EARTH AND ENVIRONMENTAL SYSTEMS INSTITUTE
COLLEGE OF EARTH AND MINERAL SCIENCES
THE PENNSYLVANIA STATE UNIVERSITY
STRATEGIC PLAN 2005/6 - 2008/9

Executive Summary

The Earth and Environmental Systems Institute seeks to promote environmental research and education within the College of Earth and Mineral Sciences. To promote this overall goal, we join with the College of Earth and Mineral Sciences in three overarching goals, described below. For each goal we highlight one or more activities to foster the college priorities during the next three years.

To create a student-centered college, EESI plans to

1) Promote the visualization of 3D environmental or materials data sets
2) Develop educational programs and promote faculty hiring that bridges between Life Sciences on campus (e.g. Ecology program) and programs in the College of Earth and Mineral Sciences
3) Develop and expand the human-environment curriculum
4) Promote a small, highly publicized, seminar series of world famous environmental scientists on inter-disciplinary topics

To develop a diversity and climate that will empower future scholars, EESI plans to

1) Strengthen ties between EESI and EMS and the University of Puerto Rico through undergraduate summer interns, faculty visits, and research seed grants involving UPR scientists

To advance the capabilities and reputations of departments and institutes, EESI plans to

1) Run a competition for centers to promote targeted research or educational initiatives such as earth system science, aerosol chemistry, carbon cycle science, human-environment interactions, or other areas

2) Partner with the Energy Institute or EMS to hire a grant facilitator to foster large proposals

3) Partner with the e-Education Institute to establish a state-of-the-art video conferencing facility in the EES building

4) Promote observational environmental science within EESI and on campus

5) Develop and maintain a world-class high-performance computing facility

These key points are discussed more completely within this document, in the context of 8 overall vision areas. The descriptions of the Vision Areas were developed by an EESI Strategic Planning Team (Appendix 1). The key points summarized in this Exec Summary are goals we expect can be accomplished in the next three years. These goals have been distilled from the broader Vision Areas, which often contain longer range goals.

Introduction

The Earth and Environmental Systems Institute (EESI) is one of the leading earth and environmental sciences research institutes in the United States. It is located organizationally in the College of Earth and Mineral Sciences, Penn State University Park Campus. The Institute's mission is comprised of four interrelated elements:

- To encourage interdisciplinary examination of the links between Earth's chemical, physical, and biological processes from atomic to global scales by supporting faculty and student research on earth sciences and environmental issues;
- To facilitate the modeling and manipulation of data in new and innovative ways through EESI's Environmental Computing Facility;
- To facilitate dissemination of research findings through publications, presentations, web pages, workshops, seminars, testimony to public agencies, and advice to public and private organizations and agencies; and
- To develop innovative, interdisciplinary research and education programs that benefit internal and external stakeholders, including the Penn State community, the Commonwealth, scientific communities, and federal and state science agencies and organizations.

Institutional Goals

The Earth and Environmental Systems Science Institute participates in the University Strategic Plan by:

- enhancing academic excellence through greater support of high-quality teaching, research, and service;
- enriching the educational experience of all Penn State students by becoming a more student-centered University;
- building a more considerate and civil University community;
- serving society through teaching, research, and service; and
- developing new sources of income and reducing costs through improved efficiencies.

The Earth and Environmental Systems Institute also supports the strategic objectives of the College of Earth and Mineral Sciences:

- to create the most student-centered college in Penn State history;
- to develop a diversity and a climate that will empower future generations of scholars; and
- to advance the capabilities and reputations of the College's Departments and Institutes.

Institute Structure and Activities

Centers. Much of the Institute research is promoted through six centers: Center for Environmental Chemistry and Geochemistry, Center for Integrated Regional Assessment, Center for Modeling Earth System History, Center for Advanced Carbon Research and Education, and the Center for Environmental Informatics.

Support of Faculty and Student Research Endeavors. The Institute provides high-quality support services through its budget and grant management personnel, computing assistance through its Environmental Computing Facility, and outreach support through its outreach support teams. Proposal development, external funding opportunities searches, and editorial assistance are available to Institute faculty as well.

Student Education and Training. Through its projects, data resources, and collaborative linkages, the Institute supports students interested in earth science and environmental research. Students gain valuable experience working as research assistants on Institute projects; often the research performed for a funded project stimulates a student's interest in the area under study, resulting in a thesis or dissertation project, and in co-authored publications. Through their work on Institute projects, students also have opportunities to "network", or make professional contacts that guide them as they make career decisions and look for employment. The Institute contributes to the College's broader educational mission by sponsoring speakers, seminar series, and other events in cooperation with other University units.

