Visionary Plan

• **Mission:** The College of Engineering serves the citizens of Kansas, the nation, and the world by providing world-class educational, research and service programs where students and faculty can develop in their chosen disciplines, and advance as successful leaders and professionals.

• **Vision:** The College of Engineering will pursue academic excellence in all of its endeavors.
COE Emphasis-Area Research Strategy

- Health
  - Biomedical systems
  - Logistics
  - Scheduling
  - Water
  - Advanced manufacturing
  - STEM education
  - Big data
  - Cybersecurity
  - Mechatronics

- Energy
  - Biofuels
  - Power systems
  - Nuclear
  - Structures
  - Transportation
  - Advanced materials and processes
  - Environmental sustainability
  - Sensors
  - High-assurance software

- Infrastructure
  - Geotechnical
  - Communication networks

Road map for faculty hiring and research facility development
Department of Mechanical and Nuclear Engineering
Semiconductor Materials and Radiological Technologies (SMART) Laboratory

- **Location** – Ward Hall (ground floor)
- **Faculty leader**
  - Douglas McGregor
- **Participating faculty**
  - Amir Bahadori, Hitesh Bindra, Jeremy Roberts, Ken Shultis, Walter McNeil, William Dunn
SMART Laboratory

• **Laboratory mission**: research and development of new and innovative radiation-detector technologies

• **Laboratory facilities**
  - 1,200-sq.-ft. class 100 clean room
  - 300-sq.-ft. class 1,000 clean room
  - Material processing furnaces
  - Mask aligners
  - Spinners, evaporators and sputters
  - Scanning electron microscopes
  - Spectroscopy systems
SMART Laboratory

• Sample projects
  – Micro-pocket fission detectors
  – Microstructured semiconductor neutron detectors
  – GaAs self-biased, low-power neutron detectors
  – Pixelated semiconductor neutron-imaging detectors

• Marks of excellence
  – More than $33M in extramural funding for radiation-detection projects since 2002
  – More than 100 refereed publications and more than 80 conference publications on radiation detectors/systems/measurements generated since 2002
  – 19 patents filed for SMART Laboratory/radiation measurement technologies
Department of Biological and Agricultural Engineering
Systems Automation and Robotics (SAR) Laboratory

• **Location** – Seaton Hall (1037)
• **Faculty leaders**
  – Ajay Sharda
  – Daniel Flippo
• **Participating faculty**
  – Edwin Brokesh
  – John Slocome
SAR Laboratory

- **Laboratory mission**: innovation and application of intelligent machine system to enhance productivity, profitability and sustainability of agricultural production systems

- **Laboratory facilities**
  - 2,700 sq. ft. for R&D
  - 725 sq. ft. for instruction
  - Automated test beds for control system validation and optimization
  - Advanced instrumentation for high-speed imaging and real-time data acquisition
  - Thermal and color infrared imaging systems
  - UAV systems for agricultural production
SAR Laboratory

- **Sample projects**
  - UAV imaging systems
  - High-speed imaging and data acquisition
  - Precision liquid and seeding technologies
  - Robotics for off-road application
  - Smart sensors for quality hay production
  - Innovative tractor performance validation

- **Marks of excellence**
  - More than $1.4M in extramural funding for automation and robotics since 2015
  - More than $1.1M in industry-supported equipment since 2014
  - More than 15 refereed publications and 20 conference publications
Department of Computer Science
Beocat – High-Performance Computing

- **Location** – Engineering Hall (1121)
- **Faculty leader**
  - Dan Andresen
- **Staff**
  - Adam Tygart, senior system admin;
    Kyle Hutson, system admin;
    Dave Turner, application scientist
Beocat

• **Mission:** growing research and education with high-performance computing and big data requirements

• **Capabilities**
  – 5,000+ compute cores
  – 200+ compute nodes
  – 2.2 petabytes storage
  – 31.5TB memory
  – Strong partnerships at regional (KanShare) and national (XSEDE) levels
Beocat

- **Sample projects**
  - Predicting macroscopic catalytic and materials properties
  - Attosecond physics
  - Agricultural big data
  - Biochemical protein modeling
  - Evolution of multicellular organisms
  - Bioinformatics

- **Marks of excellence**
  - Supports more than 125 faculty and 1,000 users from five countries
  - More than 100 million CPU-hours served
  - More than 200 million jobs run
  - More than 2,500 annual student/faculty tours
  - More than $13.5M in grants and 125+ papers since 2014 (key player in 2017 $10.2M NIH COBRE center grant)
Department of Chemical Engineering
Advanced Materials and Processes Lab

• **Location** – Durland Hall (2nd floor)

• **Faculty leader**
  – J.H. Edgar

• **Participating faculty**
  – Placidus Amama, Ryan Hansen,
    Urara Hasegawa, Keith Hohn,
    Bin Liu, Brian Tande
Advanced Materials and Processes Lab

