Item “B”

A proposal to establish a

# Center for Micro-Magnetic and Electronic Devices

Within the College of Engineering, University of Kentucky

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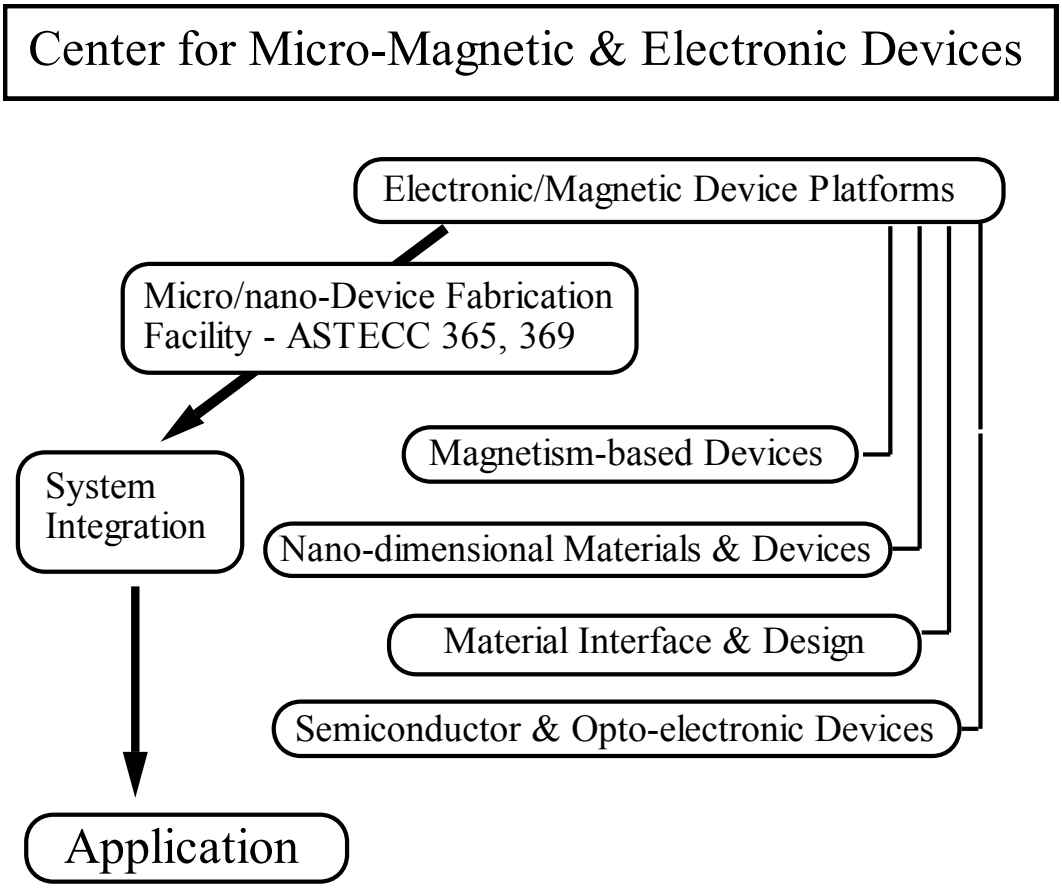
**MOTIVATION AND STRUCTURE**

The Center for Micro-Magnetic and Electronic Devices (CMED), a College of Engineering Research Center, will bring together into a formal structure a core group of faculty with unique research expertise on micro and nano-scale magnetic and electronic device design, fabrication, characterization, and application. This includes fabrication and characterization of electronic *smart* materials with device specific, electric and magnetic controllable micro/nano-dimensional features and inter-facial properties, nano-dimensional integrated electronic circuits, and adaptive *intelligent* signal processing algorithms for autonomous device control. The Research Vision of the Center will see the realization and application of electronic and magnetic devices that transcend what is now at the border of science fiction and technology. For example, consider a micron-sized stand-alone magnetic sensor that can identify, from an IC chip-like platform, healthy or cancerous cells. While such a product is years away, the devices that will enable such a reality are coming together and give impetus to the need for a Center. The core Center objective is to build upon and expand the established College of Engineering momentum in micro to nano-scale magnetic and electronic devices to create a premier, nationally recognized Center of excellence in this important field of research.

The Center will encompass and be responsible for the recently established Micro/Nano Device Fabrication Facility, in ASTECC A365 and A369, which contains a Class-10 Clean Room and associated micro/nano-electronic fabrication equipment provided through recent RCTF funding and a NSF-EPSCoR Infrastructure Proposal. The Device Fabrication Facility will be used to fabricate semiconductor-based integrated electronic devices, e.g. electronic 'chips,' and magnetic devices such as actuators and transducers. The Micro/Nano Device Fabrication Facility will serve as the focal point for micro to nano-dimensional device design, fabrication, and characterization. The Electron Microscopy Facility located in the basement of ASTeCC, Prof. Elizabeth C. Dickey Director, will be extensively used for device modification (through e-beam annealing and manipulation) and characterization.