Institute faculty work actively to communicate research findings to both academic and practitioner audiences. This is accomplished via publications, presentations, and web sites that are often designed and executed after consultation with the Institute's outreach support groups.

Staff members can assist faculty and students in developing new and innovative approaches to the creation and dissemination of environmental information resources, and facilitate their delivery to individuals, communities, and organizations within the Commonwealth, the nation, and the world; and provide graphic and cartographic design, WWW design, GIS, remote sensing, and data resources services. Future outreach and dissemination activities include publiccation of working paper and research report series; and the inclusion of press releases and special features on research currently being conducted at the Institute, on the Institute's web site.

Innovative, Interdisciplinary Research and Education Programs. The Institute endeavors to develop initiatives or centers that focus on compelling scientific, social, and engineering issues and problems that require the expertise of more than a single researcher or even a single department. The expertise and strengths of academic departments in the College of Earth and Mineral Sciences often provide the foundation for these interdisciplinary initiatives and centers. The resources of the Earth and Environmental Systems Institute are designed to create added opportunities for faculty and students and to act as a catalyst for innovative, collaborative research. In short, EESI is an integrator for the College of EMS. It represents the locus where cross-disciplinary and interdisciplinary efforts in environmental sciences are conceived and nurtured.

Faculty research projects have been or are currently supported by federal agencies, including the National Aeronautics and Space Administration, National Science Foundation, Environmental Protection Agency, U.S. Department of Agriculture, and U.S. Department of Energy; state agencies, including the Pennsylvania Department of Environmental Protection, Pennsylvania Department of Military and Veterans Affairs, and Center for Rural Pennsylvania; professional organizations, such as the Petroleum Research Fund/American Chemical Society and Soil Science Society of America; and foundations, such as the Gates Foundation, Ford Foundation, and Comer Science and Educational Foundations.

Computing. The EESI Environmental Computing Facility (ECF) provides general computing support with an emphasis on the support of High Performance Computing (HPC), and in particular support for numerical modeling

and large volume mass storage. The ECF has a small professional staff housed on a floor of the Earth-Engineering Science building that includes a 1200 square foot raised-floor modern computing room. The computing room is served with a 100 kVA UPS. The ECF staff directly supports dozens of Sun workstations and servers spread throughout EMS. The ECF also serves as college resource by providing consulting to staff in other college departments. HPC is supported with a Cray SV1-1/16-4 (16 CPUs, 4GB memory). Mass storage support is provided with a Storagetek Powderhorn tape robot with 4 9840 tape drives. The Powderhorn can hold 6000 cartridges. Current uncompressed capacity of the 9840 cartridges is 20GB, soon to double. The facility is connected to the commodity Internet and Internet2 via ATM and Gigabit Ethernet.

Historical Trends

The success of EESI in obtaining external research support is demonstrated in Appendix 1. The Institute has ranked in the top four entities within the College in research awards. In 2004/ 2005, we have already surpassed the funding level for the entire 2003/2004 year.

Vision Area 1. Ecology and Biogeochemistry of a Changing World

Human impacts on ecosystems and their underlying biogeochemical systems are profound and global. Perturbations to the environment result in the alteration of the energy, water and material fluxes within a landscape and its associated ecosystem. Such responses can shift ecosystem services, with a loss of resources for human use, impact pathogen distributions and human health, and alter the global-scale distribution of biogeochemically reactive elements. Although global in scale, the impacts of these changes are not uniformly distributed. In particular, the high latitudes and high altitude regions are highly sensitive to global climate change, as demonstrated by the unprecedented retreat of alpine glaciers, the tundra/taigra boundary and polar sea ice. Ecological and biogeochemical consequences of these changes are difficult to study and call for multifactoral, long-term experiments with integrated physical, geochemical and ecological modeling efforts. Building on our strengths in polar and climate research, the EESI is well poised to promote the investigation of the ecological consequences and biogeo-chemical significance of global-warming induced changes over a range of ecosystems, and especially in high latitude or altitude regions.

