

Collaborative ECSU — UNH Proposals and Projects

<i>Title</i>	<i>Agency</i>	<i>Status</i>
Priming the Pipeline	NOAA	Not Funded
Emergency Preparedness and Response	Homeland Security	Not Funded
Watershed Watch	NSF	Funded
Inspiring the Next Generation of Earth Explorers	NASA	Funded
Northeast Alliance	NSF	Funded
National Center for Hydrological Synthesis	NSF	Not Funded
Mentoring Undergraduate Students	NSF	Not Funded
Transforming Earth Systems Science Education	NSF	Funded
PIRE: Developing a Manufacturing Bridge for the Nano- and Micro- Worlds	NSF	Pending

Priming the Pipeline: Developing an Inquiry-Based Coastal Ecosystem Undergraduate Education Strategy

Leading Organization: University of New Hampshire; UNH
Contact: Karen Graham (karen.graham@unh.edu) Team
Members: Janet Campbell; Ru Morrison

Collaborating University: Elizabeth City State University ECSU
Contact: Linda Hayden (lhayden@umfort.cs.ecsu.edu) Team
Members: Malcolm LeCompte, Kathleen Fisher

Funding Source: NOAA Office of Education and Sustainable Development – Environmental Literacy Grant Program

Period: November 2005 – October 2008

Requested Amount: \$499,974

Status: Not Selected for Funding

Project Summary

NOAA's vision for education is “*an environmentally literate public and a diverse workforce who will use NOAA's products and services to make informed decision that enable responsible action*”. Our proposed environmental literacy project addresses this vision by developing, testing, evaluating, and disseminating an educational model that will promote a diverse, environmentally literate workforce. Our plan is to work with NOAA's Coastal Services Center (CSC) to assess and modify their existing geospatial training courses designed for coastal resource managers so that the content can be infused into inquiry-based coastal ecosystem undergraduate science classes at colleges and universities, including several Historically Black Colleges and Universities and Minority Serving Institutions (HBCUs/MSIs). We also propose to address the NOAA pipeline issue by training students enrolled in these courses to apply for internships with coastal resource managers (*funded by this proposal*), to apply for NOAA's Hollings Undergraduate Scholarship Program, and to apply for other NOAA educational opportunities.

The main objectives of our project are:

- develop, evaluate, and disseminate an inquiry-based coastal ecosystem course focusing on the use of geospatial technologies for undergraduate students that engages science undergraduates at majority and minority institutions so they have the skills, the interest, and the knowledge to serve as future coastal resource managers;
- increase the number of qualified and well trained under-represented minorities applying for and winning NOAA internships, scholarships, and jobs;
- raise the environmental literacy of all participants (i.e., students, faculty, coastal resource managers, and stakeholders) regarding coastal ecosystems and the application of geospatial tools to inform decisions.

These objectives will be met via a number of related tasks including curriculum development, piloting and evaluating the inquiry-based coastal ecosystem course, training faculty during summer workshops to teach the course, and having students present the results of their coastal ecosystem research projects at annual student research conferences.

New England Academic Center for Emergency Preparedness and Response

Leading Organization: University of New Hampshire;

UNH Contact: Richard Messner (Rich.Messner@unh.edu)

Collaborating Universities: Yale University, Dartmouth College, University of Connecticut, Capital Community College, University of Vermont, Massachusetts Institute of Technology, and Elizabeth City State University

Funding Source: Department of Homeland Security

Period: October 2005 – September 2008

Requested Amount: \$25,000,000

Status: Not Selected for Funding

Project Summary

The New England Academic Center for Emergency Preparedness and Response (NEACEPR) proposes a three-year, multi-faceted, multi-disciplinary research and education program. This Center will focus on policy analysis and development; technologies for the acquisition, analysis, and dissemination of time critical information; field testing and evaluation of technical enhancements for emergency operations; and application of research-based principles of adult learning to identify and develop, directly with emergency responders, the knowledge and cognitive skills (thinking, reasoning, and decision-making) that emergency personnel need to effectively prepare for, respond to, and recover from catastrophic events. All Center activities will be accomplished by engaging and working directly with emergency responders.

This Center includes academic institutions throughout the New England region, including the University of New Hampshire, Yale University, Dartmouth College, University of Connecticut, University of Vermont, Capital Community College of Hartford, CT, and the Massachusetts Institute of Technology. The Elizabeth City State University in Elizabeth City, NC has also partnered with the Center to provide additional expertise for Center activities.