• **Mission:** develop new processes and materials for cleaner, more sustainable and efficient energy sources to enhance human health and biosecurity, and promote sustainable agricultural production

• **Laboratory Facilities**
  – Five energy-efficient research laboratories with state-of-the-art equipment and safety features
  – Advanced instrumentation for crystal growth, and carbon nanotube and polymer synthesis
  – State-of-the-art equipment for characterization, structural analysis, live-cell microscopy and maskless lithography
Advanced Materials and Processes Lab

• **Sample projects**
  – Synthesis of carbon nanotubes and their environmental and catalytic applications
  – Semiconductors for energy harvesting, homeland security and chemical sensing
  – Microwell array platform for high-throughput screening and discovery of microbial interactions

• **Marks of excellence**
  – $11.9M in extramural funding since 2002
  – 170 refereed publications cited more than 2,700 times since 2002
  – Eight current NSF grants worth $3.0M
Department of Electrical and Computer Engineering
Smart Grid Laboratory
(Power Electronics and Power Systems)

- **Location** – Engineering Hall (2nd floor)
- **Faculty leaders**
  - Behrooz Mirafzal (power electronics)
  - Mohammad Shadmand (smart grid)
- **Participating faculty**
  - Anil Pahwa, Dwight Day,
    Hongyu Wu, Caterina Scoglio
Smart Grid Laboratory (Power Electronics and Power Systems)

• **Laboratory mission:** develop hybrid, smart electrical distribution system of the future and novel solid-state power converters for modern energy conversion systems

• **Laboratory facilities**
  – Solar- and wind-power generation grid simulators
  – Hardware-in-the-loop testbeds
  – High-performance embedded controllers
  – Phase measurement unit hardware and relays
Smart Grid Laboratory
(Power Electronics and Power Systems)

• **Sample projects**
  – SiC-based, medium-voltage grid-integrated photovoltaic inverters
  – Hierarchical control of smart microgrid systems
  – Smart grid-interactive power converters
  – Indirect-boost matrix converter for wind energy

• **Marks of excellence**
  – More than $6M in federal and industrial funding
  – More than 100 refereed patents, and journal and conference publications since 2012
  – Establishing a multi-university NSF I/UCRC center
Department of Industrial and Manufacturing Systems Engineering
Advanced Manufacturing Processes Labs

- **Location** – Rathbone Hall (0049, 0051, 2094)
- **Faculty leader**
  - Shuting Lei
- **Participating faculty**
  - Suprem Das, Dong Lin, Meng (Peter) Zhang
Advanced Manufacturing Processes Labs

- **Laboratory mission:** dedicated to research and development of new and innovative manufacturing technologies

- **Laboratory facilities**
  - Flexible electronics, 3-D aerogel, and continuous-fiber composite printers
  - Chemical vapor-deposition equipment
  - Ultrafast lasers for micromachining
  - Biomass energy conversion systems
  - Rotary ultrasonic machine
Advanced Manufacturing Processes Labs

• **Sample projects**
  – Process optimization for bioenergy manufacturing
  – Ultrasonic machining of aerospace materials
  – Printable and laser-treated micro/nanostructure electronics for sensing and energy
  – 3-D printing of aerogels and fiber composites

• **Marks of excellence**
  – Developed world’s lightest 3-D-printed material
  – Developed laser micro/nanopatterning of inkjet-printed graphene for glucose sensing
  – More than 60 journal papers and 28 refereed conference papers since 2015
Department of Civil Engineering
Jerry and Robin Westhoff Concrete Mixing and Curing Lab, and Structures Laboratory

• **Location** – Engineering Hall (0107 and 0108)
• **Faculty leader**
  – Robert Peterman
• **Participating faculty**
  – Christopher Jones, Hayder Rasheed, Asad Esmaeily, Hani Melhem
Concrete Mixing Laboratory and Structures Laboratory

- **Laboratory mission:** dedicated to research and development of novel transportation infrastructure elements

- **Laboratory facilities**
  - Advanced concrete mixing capabilities
  - State-of-the-art fabrication facility for full-scale prestressed concrete members
  - Servo-hydraulic testing of infrastructure elements
  - Five-ton crane capability
  - 60-gpm hydraulic power supply
Concrete Mixing Laboratory and Structures Laboratory

• **Sample projects**
  - Reinforcement bonding of prestressed concrete railroad ties (PCRT)
  - Eliminating splitting failures in PCRT
  - Abrasion and freeze-thaw resistance of PCRT
  - Bond of large-diameter prestressed wires

• **Marks of excellence**
  - Developed a new ASTM standard to test bonds of indented prestressed steel wires
  - Obtained a patent to determine prestressed tendon bonds using laser-speckle imaging
  - More than $5.2 million of funded research and 48 refereed papers in the past six years