One example of a biogeochemical system impacted by global change is carbon storage in soils. The storage of carbon in soil systems is profoundly impacted by shifts in climate and land use through changes in terrestrial biological productivity, hydrological patterns and community structure. Likewise, the efficiency of biological carbon oxidation and cycling in soils, will follow changes in carbon substrate inputs, and is also impacted by shifts in temperature, water and nutrient supply. This problem demands integration of molecular-scale studies of mechanisms of carbon fates and transformations with studies of ecologic and environmental change on regional to global scales. With strength in climate, weathering processes, wetlands, organic geochemistry and microbial biogeo-chemistry and linkages to soil science research on campus, the EESI can promote novel, integrated approaches to carbon cycling in continental settings. Interdisciplinary research into carbon dynamics on the scale of 10 to 25 researchers (i.e., in the range of $1 to $3 million/year for 3 to 5 years) is necessary to move forward in understanding of carbon cycling. Scientists with expertise in nearly all aspects of the problem are already at Penn State, and EESI can play a central role in fostering the dialogue on carbon cycling across the college and the university.

The Center for Advanced Carbon Cycle Research and Education (ACRE), fostered by EESI, has assembled a team consisting of researchers in energy, soils, forests, fresh and salt water, meteorology, and social science among other disciplines. The acknowledged human impact on climate now needs to play a role in the economic planning of government and industry at the highest levels. Synthesis of research from physical, biological and social sciences into formats under-standable by policy makers and stakeholders will be critical in helping to generate intelligent management of the carbon budget. A large-scale, long-term collaboration among researchers from all involved disciplines will facilitate this knowledge transfer, and EESI can be catalyst of connecting scientists with government and industry leaders.

Specific Recommendations:

1) EESI should continue and strengthen efforts to promote interdisciplinary carbon research in soils and ecosystems within continental settings. EESI will work to support large research team proposals, facilitate communication between researchers on campus and by working to ensure faculty researchers are able to respond to opportunities for funding as they arise.

2) EESI should also pursue faculty hires in soil carbon and global ecology, perhaps with a focus upon high latitude environments, in order to promote linkages with long-term ecologic observational efforts and platforms such as NEON and ITEX (International Tundra Experiment) and to strengthen computational efforts linking GCM, ecosystem/biome and carbon cycle models.

Vision Area 2. Atmospheric aerosols

One area of research where PSU researchers are prepared to form a large collaborative group and where ample funding should be available for the foreseeable future is the topic of atmospheric aerosols. There is a huge national interest in this area because it impacts human health and economic success. Penn State currently employs researchers working on atmospheric aerosols from their generation (Energy Institute), atmospheric transport (EESI), and deposition (Agriculture and Forest Hydrology). Assembling a team of physical scientists on this topic will allow us to form stronger bonds with the medical community studying the human health impacts of atmospheric particulate matter (Hershey Medical School).

Specific Recommendations:

1) Short term activities should include sponsorship of proposal retreats wherein all interested parties could discuss research topics, methods, and management strategies with the goal of generating draft proposals to take advantage of any funding opportunities that arise.

2) A longer term mechanism for achieving success in large collaborative projects involves expanding the number of staff positions that facilitate contacts among faculty and researchers. Hiring a professional to keep up with changes and ensure that new contacts are formed would significantly enhance our ability to identify and capitalize on new research opportunities in a timely manner.

Vision Area 3. Environmental observation science

At the core of our ability to understand complex environmental systems and prescribe solutions to emerging problems is the need to develop interdisciplinary approaches to observing, archiving, and synthesizing information on the physical, chemical, and biological realms. At both the international and national-scales we see a number of emerging initiatives focused on the development of coordinated environmental observation systems. A non-exhaustive list of examples includes GCOS (the Global Climate Observing System), GEON (Cyberinfrastructure for the Geosciences), NEON (National Ecological Observatory Network), Earth-Scope (a network focused on seismic and volcanic hazards assessment), CUASHI (Consortium of Universities for the Advancement of Hydrologic Science); and the WSSC (Weathering System Science Consortium).

State and regional-scale initiatives are also being developed to support a variety of environmental observations, networks, and synthesis activities. EPA's National Assessment has led to the development of regional consortia focused on synthesizing a wide range of environmental observations related to the human impacts of global change. Consortia are currently active in the Mid-Atlantic (CARA-Consortium for Atlantic Regional Assessment) and the Great Lakes. At the state-level, no less than two dozen states are currently in the process of planning or installing environmental observation networks (mesonets) for the purpose of collecting near-real time data on environmental variables like temperature, pressure, precipitation, etc. These initiatives, whether at the global, regional, or local scales are facilitated by rapidly developing sensor and network technology, advancing computing and data mining capabilities, and a recognition by funding agencies that integrative, interdisciplinary science requires cohesive, coordinated observation networks.