The composition and location of the proposing team offers several key advantages. The institutions are among the nation's top academic organizations, providing excellence in education and research in areas of direct relevance to homeland security and high consequence event preparedness, response, and recovery. All team members have in-depth experience working with policy makers and emergency responders at the local, state and federal levels. In addition, several Center institutions already have performed extensive Research and Development and provide practical, mission ready products to local fire, police, EMS and hospital services, as well as to the federal emergency preparedness and response community. The close working relationships that already exist, combined with the close proximity and number of team members, will enhance coordination of cross-institution activities and facilitate team interaction, thus maximizing research productivity. The New England region is geographically diverse and ideally suited for performing various scenario-driven emergency response exercises representing a wide variety of high-consequence event types, locations and magnitudes.

Excellence in Research Focused on Emergency Response- The proposing team has extensive interdisciplinary experience in the fields of electrical and computer engineering, emergency and disaster medicine, computer science, social sciences, education, and public policy with a robust track

record of prior research and development, both individually and cooperatively, in numerous areas directly supporting event preparedness and response. Specific areas of research include:

Preparedness:

- Inter-jurisdictional emergency response doctrine development
- Autonomous and semi-autonomous systems for detection of infectious agents, including intentionally released pathogens
- Replacement of lecture-based training modules with practical, hands-on methods for training and skills maintenance in the fire-rescue, law enforcement and emergency medical communities
- Use of adult learning methodologies to enhance situational awareness and to prepare the civilian population to provide self and neighbor aid under large scale emergency circumstances
- Use of simulation-based exercises to fine-tune and rehearse inter-jurisdictional emergency operations requiring local, state and federal responses

Response:

- Use of open standards to integrate systems developed for mobile based, hands-and-eyes free device control and information management for law enforcement into an interoperable incident management network
- Integration of a national public safety management system that will help police and fire personnel know whether the incident site contain hazardous materials
- Development and use of real-time telemedicine, telematics, and telementoring systems
- Development of remote physiological monitoring devices for fire rescue and HAZMAT personnel
- Distributed, wireless sensor networks for environmental monitoring

Recovery:

- Key dimensions of how adults learn best as the basis of an educational plan for enhancing the preparedness, effectiveness, and proficiency of emergency personnel responding to a disaster; and
- Remote sensor data collection, analysis, and dissemination to support post event activity.

Innovative Research Plan — Our nation's current emergency preparedness and response system is an amalgamation of varied organizational and cultural paradigms. The emergence of the National Incident Management System (NIMS) and the National Response Plan (NRP) will influence these paradigms and play an integral role in the ability of our nation to prevent and respond to high consequence events. Under the proposed effort we will explore and measure the effectiveness of current and future preparedness and response policies; provide recommendations for activities, technologies, and educational strategies to address identified issues; and integrate fundamental policy concepts, such as the Incident Command System (ICS) into the technical aspects of our research.

Building on our prior emergency response technology research and collaborations, we will construct a human-technology test bed (HTT) to explore various tactical and operational approaches to high consequence event preparation, response, and recovery. The HTT will include both simulated and live exercise environments. The physical test bed will comprise sensors, algorithms, applications, and various wireless networks, with the hardware and software required to demonstrate coordinated, real time collection and dissemination of information gathered during live exercises by police, fire, other emergency responders, and deployed multi-sensor systems. Critical components of the simulation test bed will be synthetic environments, virtual multi-player, multi-site scenarios and virtual prototyping of

new devices and systems. These can be used to model the effects of altering tactics, gauge the feasibility of integrating human and instrumental inputs, as well as both develop and measure the proficiency of responders in using the technological enhancements effectively.

Through small to large-scale exercises the Center's HTT capability will facilitate analysis of issues at the human-technology interface. Promising technologies can be integrated into exercises and evaluated using direct feedback from the emergency response personnel, prior to, and following such exercises. In such scenarios, multi-jurisdictional cooperation, hardware and software interoperability, information acquisition and dissemination procedures, data security and prioritization, decision support and visualization can be evaluated and analyzed for effectiveness. Because the effectiveness of policy, procedures and technology depends on how they well they are correlated and implemented. To maximize these emergency personnel will be an integral part of the development process. Their subsequent engagement in the scenarios will be used to validate the ways, and extent, to which principles of adult learning are effective in developing coordinated, proficient responses.