There are immediate and long-term benefits to establishing this engineering-oriented Center. {1} The Center will leverage RCTF funding in equipment and faculty lines to develop a strong synergistic research cluster significantly better able to secure extramural funding in the nano-technology field, the growth of which is seeing tremendous support by industry and government. {2} Building upon established excellence in magnetic and electronic device

research and RCTF-provided equipment, the Center will be a high profile, state of the art facility that will show the College of Engineering, Advanced Science and Technology Commercialization Center, and the University of Kentucky in their best lights. A high technology, leading-edge Center, such as the Center for Micro-Magnetic and Electronic Devices, will help to recruit both faculty and students, expose junior faculty to new research opportunities, and provide potential donors with the visual certainty that their contributed funds are going to an institution worthy of support. {3} The Center will seek to establish strong links between the College of Engineering, in particular the departments of Electrical Engineering and Materials Engineering, with the College of Medicine to integrate intelligent micro and nano-dimensional magnetic and electronic devices into bio-implants/bio-probes that will add tremendous utility to the capabilities of these products. This is a bold vision of the future which the Center for Micro-Magnetic and Electric Devices will help to define.



**JUSTIFICATION**

As an example of the economic impact novel nano-dimensional magnetism-based devices offer, consider giant magneto-resistive (GMR) read-heads used for data storage. GMR is an effect seen only on a nano-scale of dimensions, and was discovered nine years ago. Yet today GMR recording-heads comprise a $47 billion/year industry. The projected fiscal year 2000 Federal government support of research concerned with the nano-scale of dimensions is over $312 million [*Nanotechnology Research Directions*, M.C. Roco, R. S. Williams, P. Alivisatos, Eds., Kluwer Academic Press, 2000]. Dr. Neal Lane, currently the President's Advisor for Science and Technology and former NSF director, stated at a Congressional hearing in April 1998, "If I were asked for an area of science and engineering that will most likely produce the breakthroughs of tomorrow, I would point to nanoscale science and engineering." Dr. Lane is certainly not alone in the belief that nanotechnology will lead to the next industrial revolution. The Center for Micro-Magnetic and Electronic Devices will be at the forefront of research designing new smart-materials and devices. Successful development of such devices would be greatly facilitated with a focused structure, such as a Center, with multiple team members dedicated to the realization of such devices. The Micro/Nano-dimensional devices that come from the synergism for which the Center will serve as a catalyst may well positively affect the life of every Kentucky resident, every citizen of this nation, and every person in this world.

**FACULTY LEADERSHIP**

Prof. Craig Grimes of the Dept. of Electrical Engineering will be Director. Initial faculty participants include Drs. Vijay Singh, Zhi Chen, Arthur Radun, Janet Lumpp, and Andrew Mason of the Department of Electrical Engineering, as well as Drs. Elizabeth Dickey and Susan Sinnott of the Materials Engineering Department. The combined faculty members represent an extensive and unique background in magnetism, electronics, nano-scale electronic devices, nano-dimensional materials, and design of atomic level material interfaces.

**POTENTIAL FOR GENERATING EXTRAMURAL FUNDS**

Collectively the Center affiliates represent some $5.4M in current funded extramural research grants from NIH, NASA, NSF, DoD and DoE. It is anticipated that the Center will boost and accelerate the demonstrated excellence in research that these numbers represent. As a Center, the collective members will be able to compete for extramural funds reserved for recognized Centers or Institutes. These include a number of NSF programs, Focused Research Groups, Science and Technology Centers, Engineering Research Centers, as well as various DARPA RFPs that seek a cluster of faculty (i.e. a Center) working on research topics of programmatic interest. There are also NASA and NIH focused Block Grants reserved for Centers or Strategic Clusters.

**REPORTING RELATIONSHIPS.**

The Center Director will report to the Dean of the College of Engineering.

**STAFF AND FACULTY REQUIREMENTS**

Together with Dr. Singh and Dean Lester, Dr. Grimes will work to establish an endowment for the Center. This Endowment can be used to help Faculty Affiliates focus on research, provide supplies or equipment, permanent staff, *etc*. The PI will pursue extramural funding that will support the hiring of additional research faculty, and start-up equipment funds for the support of tenure-track faculty.

**EQUIPMENT AND INSTRUMENTATION**

No additional equipment is needed.

**ADVISORY COMMITTEE**

A five-member Advisory Committee, comprised of at least two members internal to UK will be formed to provide useful input that will help guide the center.