

**COSET RESEARCH & DEVELOPMENT (R&D) CAPABILITY SUMMARY**

Our Principal Investigators (PI's) are active in pure and applied research, problem-solving, and product development. All offices and research labs have computers and printers with network access through wireless and LAN systems and are on the College and University Networks, respectively. Applicable research and development capabilities for COSET departments are summarized below:

**AVIATION SCIENCE and TECHNOLOGY:** O. Criner, V. Baker, T. Hall & R. Edwards

**Instruments and Equipment:** Two full size flight simulators, 10 PC based flight simulators

**Research and development areas:** Big data research to collect unstructured communications data to improve coordination and planning of ground airport traffic operation

**BIOLOGY:** W. Williams, S. Shishodia & J. Rosenzweig

**Instruments and Equipment:** Tissue culture hoods, chemical hoods, CO2 incubators, microplate spectrophotometer, gel electrophoresis equipment, electrophoresis power supplies, refrigerated bench top centrifuge, bench top micro-centrifuge, shaker incubator, incubators, orbital shakers, MilliQ water system, bright field microscope (Nikon), inverted microscope (Nikon), microtome and tissue processing console, refrigerators, and – 80°C ultra-deep freezer (Harris).

**Research and development areas:** Characterization of Bio-Molecular Response to Environmental Stress, Microbiology, Cell Signaling

**CHEMISTRY:** M. Saleh, B Wilson, J. Sapp, and Post Doctorial Research Associate K. Anthony

**Instruments and Equipment:** (1) Gas Chromatograph Mass Spectrometer (GCMS) Configured for monitoring both air and water (2) High-performance liquid chromatography HPLC MS (3) Raman Spectrometer (4) Fourier Transformed Infrared (5) Ultraviolet Spectrometers (6) Inductively Coupled Plasma Mass Spectrometer (ICP-MS), and (7) Scanning Electron Microscope.

**Research and development areas:** Environmental Chemistry and Toxicology Laboratory and its biosensorbiomarker core facility identify the signaling molecules responsible for the bacterial communication. Quorum sensing (QS) studies with how bacteria produce and release chemical signals in search of other bacterial cells in the neighborhood. If sufficient bacterial cells are found, then the bacteria begin to build the environment in which to multiply. Limiting this bacterial growth is the objective this research.

**ENVIRONMENTAL and INTERDISCIPLINARY SCIENCES:** H. Hwang, M. Bhaskar, M. Yakubu, and others from collaborating departments

**Instruments and Equipment:** Geographic information systems (GIS) Laboratory, Major analytical instruments in these laboratory include high-volume size-fractionated PM samplers, soil core pipe samplers, inductively coupled plasma-mass spectrometer (ICP-MS), high-performance liquid chromatograph-mass spectrometry (HPLC-MS) and ion chromatograph (IC). The Core laboratory also has multiple walk-in cold rooms and freezers for sample storage.

**Research and development areas:** Faculty who participate in this department are very broad, to include water, air, and soil monitoring, environmental chemistry, systems biology, toxicant exposure gene profiling, environmental microbiology, cell signaling, ecotoxicology, remote system monitoring, and transportation-related/induced health disparities.

**MATHEMATICS:** W. Taylor & J. Williams

**Research and development areas:** in applied mathematics, bioinformatics, differential and difference equations, discrete dynamical systems, graph theory, information theory, probability and statistics,

**PHYSICS:** C. Handy, C. Tymeck, & D. Vrinceanu

**Instruments and Equipment:** Radiation detection apparatus, radiation detectors, radioactive sources and radiochemistry apparatus. High Performance Computing Center (HPCC) has two Linux clusters Ares and Hades. The full parallel cluster has a total of 800 virtual cores and a total memory of 768 Gigabytes, with a theoretical peak speed of 5.0 Teraflops.

**Research and development areas:** Health physics research area include: 1) computational modeling of the underlying physics mechanisms that engender free radicals in water at the size of blood cells (e.g., in space), 2) modeling studies on stray radiation production in radiotherapy, (3) nuclear radiochemistry and spectroscopy, (4) nuclear magnetic resonance and (5) environmental radiation studies.

Radio Astronomy focusing on stellar and planetary formation, stellar evolution and evolution of galaxy mergers. Experience with the Very Large Array, the Very Long Baseline Array, the European VLBI Network, MERLIN-UK and the Australian Telescope Compact Array instruments. Participated in projects including the Japanese HALCA and the Russian Radio-Astronomy missions of launching radio telescopes in Earth orbit. Present activities include the participation with the development of the Square Kilometer Array in both Australia and South Africa.

Capabilities in investigating the dynamics of matter under extreme conditions with relevance for astrophysics, atomic and molecular physics and nano-science. Research involves theoretical and mathematical methods in physics for high performance computing and experimental methods. Active research collaborations with Harvard's ITAMP Center and Rice University, computational research impacting molecular and many body systems.

**COMPUTER SCIENCE:** W. LI, O. Criner, A. Sleem, L. Ghemri & F. Khan

**Instruments and Equipment:** Wireless sensor network laboratory, Mobile application development, Advanced Networking and Multimedia Research Laboratory, Large -scale data analysis of socioeconomic systems ("Big Data")

**Research and development areas:** Energy optimization in wireless sensor networks, decision processes in real-time dynamic time series analysis, cyber-security, programmable logic controllers for industrial control processes, computational science, applied mathematics, numerical analysis, software engineering and software development process quality.



Advanced Networking and Multimedia Research Laboratory has three local area networks (LANs) connected to form a single wide area network (WAN) that provides the environment to study, conduct research, and investigate protocols, techniques, traffic patterns, and applications within local area networks, enterprise networks, wide area networks, and service provider networks. Additionally, the lab has the capabilities to simulate internet protocol television (IPTV) and voice over IP (VoIP) environments.

**ENGINEERING:** D. Olowokere & G. Thomas

**Instruments and Equipment:** Virtual and remotely accessible laboratory, Control Systems Laboratory, Materials Testing Laboratory

**Research and development areas:** Fatigue analysis, Structural health monitoring, communications and control systems

**TRANSPORTATION STUDIES:** C. Lewis, L. Yu & Y. Qi

**Instruments and Equipment:** Driving Simulator Laboratory, Portable Emission Monitoring System Laboratory, and Mini-TranStar Laboratory.

**Research and development areas:** Assessment of Intelligent Transportation System (ITS) concepts, Driver preference and acceptance research, Accident analysis and development of crash, avoidance counter-measures, Design and evaluation of automotive products and technologies, Machine-2-machine

and machine-2 infrastructure communications and algorithms for intelligent vehicle problem solving and situational awareness.

**INDUSTRIAL TECHNOLOGY:** J. Horner, J. Lewis & C. Lott

**Instruments and Equipment:** Additive manufacturing (3D printing) laboratory

**Research and development areas:** Analyze processes for creating classes of structures using additive manufacturing technology and various software implementations

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