Building the test bed through the extensive cooperative partnerships we have established in the emergency response community in New England, we will conduct scenario-driven interoperability testing. Reliability, utility, and ergonomic functionality will be assessed through academically rigorous evaluation in the operational environment. The reasoning and decision making protocols responders employ when using the technology effectively—as well as the processes to enhance the learning of these protocols—will also be identified. Our consortium will also serve as a “clearinghouse” for testing the interplay between responders and novel technologies in high consequence events, and technology-enhanced local response entities with upper tier agencies from state and federal government. Employing an iterative cycle of analysis, experience-based learning, and testing, in both physical and synthetic environments, the Center will serve as a critical national resource for high consequence event preparation and response.

Effective Management Structure — Principal Investigators Dr. Richard Messner and Dr. Sandy Bogucki will provide oversight of Center-based technical and administrative activities. Dr. Messner will serve as Center Director and will track the accomplishment of deliverables in cooperation with the institution leads. Dr. Bogucki will coordinate the joint project in technology-enhanced ICS that comprises the focal, collaborative effort of the Center. Institution leads will be responsible for managing the activities within their respective organizations, reporting directly to Dr. Messner. The Center has established web-based information sharing and teleconferencing mechanisms that will be used for day-to-day coordination. The Center will also convene monthly meetings of principals and technical personnel, as well as quarterly technical workshops and annual reviews. The close proximity of the participating institutions and our prior history of collaboration will facilitate cost-effective, coordinated research progress and joint Center management.

Education as an Integrated Center Goal — Continuous learning that is focused on the developing the thinking, reasoning, and decision-making skills individuals require to respond skillfully and proficiently provides the base for emergency teams to develop and maintain the highest level of preparedness. Since research indicates that many approaches designed to support continuous learning (including traditional classroom settings) are limited or ineffective, the educational plan at the heart of this proposal will not devote extensive resources to traditional classroom-based “training” events. Instead, the educational plan will be guided by principles of adult learning. Activities conducted by NEACEPR will be guided by a framework where “learning” and “doing” will not be separated. For example, as emergency personnel learn about technologies to improve their capacity to respond, they will use the technologies in simulated disaster situations. As they use the technologies, each use will be crafted as a learning activity. The goal of all activities will be to develop responders' proficiency, their ability to use information, skills, and technologies skillfully when taking action to catastrophic events.

The educational plan for preparing responders will also be used when working with researchers and scholars at all levels. We propose to establish an inquiry-based learning process in all aspects of Center-based activities at each participating institution and to use this process to support exchanges with visiting and invited researchers, scholars, and the practitioners who will collaborate in the Center's work. To maximize the effectiveness of the educational mission and to ensure the widest possible dissemination of research findings and lessons learned, the University of Connecticut's School of Education will take the lead in defining and facilitating the Center's educational efforts.

Collaboration with Existing Centers and Information Dissemination — As a national resource, the Center must be cognizant of the need to be a “consumer” of appropriate knowledge from other DHS Centers of excellence, as well as be a “provider” of knowledge to those Centers. To facilitate the shared knowledge of all the DHS Centers, each Center will have a seat on The NEACEPR advisory board. In addition, the establishment of a seminar series and the possibility of sharing scholars among the various Centers will be pursued with each of the other four established DHS Centers of excellence.

Watershed Watch: Monitoring the Merrimack and Pasquotank drainage basins as a STEM Undergraduate Recruitment and Retention Tool

Leading Organization: University of New Hampshire
UNH Contact: Karen Graham (karen.graham@unh.edu)
Team Members: Barry Rock, Elise Sullivan, Allan Tucker,
Yeping Le, Eleanor Abrams, Steve Hale
Collaborating University: Elizabeth City State University
ECSU Contact: Linda Hayden (lhayden@umfort.cs.ecsu.edu)
Team Members: Kathleen Fischer, William Porter
Funding Source: NSF STEP
Period: September 2005 – August 2010
Requested Amount: \$1,000,000
Status: Funded

Project Summary

The University of New Hampshire (UNH) and Elizabeth City State University (ECSU), in collaboration with regional two-year colleges, propose to develop a Type 1 proposal, *Watershed Watch*, as a model for recruiting and retaining STEM majors at both campuses. *Watershed Watch* will be an exciting, inquiry-based undergraduate research experience that builds on “established best practices” to create supportive learning environments for *all students*. It will focus on two local watersheds, the Merrimack River watershed in NH/MA, and the Pasquotank River watershed in NC/VA.