EESI is well-poised to make strong contributions to developing Penn State initiatives involving environmental observation networks and the subsequent informatics support required to optimize this information for both research purposes and applied decision support environments. Cases in point include EESI's involvement in the current development of the PA Mesonet, the EPA-sponsored Consortium for Atlantic Regional Assessment (CARA), the CUAHSI-related initiative Susquehanna River Basin Hydrologic Observatory (SRBHOS), and potential involvement in the NEON-sponsored Mid-Atlantic Regional Observatory (MAREO).

In addition to in-house expertise in relevant technologies, there is a developing expertise at Penn State in the areas of sensor technology and network design and the application of these technologies to environmental science problems. This expertise is found in numerous academic and research institutes across the campus including the Colleges of Agricultural Sciences, Science, Earth and Mineral Sciences, Engineering and the School of Information Sciences and Technology.

Specific Recommendations:

1) Using some of the staffing suggestions highlighted under Vision Area 1 above, develop a deliberate, focused effort to put teams of Penn State faculty together that would pursue long-term funding in the area of environmental observation science. Necessarily, these efforts would probably be focused around specific issues

like sustainability, human health and the environment, food security, etc.

2) Facilitate the development of an interdisciplinary seminar series that would focus on issues related to environmental observation including sensor and network technology, data mining and analysis, and interdisciplinary applications of data from environmental observation networks.

3) Facilitate the development of a series of graduate-level special topics courses devoted to the inherent problems of making environmental observations with emerging sensor and network technology. These courses could be led by faculty from both the technology development side and the applied side (we have both of these a Penn State) and would give our graduate students some real insight into the application of these technologies.

4) Promote new outreach efforts to develop environmental decision support tools for policy makers at local, state, and Federal levels.

5) Promote the Weathering System Science consortium and the Susquehanna River Basin Hydrologic Observatory through EESI activities.

Vision Area 4. Paleoclimatology

Over the past two decades, paleoclimate modeling in the Earth Systems Science Center (ESSC) at Penn State achieved widespread recognition under the leadership of Eric Barron. We propose to continue and build on these efforts within EESI, moving towards an interdisciplinary Earth System approach to paleoclimate. The expertise of Geosciences and Meteorology faculty in geochemistry, geology, ice science and climatology, combined with climate modeling capability in EESI, form the ingredients for a world-class center of paleoclimate modeling.

Some examples of specific activities of an ESSC are listed below, intended not as a definitive list but to illustrate the scope and potential of the center.

- Participation in new national and international opportunities directed at paleo-Earth Systems, such as the new NSF Geosystems (geosystems.ou.edu) and the World Universities Network (www.wun.ac.uk) Arctic Climates and Environments initiatives.
- Collaboration using the new GENIE Earth Model of Intermediate Complexity, under development in the UK (www.genie.ac.uk). The model is a natural hub for paleoclimate modeling, with core climatic components able to perform million year integrations, and with a modular design allowing other components to be interchanged.
- Ice-sheet modeling and observations, combining detailed present-day observations of Antarctic and Greenland ice processes and current state, with coupled ice and climate simulations of their long-term past and future evolution.
- Development of new atmospheric radiative model components, to enable climate models to realistically predict conditions for atmospheres with very high carbon dioxide and methane amounts in the Archean and Proterozoic.
- Development of new educational tools aimed at university education within EMS and nationally, by building user-friendly fast-running PC versions of our climate models, interactive CD sessions and web sites, and other classroom tools.

Specific Recommendations:

*1) We propose to form a center under EESI, called the Earth System Science Center to benefit from the still widespread name-recognition of the original ESSC. Much of the infrastructure for the center is already in place. A funding level of several ongoing mid-sized grants is anticipated, targeted mainly at NSF (Paleoclimate/ESH, Geology & Paleontology, OPP/Arctic and Antarctic). These will partially support a small number of research scientists in EESI, students, computer maintenance, and collaborative projects with fac*ulty *as outlined below.*

2) Whether under a new center or not, the broad scope and interconnections of the proposed EMS-EESI collaborations will require a faculty-level leader to establish scientific foci and direct funding efforts. This leader might consist of the new faculty member already targeted by EESI and Meteorology if this person comes to PSU. Alternately, a new faculty hire in Geosciences, for an established paleoclimate scientist with broad interests and leadership qualities, could be sought to fill this role.

