



Item: IX

Wednesday, May 16, 2007

**SUBJECT: FEDERAL RESEARCH OVERVIEW AGENDA**

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**PROPOSED BOARD ACTION**

Informational

**BACKGROUND INFORMATION**

There are 8 priority initiatives on the FAU list for support by the Florida Congressional Delegation. Two projects are system wide - FL Bioinformatics Consortium (this project is new and includes IBM, Scripps, University of Miami, FIU and Nova as partners) and the Center for Inter-modal Transportation (this project is a continuation). Then, we are requesting support for five other University specific projects. Our continuation project is the Center for Durability of Composite Materials and Structures. The new requests are: Alzheimer's and Diversity, Florida Initiative for the Advancement of Teaching, Center for Ocean Energy Technology, and the Florida Area Coastal Environmental Initiative. Finally, we have eight other proposals that are a part of our list that are not priorities but still very important to the research enterprise of FAU.

**IMPLEMENTATION PLAN/DATE**

N/A

**FISCAL IMPLICATIONS**

N/A

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**Supporting Documentation:** FAU FY 2008 Federal Initiatives

**Presented by:** Dr. Larry Lemanski, Vice President for Research **Phone:** 561-297-0267



## **FY 2008 Earmark Proposals**

#	Type (New or Continued)	Title	Principal Investigator (PI)	Amount	Appropriations Bill/Agency/ Account	Pg.
<b>Systemwide Projects</b>						
1.	<b>New</b>	Bioinformatics Research Consortium	Narayanan	\$8,000,000	Energy and Water Science account	4
2.	<b>Continuation</b>	Center for Advanced Transportation and Infrastructure Safety and Security (Formerly known as University Consortium for Intermodal Transportation Safety and Security)	Scarlatos	\$6,000,000	Transportation/ HUD TCSP account	6
<b>University Projects</b>						
3.	<b>Continuation</b>	Durability of Composite Materials and Structures	Granata	\$2,000,000	Defense/Dept. of Navy/NSW/ ONR account	8
4.	<b>New</b>	Center of Excellence in Ocean Energy Research and Development	Driscoll	\$12,000,000	Interior Science and Technology Research: Congressional Priorities account	10
5.	<b>New</b>	Florida Initiative for the Advancement of Teaching	Aloia	\$3,000,000	Labor/HHS/ Education Fund for the Improvement of Postsecondary Education account	12
6.	<b>New</b>	Diversity and Alzheimer's Disease (AD): A Model for the Care of Minority and Disadvantaged Older Adults at Risk for AD and Related Dementias	Tappen	\$2,000,000	Labor/HHS/ Education Aging Research, Demonstrations, and Training Account	14

#	Type (New or Continued)	Title	Principal Investigator (PI)	Amount	Appropriations Bill/Agency/ Account	Pg.
7.	<b>New</b>	Florida Area Coastal Environmental Initiative	Bloetscher	\$3,600,000	Interior/EPA Science and Technology Research: Congressional Priorities Account	16
8.	NOTE: This project was approved in the FY07 Appropriations Bill; however, it was not funded.	Center for Caring to Reduce Health Disparities	Liehr	\$1,500,000	Labor/HHS/ Education Public Health Improvement and Leadership Account	18
<b>Others</b>						
9.		Center for Remote Sensing of U.S. Exclusive Economic Zone	Schock	\$4,000,000	Defense/ ONR	20
10.		Computational Clinical Imaging In Breast Cancer	Goldwyn	\$3,000,000	Military Quality of Life Research and Development account	22
11.		Demystifying and Correcting the Science Taught to Elementary Students	Thomas	\$4,000,000	Labor/HHS/ Education Fund for the Improvement of Postsecondary Education account	24
12.		Engineering Healthcare Informatics and Technology	Ilyas	\$3,000,000	Labor/HHS/ Education Aging Research, Demonstrations, and Training account	26
13.		Florida's Marine Biota – A Novel Resource to Combat Bioterrorism	Fields	\$3,000,000	CJS NOAA Operations. Research, and Facilities account	28
14.		Secure Free Space Quantum Communication Technology: QKD with Orbital Angular Momentum Photons	Miller	\$1,200,000	Defense/ CCIT account	32
15.		Study of Catastrophic Disasters and Population Displacement	Esnard	\$2,500,000	Labor/HHS/ Education Public Health Improvement and Leadership account	35
16.		Technologies for Law Enforcement	Furht	\$3,000,000	Commerce/Justice/ Science Byrne Grant account	37