The overall goal of *Watershed Watch* is to increase STEM recruitment rates at UNH and ECSU, particularly among under-represented groups, by involving them at an early academic stage in exciting, hands-on authentic, research focused on scientific problems of societal relevance. Entry-level undergraduates, recruited from undeclared four-year degree students at UNH and ECSU, as well as two year degree students from local community and technical colleges, will be introduced to STEM disciplines via hands-on use of geospatial technologies (GST) in an integrated, multidisciplinary study of terrestrial, aquatic, and social components of each watershed. *Watershed Watch* will incorporate: 1) the lessons learned from previous inquiry-based outreach projects at UNH; 2) the expertise gained at ECSU from working with entry-level, minority, undergraduates at the *Center of Excellence in Remote Sensing and Research* (CERSER); 3) the research expertise in GST (remote sensing, GIS, and GPS) at both UNH and ECSU; 4) an exceptional and diverse faculty selected on the basis of their commitment to innovative teaching methods, integration of scientific disciplines, and an embracement of diversity; and 5) the expertise in curriculum development and assessment of the UNH *Joan and James Leitzel Center for Mathematics, Science, and Engineering Education*. The program will consist of three key components: 1) an intensive, field-oriented and technology-rich Summer Research Institute held between freshman and sophomore years, led and mentored by STEM faculty from both UNH and ECSU; 2) as part of a weekly academic year Seminar, student research teams will design and implement either an authentic watershed research project or educational outreach project; and 3) an effective Faculty Development Workshop that will focus both on mentoring students (particularly those in under-represented groups), and on developing appropriate research and education/outreach projects.

The **intellectual merit** of this proposal includes the development and testing of a model for recruitment and retention of STEM undergraduates, faculty development on mentoring under-represented groups and developing inquiry-based research intensive curricula, and contributing to current scientific questions in STEM fields.

Broader Impacts: The *Watershed Watch* project will recruit from untapped populations and support their entry into the STEM disciplines. We will attract and retain these students by intentionally building equitable learning environments designed to meet their unique needs. A deliberate and aggressive dissemination strategy will ensure broader impacts on a national scale. By encouraging these students to major in STEM disciplines, society will benefit through 1) a larger STEM workforce that is more diverse; 2) students with experience in collaborative, multidisciplinary studies; and 3) students who are more aware of the interrelationships between physical, biological, and social sciences in determining the extent and impact of human actions, both direct (land use change) and indirect (climate change). In addition, *Watershed Watch* students will produce research and outreach products of relevance to other students, as well as to the general public. A dissemination strategy will utilize an interactive Website, faculty workshops and presentations at national meetings (AGU, ESA, etc.), and the NASA MUSPIN and Space Grant networks for distribution of piloted *Watershed Watch* educational materials.

Inspiring the Next Generation of Earth Explorers through Remote Sensing Studies: Remote Sensing Explorers

Leading Organization: Elizabeth City State University
ECSU Contact: Linda Hayden (lhayden@umfort.cs.ecsu.edu)
Team Members: Malcolm LeCompte, Lloyd Mitchell

Collaborative Organization: University of New Hampshire;
UNH Contact: Karen Graham (karen.graham@unh.edu)
Team Members: George Hurtt, Barry Rock, Cameron Wake

Funding Source: NASA
Award Period: October 2005 – September 2008
Award Amount: \$583,000
Award Status: Funded

Project Summary

This effort responds to the NASA imperative to assist in meeting our nation's technological needs, and specifically respond to NASA's education and workforce development missions. We will work with over 30 historically black colleges and universities (HBCUs) and other minority serving institutions (MIs) to enhance the geoscience curriculum, develop faculty and student knowledge and expertise, evaluate outcomes, and disseminate results. An innovative and mutually beneficial partnership arrangement between Elizabeth City State University (ECSU, an HBCU), the Minority University - Space Interdisciplinary Network (MU-SPIN) Office at Goddard Space Flight Center (GSFC), and the University of New Hampshire (UNH) will serve as the foundation for these activities.

Program activities will target minority students and faculty at Elizabeth City State University and the 54 HBCU/MI institutions within the MU-SPIN Goddard Space Flight Center Consortium. Summer workshops are planned for a selected 45 HBCU/MI faculty to train them to implement one advanced and one research-based Earth System Science course at their institutions during the academic year with support from UNH, ECSU, and GSFC. ECSU will provide models and support on how to mentor minority students within and outside the two-course structure. The faculty also will be supported in their own research and professional development activities related to Earth Systems Science by faculty at UNH and by Goddard employees. Students enrolled in the two courses at the participating HBCU/MIs will be able to apply for new academic year research training activities, pipeline activities, and summer internships under the direct, hands-on direction of faculty who will have been trained in mentoring as part of this program. We anticipate 1800 students to be impacted by the enhanced course curricula and mentoring activities. Outstanding students with special needs will be able to compete for financial support.