3) A significant computing capability must be developed and maintained to support these efforts.

Vision Area 5. Human-Environment Interactions

Environmental problems involve the interactions of people with their chemical, physical, and biological environment. Through the Center for Integrated Regional Assessment (CIRA), EESI has been a leader in this area of research. CIRA originated in 1996 as an inter-college and inter-university community. Its purpose was to promote and facilitate scholarship, interdisciplinary research, and education in the human dimensions of global environmental change at the local to regional levels. The primary themes of CIRA have included:

- Human dimensions of climate change, land-use change, and the carbon cycle
- Impact of and vulnerability to global change
- Perceptions of and behavior towards global change
- Stakeholder interaction and out-reach

Despite its success, CIRA has focused narrowly on the study of the human dimensions of global change. Recently, there has been explosive growth in the broader field of coupled human-environment systems. Major initiatives in sustainability science and in complex environmental systems have soared to the top of local, regional, national, and international science agendas. Furthermore, Penn State has developed a wide array of scientists investigating various aspects of human-environment interactions, but most would not see their work falling under the banner of global change.

Thus, CIRA is in the process of expanding its purpose to encompass a more extensive view of human-environment interactions and a larger community of Penn State scientists. In addition to its original purpose, the expanding CIRA aims to welcome all Penn Staters with human-environment interests, to facilitate interaction and collaboration among these scholars, and to disseminate information on research and educational opportunities in human-environment studies.

Specific Recommendations:

1) Develop an explicit human-environment component to the research proposed in Vision Areas 1, 2, 3, and 4. Focus on partnering social and biophysical scientists in funded research and on including social science students in this research.

2) Develop an ongoing Community Energy Project that presents an interdisciplinary service-learning program to EMS and other majors. Procure base funding to run this program.

3) Develop permanent base funding from institutes across campus with significant human-environment interests.

4) Develop and expand the human-environment curriculum. In EMS, develop human-environment options in Earth Sciences and Geography. Across campus, work closely with the Environmental Inquiries Minor to build this curriculum.

Vision Area 6. Interactions with the Energy and e-Education Institutes

In the broad area of energy/ environment, PSU stands as a leader through leadership of both the Energy Institute and EESI. Similarly, the e-Education Institute leads educational initiatives on campus. However, little to no formal interaction occurs between the two Institutes. In initiating strategic planning, we see an immediate mutual interest in fostering diversity among students and faculty within the environmental and energy disciplines at PSU. To identify other target opportunities of mutual interest will require a longer planning activity.

Specific Recommendations:

1) To promote interactions among the institutes, we propose an ad hoc committee with personnel from institutes to identify areas of mutual interest, governance, and opportunities. The charge to the committee will consist of identifying areas of mutual interest that should be targeted by the Institutes for multi-disciplinary proposals.

2) The EESI and Energy Institute, in collaboration with the College of Agricultural Science, College of Engineering, and the Eberly College of Science, should initiate a Penn State-University of Puerto Rico program in environmental and materials sciences. To start this program, we should send a variety of professors from the University Park campus to Puerto Rico to give seminars as a stepping stone toward building a PSU-UPR program. EESI should promote this by facilitating discussions among appropriate faculty to brainstorm how to make such a program a success, including hosting UPR faculty at Penn State. EESI and the Energy Institute should fund these visits to foster the program. In addition, the possibility of jointly developing a course or curriculum will be explored. A potential topic could be sustainable energy from sub-tropical biomass.

3) EESI and the e-Education Institute should develop a state-of-the-art video conferencing facility.

Vision Area 7. High Performance Computing and Data Storage

The Earth & Environmental Systems Institute is undergoing a transitional period that presents opportunities to expand the number of participating individuals and funding sources. To build upon current EESI strengths, we plan to focus on building computational resources that can service the climate modeling, remote sensing, and computational environmental chemistry communities. The strategy is to begin a positive feedback loop where investment in cyber-infrastructure will allow EESI to compete effectively for funding and increased funding will allow for maintenance and growth of the cyber-infrastructure. Increasing the capacity for handling large datasets and obtaining a new shared memory high-performance computer are the two main items necessary for building the necessary cyber-infrastructure. Human resources are also necessary to maintain the software, communications, and databases essential to effective utilization of the cyber-infrastructure will also be required. The goals of HPC in EESI will include expanding the role of the Environmental Computational Facility (ECF) of EESI as a nationally recognized and utilized center for high-performance computing in environmental sciences; obtaining a single architecture capable of running climate modeling and computational chemistry codes; upgrading of tapes used for the Hierarchical Storage Manager (HSM) and fund maintenance of this facility by marketing ECF large dataset capacity internally within PSU and externally in the scientific community; funding technical personnel and research associates to maintain hardware and software associated with ECF as well as increase the user community via training.

