testing large-scale asphalt and concrete pavement sections under full-scale loading. Recent research activities related to railroad tie materials and strength.</p> <p>Engineering has faculty involved in unmanned aerial vehicle and their systems for various applications collaborating with others across campus.</p>
F. Keywords/Tag words:	

A. Area of Strength:	Environmental applications
B. Scope and Context:	Includes areas of air/land quality, monitoring and remediation, and human/thermal interactions
C. Current or Emerging Strength:	<input checked="" type="checkbox"/> Current <input type="checkbox"/> Emerging <input type="checkbox"/> Both
D. Criteria of Strength (1, 3, 5, etc.):	1, 2, 4, 11, 17, 18
E. Narrative:	<p>Engineering faculty monitor, evaluate and develop mitigation strategies for air quality challenges related to agricultural applications as well as contained spaces such as aircraft cabins. Additional work is done on brownfields or contaminated land including clean-up and remediation techniques.</p> <p>The Institute for Environmental Research is an interdisciplinary research center for the study of the thermal interaction of people and their surroundings. It has controlled environmental chambers and supporting instrumentation necessary to study the aspect of human comfort. IER research deals with thermal comfort, thermal stress, clothing systems, indoor environmental engineering, and related topics.</p>
F. Keywords/Tag words:	

A. Area of Strength:	Sensors, Systems and Networks
B. Scope and Context:	Includes all types of sensors; and system and network modeling, simulation and analysis;
C. Current or Emerging Strength:	<input type="checkbox"/> Current <input type="checkbox"/> Emerging <input checked="" type="checkbox"/> Both
D. Criteria of Strength (1, 3, 5, etc.):	1 (NBAF, GFS), 2, 4, 11, 13, 15, 18
E. Narrative:	<p>This area provides support tools for interdisciplinary applications related to system and network modeling and interactions. Examples include power systems, communication systems, and spread of diseases. Engineering faculty provide the modeling and computational capabilities for system-level simulations.</p>

	Related to sensors, engineering faculty members provide the application need as well as help develop the sensors and their systems necessary to collect and record necessary data. Faculty work with the Electronics Design Laboratory as well for electronic needs.
F. Keywords/Tag words:	

A. Area of Strength:	Biomedical Applications
B. Scope and Context:	Includes advancement of biomedical imaging, sensing and treatments as well as development of biomedical devices and sensors for animal and human applications (including wearable and implantable).
C. Current or Emerging Strength:	<input type="checkbox"/> Current <input checked="" type="checkbox"/> Emerging <input type="checkbox"/> Both
D. Criteria of Strength (1, 3, 5, etc.):	1 (NBAF), 4, 6, 15, 17, 18
E. Narrative:	Engineering faculty are advancing techniques and technology and developing devices and sensors related to the area of biomedical engineering. Recent hires have strengthened this area and created a critical mass coupled with opportunities to collaborate with NBAF related research areas. Engineering faculty are part of an interdisciplinary team that received new NSF MRI funding.
F. Keywords/Tag words:	

A. Area of Strength:	STEM Education
B. Scope and Context:	Includes activities to increase recruitment of STEM students; to increase recruitment and retention of women, multicultural and veteran students; and collaboration with education on developing future STEM K-12 teachers.
C. Current or Emerging Strength:	<input type="checkbox"/> Current <input checked="" type="checkbox"/> Emerging <input type="checkbox"/> Both
D. Criteria of Strength (1, 3, 5, etc.):	1 (UEIA), 2, 3, 6, 16 (veteran students), 18, 19
E. Narrative:	Engineering has formal and informal research activities to increase the number of STEM students, especially in the areas of women, multi-cultural students and veterans returning to the university. Collaborations continue with the College of Education related to these students as well as helping provide training and application examples for pre-service K-12 teachers and high school counselors.
F. Keywords/Tag words:	