This four-pronged approach of curricula enhancement, faculty development, student development, and evaluation/dissemination will insure the impact and sustainability of the activities beyond the period of the NASA grant. Together, this partnership will serve as a "national model" to improve teaching and learning within the STEM disciplines at HBCUs/MIs that explicitly articulates how two demographically diverse institutions in different coastal regions with specific disciplinary strengths can effectively collaborate to educate and inspire the next generation of Earth explorers.

Northeast Alliance for Graduate Education and the Professoriate

Leading Organization: University of Massachusetts

Collaborative Organizations: University of New Hampshire Plus
10 other Northeast Colleges and Universities UNH Contact: Dr.
Karen Graham (karen.graham@unh.edu) UNH Team
Members: Eleanor Abrams, Christopher Bauer, Karen
Carleton, Taylor Eighmy, Howard Mayne, Harry Richards, Lee
Seidel, Cameron Wake

ECSU Contact: Linda Hayden (lhayden@umfort.cs.ecsu.edu)

Funding Source: NSF – Alliance for Graduate Education and the
Professoriate

Award Period: March 2005 – February 2010

Award Amount: \$650K (UNH); \$8 million (Total Grant)

Award Status: Funded

Project Summary

As part of the Northeast Alliance, there are several strategies the University of New Hampshire would like to explore for increasing diversity in our doctoral programs in the areas of recruitment, retention, and careers in the professoriate. These efforts will build upon the successes and lessons learned from the original NSF-AGEP grant to the University of Massachusetts and from our own ongoing efforts.

Recruitment

- Expanding our joint UNH-NASA “Research and Discover Program” summer internship program and/or our McNair Graduate Opportunities Program to include additional minority rising undergraduate seniors in STEM majors. We expect this would dovetail well with the existing “Summer Program for Undergraduate Research” at UMass. Students participating in these summer internships would experience the real world of field and laboratory research and data analysis, developing and giving a professional presentation to peers and mentors, as well as exposure to graduate programs at Northeast Alliance Institutions
- Organizing a fall recruiting weekend at UNH for minority students. Faculty, staff, graduate students and administrators will be involved in organizing and participating in the three day event. Special attention would be paid once again to connecting students and faculty with similar research interests. We expect that a significant percentage of students who participate in the recruiting weekend would apply to UNH for their graduate studies.
- Establishing a UNH Diversity Team (consisting of one faculty member, one graduate student, and a Graduate School representative) to participate in Northeast AGEP Days and Lecture Series at partner institutions and national meetings, as well as visiting minority-serving schools.
- Reviewing UNH procedures and approach to admissions policies to enhance the effectiveness of successfully recruiting minority students. The Graduate School and participating departments will work together with the Northeast Alliance partners to identify minority students who match the strengths of UNH, assign a peer sponsor to follow-up on any questions and concerns a minority applicant may have, and arrange to bring interested students to campus.

Retention

- Assigning faculty advisors, college mentors, and peer mentors to incoming minority students in addition to organizing meetings of the faculty advisors, college mentors, peers mentors and the students three times a year to share experiences, raise common questions and concerns and to network across the disciplines.
- Participating in the Northeast Alliance workshops that train faculty how to mentor minority students and that encourage peer-to-peer communication.
- Developing a consulting relationship with faculty experts on mentoring minority students from one our partner institutions. We are collaborating with faculty from Elizabeth City State University who have had considerable success mentoring minority students.
- Hosting Northeast AGEF Day which would include presentation of Northeast Alliance minority student research as part of the spring UNH Undergraduate Research Conference. This would provide an additional venue for minority graduate students from across New England to present their research and meet with their peers.

Careers in the Professoriate

- Hosting Northeast Alliance doctoral students and faculty mentors to participate in the UNH Summer Institute on College Teaching. The Summer Institute is a key component of the UNH Preparing Future Faculty (PFF) Program which is designed to provide graduate students with the necessary tools to become successful faculty members. This would build upon an already successful relationship with Howard University where students and faculty have enrolled in our Summer Institute on College Teaching. More information is available at: <http://www.gradschool.unh.edu/pff/pffprogram.html>.
- Providing travel support to students to encourage presentation at professional conferences.