Specific Recommendations:

1) Upgrade current Cray SV-1 and IBM SP computers with high-performance clusters. This is being accomplished through the NSF Environmental Molecular Science Institute program that funded the Center for Environmental Kinetics Analysis (CEKA).

2) Purchase a stand-alone Tivoli Storage Manager server, two additional T9940A tape drives, and increased data density tapes for the ECF HSM.

3) Submit a Major Research Instrumentation grant to NSF to create a Center for Computational Geochemistry involving faculty at outside institutions to expand the server into a super-cluster.

4) Work with NSF, NIST, and EPA to create web-accessible, standardized databases in environmental sciences.

5) Interact with the Institute for Computational Science (ICS) at PSU to facilitate collaboration across cam-pus on issues of high-performance scientific computing.

Vision Area 8. Research Proposal Support

EESI proposes to help EMS investigators by providing infrastructure and personnel support for the generation of interdisciplinary, and multi-investigator proposals for external support. EESI can provide access to grant-writing specialists, education and outreach specialists, and technical support personnel. EESI could help coordinate and sponsor proposal working retreats wherein all interested parties could discuss research topics, methods, and management strategies with the goal of generating common ground and draft proposals to take advantage of any funding opportunities that arise. With advertisement, logistics, and minimal monetary support from EESI, the difficult and time-consuming groundwork for forming the foundation of these large collaborations could be completed. Often opportunities arise, such as the EPA call for Particulate Matter Centers, but the individual researchers do not have time to organize and respond. Preparation in anticipation of funding opportunities would alleviate much of the stress in meeting deadlines for documents that involve larger groups. EESI could make sure that simple tasks, such as compiling curriculum vitae, current and pending funding, and facilities documents are done in advance. More complex tasks, such as defining themes and connections among researchers would be supported in advance through the retreat format so that much less time would be required to complete a given proposal.

Specific recommendations:

1) Maintain active records of each large proposal, both successful and unsuccessful, including the participants, the proposal drafts, and its reviews.

2) After rejection, call a team meeting to collectively assess the reviews and the potential for success in future requests for proposals. If the team feels there is a future, then take more steps.

3) Keep the idea simmering on the backburner by holding periodic team meetings in which previous actions are discussed and future actions are determined and assigned. This includes enlisting team members to fill voids that were pointed out in the reviews, do any simple calculations that could bolster the case, and prepare responses for reviews that were wrong.

4) Anticipate deadlines by calling meetings well ahead of time.

Budget Remarks.

To accomplish these goals, EESI will need additional resources and support.

The two main financial needs are funding for the grant facilitator (possibly partnered with the Energy Institute) and for new faculty hires (in areas of Life Science/EMS interface or paleo-climatology). We estimate additional funding on the order of $100 k/year would be needed to accomplish these hiring priorities.

Appendix 1:

List of EESI Strategic Planning Team

1 - Doug Miller
2 - Brent Yarnall
3 - Mercedes Maroto Valer
4 - Dave Pollard
5 - Kate Freeman
6 - Jim Kubicki
7 - Bill Brune

Appendix 2: Extramural Awards

Fiscal Year	EMS: Award Amt	EMS: # of Awards	EESI Awards: Award Amount	EESI Awards: % of EMS Awards ($)	EESI Awards: # of Awards	College Ranking
2003/2004	$31.8M	427	$2.2M	7%	26	5th
2002/2003	$35.3M	422	$4.7M	13%	31	4th
2001/2002	$33.7M	427	$1.8M	5%	32	6th
2000/2001	$33.5M	424	$2.3M	7%	31	5th
1999/2000	$27.5M	340	$4.9M	18%	32	3rd
1998/1999	$17.3M	304	$2.7M	16%	30	4th

Funding for 2004/2005 to date exceeds $2.4M