Sustainability

- Disseminating the successful mentoring models that arise on campus as a result of our interaction in the Northeast Alliance partnership activities. College mentors would become a resource for departments to help them develop successful models of mentorship that would fit within their departmental contexts.
- Enhancing our PFF program through curriculum development during the period of the grant will make cultural shifts in the way we train future faculty.
- Maintaining our approach to admissions. The Graduate School in conjunction with STEM departments will continue to foster relationships with the Northeast partner institutions as well as others to continue to recruit and support minority students through the application process.
- Enhancing grantmanship. The Northeast Alliance will strengthen our ability to work with other Northeast Alliance institutions and partner institutions. These relationships will result in the production of other grant proposals that would support the partnership beyond the term of the NSF AGEF grant.
- Building the number of Diversity Teams that can travel to professional and research conferences to recruit minority students. The Diversity Team model will be developed in several STEM departments during the period of the grant activities but it is our goal to continue to build upon this model after the NSF AGEF grant.

Increasing Diversity in the Hydrological Sciences as part of the UNH National Center for Hydrological Synthesis (NCHS)

Leading Organization: UNH (Charlie Vorosmarty, PI for entire NCHS proposal)
UNH Contact: Dr. Cameron Wake (cameron.wake@unh.edu)
UNH Team Members: Karen Graham; Julie Williams
Collaborating Organizations: Elizabeth City State University
ECSU Contact: Linda Hayden (lhayden@umfort.cs.ecsu.edu)
Funding Source: NSF via Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI)
Award Amount: \$183,000 (Diversity); \$15 million (Total Requested)
Award Status: Not Selected for Funding (submitted fall 2004)

Project Summary

Vision: The NCHS values diversity and understands that the water sciences will be strengthened by the inclusion of minorities and women, who the U.S. Department of Labor indicates will be a significant majority of people entering the U.S. labor force by the year 2005. The Center will be a platform for initiating transformation in the hydrological sciences by developing programs, engaging new students, faculty and practitioners and writing and presenting scientific papers all designed to have a measurable impact on the numbers and material contribution of underrepresented minorities in the hydrological sciences.

Need: Despite increases over the last decade in the number of undergraduate and graduate degrees awarded to underrepresented minorities (e.g. African Americans, Hispanics, Native Americans & Pacific Islanders) and women in science and engineering (S&E) fields, both groups remain underrepresented in fields of study most closely related to the hydrological sciences (e.g., earth sciences, computer science, civil engineering)(NSF, 2003). The National Science Foundation (2004) states that “*the U.S. continues to suffer from a long-standing under representation of minorities (i.e. African American, Hispanics, American Indians, Alaska Natives, Native Hawaiians or other Pacific Islanders) among science, mathematics and engineering doctorates. This untapped talent has serious consequences for the nation’s ability to compete in a world economy driven by technological advances, as well as for a large segment of the nation’s citizens who suffer loss of opportunity.*” The need to attract more underrepresented minorities into the hydrological sciences is thus supported by the National Science Foundation, through its own efforts to attract and increase opportunities for the inclusion of these individuals within the STEM disciplines.

Goals and Objectives: Our primary goal with respect to diversity is to make a measurable and documented difference in the numbers and material contribution of underrepresented minorities to the hydrological sciences. We plan to accomplish this by infusing our entire effort with diversity. As stated in the introduction, diversity is a core value of the NCHS. Our objectives to meet this goals are listed briefly below. More detail is provided in Appendix XX: 1. Identifying a committee of 7-8 of individuals in the hydrological sciences with knowledge and interest in diversity issues; 2. Establishing a “NCHS Diversity Team” to develop relationships with faculty from Minority Serving Institutions with strength in the hydrological sciences and with majority institutions that graduate large numbers of underrepresented students in the hydrological sciences; 3. By 2006, increasing the representation of under represented minorities on the Scientific Advisory Board and all of the Working Groups; 4. Inviting underrepresented faculty, undergraduate and graduate students to participate and/or lead

NCHS workshops. 5. Including a cohort (approximately 5) of underrepresented minorities in the graduate and undergraduate summer institutes; 6. Establish a clearinghouse to connect talented students with graduate programs that reflect their interests; 7. Holding a major planning workshop in year 5 of the grant to develop a proposal to continue expanding diversity in the hydrological sciences based on lessons learned over the previous 4-5 years. 8. Encouraging all students to enroll in the online Summer Institute on the nationally recognized program, Preparing Future Faculty (www.gradschool.unh.edu/PFF) that provides graduate students with the necessary tools to become successful faculty members.

Mentoring Undergraduate Students in Earth System Science Research Through a University of New Hampshire – NASA Partnership: A Track 1 Project

Leading Organization: University of New Hampshire

UNH Contact: Barry Rock (barry.rock@unh.edu)

Collaborating Organizations: NASA Minority University

Interdisciplinary Space Network (MU-SPIN) and Elizabeth City
State University

Funding Source: NSF Diversity in the Geosciences

Requested Amount: \$85,000

Status: Not Selected for Funding (submitted October 2004)

Project Summary

The University of New Hampshire (UNH) and the NASA Minority University-Space Interdisciplinary Network (MU-SPIN) will partner to develop a Track 1 project to increase participation of underrepresented undergraduate students in geoscience. The main goals are to: 1) provide new geoscience research opportunities for undergraduate students from underrepresented groups; 2) foster educational and research partnerships among UNH, Historically Black Colleges and Universities and Minority Serving Institutions (HBCUs/MSIs); and 3) continue to develop and enhance collaboration among a community of individuals dedicated to improving diversity in the geosciences.

Our main focus is the development of a six-week Summer Research Internship (SRI) that builds on the current UNH Research and Discover model. We will select and support six undergraduates from 54 HBCUs/MSIs from the NASA MU-SPIN programs to work in close collaboration with UNH faculty to address key geoscience research questions. UNH faculty members will also be trained in effective mentoring of minority students by Linda Hayden from Elizabeth City State University, recognized by NSF (2004; Presidential award) as a national expert on mentoring STEM discipline students. The proposed SRI represents one piece of a larger strategic puzzle aimed at promoting diversity and fostering research excellence at the University of New Hampshire.

The intellectual merit of this effort includes: developing and testing of a new model for promoting diversity in the geoscience and engaging minority students and their faculty mentors in authentic geoscience research. Broader impacts include expanding minority student opportunities at the graduate level, training faculty in the best practices for mentoring minority students, and contributing to a 'national model' that illustrates how demographically diverse institutions of higher learning and federal funding agencies can effectively collaborate to improve teaching, learning, and research within specific STEM disciplines.

UNH GEO Tech: Transforming Earth System Science Education

Leading Organizations: University of New Hampshire

Collaborating Organizations: Pennsylvania State University,
Elizabeth City State University, Dillard University

Funding Source: National Science Foundation

Period: November 1, 2006 – April 30, 2010

Requested Amount: \$3 million

Status: Funded (Submitted November 1, 2006)

Project Summary

Intellectual Merit: Excellence in Earth science education is an important national priority because of the critical role of the Earth sciences in energy resource and environmental issues. Earth science teaching in our schools, however, faces several foundational challenges as looks to meet the needs of our future generations. The nature of these challenges demands that we look toward creating an entirely new archetype for preparing our teachers, rather than merely making minor modifications to our existing model. The *UNH GEO-Teach* project will address the need of *highly qualified* teachers in the geosciences by developing a comprehensive plan to transform Earth system science education at the middle and high school levels. Our program, built in collaboration with the Pennsylvania State University (PSU), Elizabeth City State University (ECSU), and Dillard University (DU), includes the bolstering of an existing preparation program for pre-service teachers to include mentoring and networking with in-service teachers an enrichment program that includes a research and curriculum development component. The goals and objectives for *UNH GEO-Teach* designed to support teachers at various levels in their professional careers; the *UNH GEO-Teach* Project will:

- Develop and implement a professional development program for in-service teachers that integrates teacher content knowledge development with authentic research experiences.
- Provide the opportunity for teams of university faculty/graduate students and middle/high school teachers to develop inquiry-based curriculum models that promote an integrated approach to Earth science.
- Provide infrastructure support to assist university faculty with integration of teachers and their students with existing research groups.
- Develop and sustain a model for a teacher preparation program in Earth system science that incorporates integrated, inquiry-based coursework and research experiences.
- Disseminate the professional development model and inquiry-based curriculum modules developed during the project.

To meet these goals and objectives, we will initially coordinate primarily with teachers from a number of school districts we have identified in Northern New England, rural Pennsylvania, coastal North Carolina, and New Orleans. As the program grows, we will build enrichment programs in each of these sites to attract participants nationally.

Broader Impacts: Participating pre- and in-service teachers will improve their knowledge base of Earth Sciences from a systems and process perspective and develop a professional network consisting of teachers and faculty mentors across the country. The project will support the development of inquiry-based classroom activities integrating all aspects of Earth System science. Results of this project will be published widely. In the five-year program, we have requested support for thirty-three one-year graduate fellow awards to support the work of the project during the school year. In order to maintain consistency in the program, we plan to have some continuing fellows who participate for more

than one year in this scientist-in-residence program, but we anticipate that approximately twenty graduate students will participate in this program over the full duration of the award. Support from the GEO-Teach program will contribute toward the GEO-Teach fellow's completion of their graduate degrees and as they move on into their future endeavors, they will enter them with a much richer appreciation of the challenges of teaching science in middle and high school environments.

PIRE: Developing a Manufacturing Bridge for the Nano- and Macro-Worlds: There is Plenty of Room in the Middle

Leading Organization: University of New Hampshire

UNH Contact: Brad Kinsey (brad.kinsey@unh.edu)

Collaborating Universities: Northwestern University, University of Illinois, Elizabeth City State University, Nagoya Institute of Technology, Japan, Korea Institute of Machinery and Materials, and University of Erlangen, Germany

Funding Source: National Science Foundation

Period: March 1, 2010 – March 1, 2015

Requested Amount: \$5 Million

Status: Pending

Project Summary

In Feynman's groundbreaking talk entitled "There's Plenty of Room at the Bottom," the Nobel Laureate laid out his now half-century-old vision of nano-technology. But the challenges of manufacturing have lagged this vision, creating a bottleneck as nano-science and -technology development bridges to innovation and commercialization. However, the recent emergence of manufacturing processes to create micro-features shows great promise toward filling this rapidly expanding void. A striking example that typifies the impact of micro-technology on bridging nano-sciences with macro-applications is seen in the wide range of systems that rely on micro-channel features for their functionality, some with textured surfaces. The *technical goal* of this project is to create the science, technology, and commercialization bases necessary for the realization of new manufacturing processes and equipment capable of producing high accuracy micro-scale 3D features in a wide range of hard materials. The *educational goal* is to provide our students and post-docs with a unique international collaboration opportunity that will prepare them both technically and culturally to operate effectively in a global environment. A key enabler in achieving these goals is our "Laboratory Without Borders" through which partners will share unique facilities and expertise via the Internet. Such ambitious goals can only be achieved in a reasonable timeframe through a large-scale international collaborative research and education endeavor.

Intellectual Merit. A 2005 World Technology Evaluation Center assessment of micro-manufacturing technology showed that while the U.S. is a global leader in nano-science, Europe and Asia are more advanced in micro-scale technologies. This proposal targets this U.S. weakness by focusing on the need for fundamental science and manufacturing technologies to create micro-scale features and surface textures by assembling an international team well-positioned to achieve its *technical and educational goals* through the strengths of each party: surface engineering, micro-forming, and micro-machining (U.S.); precision die fabrication (Japan); micro-manufacturing systems (Korea); and precision micro-forming (Germany). Our technical efforts will be built around two specific problem areas: the creation of micro-channel geometry and surface texture generation. Two major research thrusts are planned to address these challenges: *Science-Base of Surface Texturing* and *New Processes and Engineering Systems*. In the area of surface texturing, the team will model the tribological and residual stress effects due to surface texturing; study the science of surface texturing using a novel pico-second 5-axis laser texturing system; and investigate the impact of various surface textures on component functionality. The team will pursue the study of new processes including ultra-precision micro-forming, a novel nano-planing process approach, and new hybrid multi-physics processing methods in multi-material systems.

Broader Impacts. A key enabler to meeting our goals is a collaborative environment, our “*Laboratory Without Borders*”, that through the use of the Internet provides access for remote monitoring and control of unique laboratory facilities at the various US and international partner sites. This mechanism will not only facilitate our collaborative research and education efforts but also provide tools for researchers and educators around the world. Our partnership with HBCU Elizabeth City State University will enable their bright undergraduates to not only broaden their horizons through international research experiences but hopefully excite them about the opportunities that exist for graduate studies. We will work to bring together the International Conference of Micro-Manufacturing (ICOMM) in the U.S., the Multi-Material Micro-Manufacture (4M) Conference in Europe, and the International Microfactory Workshop first established in Japan, to create a foundation to strengthen collaborations for the micro-manufacturing research community worldwide. Our Industrial Advisory Board will assure that our research focus is broadly applicable to the needs of industry and will stimulate employment opportunities for participants. Finally, our students will benefit from our joint seminar course and joint mentoring with international experts, both of which provide examples to others of the benefits of international exposure for students.