**Name of Project:                    Bioinformatics Research Consortium: Genomics for Quality Healthcare**

Appropriations Bill:            Energy and Water  
Agency/Account:                Science  
FY 2008 Request:                \$8,000,000 (\$20,000,000 over three years)  
Previous Appropriations:        None

**Project Description:**

Recent advances in the human genome sequencing effort have led to the development of a new discipline called bioinformatics, which uses the power of computers to understand biology. We propose to take advantage of this powerful new technology to benefit patients with cancer, neurodegenerative diseases and AIDS. The research efforts of the Consortium will revolve around the **genes-to-drugs paradigm** to transfer the benefits to the patient's bedside rapidly.

We will use the power of supercomputers to harness the human genome for the discovery of highly disease-specific genes. This will allow risk prediction, earlier diagnosis, and the discovery of novel drugs that are better targeted to the disease. These drugs will be less toxic, making treatment less debilitating and more effective.

**Background:**

For the past five years, scientists in the Colleges of Science and Engineering & Computer Science at Florida Atlantic University (FAU) have been laying the groundwork for a bioinformatics infrastructure. A computational framework including supercomputing and parallel computing already exists within FAU at the Colleges of Science and Engineering & Computer Science. In addition, Latin American institutions (part of the LA Grid initiative <http://latinamericagrid.org/>) will form a strong team providing resources, and the Project Checkmate supercomputer will be available for the Bioinformatics Consortium's research activities. Discovery and preclinical validation of two highly cancer-specific genes at FAU for pancreatic and colon cancers using bioinformatics provides a proof of concept for the genes-to-drugs paradigm.

**Objectives:**

The mission of the **Bioinformatics Research Consortium** is to establish an interdisciplinary research thrust in bioinformatics involving a highly proficient group of more than fifty FAU faculty members, LA-grid Universities, IBM and The Scripps Research Institute. The Consortium will provide technology access to universities throughout the entire state of Florida. With the underlying theme of exploiting the genes-to-drugs paradigm, the major objectives of the Bioinformatics Consortium are to establish a fingerprint of gene markers for cancer, neurodegenerative diseases and AIDS to facilitate: 1) early diagnosis and 2) the rapid discovery of drugs for therapy.

**Significance:**

Bioinformatics technology is expected to play a major role in healthcare. The interdisciplinary projects developed by the Consortium will vastly improve healthcare research to benefit today's patients. The students will be trained in state-of-the-art technology, which will help prepare them for competitive jobs in biotech and engineering industries that are emerging in Florida and elsewhere. It is expected that the inventions arising from the Consortium's research will result in startup companies and licensing to major pharmaceutical companies, further contributing to economic development in Southeast Florida. The research focus of the Bioinformatics Consortium will bring the benefits of the recent revolution in genomic research to these patients in the shortest possible time.

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**Name of the Project:**                      **Center for Advanced Transportation and Infrastructure Safety and Security (SUS-CATISS)**

Appropriations Bill:                      Transportation  
Agency/Account:                      FTA/TCSP Account  
FY 2008 Request:                      \$6,000,000  
Previous Appropriations:                      FY 2005: \$6,958,770; FY 2006: \$2,151,925

**Project Description:**

The proposed State Universities System Center for Advanced Transportation and Infrastructure Safety and Security (SUS-CATISS) will expand on the experience gained from the University Consortium for Intermodal Transportation Safety and Security (UCITSS) to other important aspects of state and national infrastructure safety and security issues, including but not limited to water resources, dam safety, hazardous waste management, power plants and utilities, intermodal transportation systems, and other public facilities with large transient populations such as university campuses, shopping centers, etc. The Center is expected to act as an information clearinghouse, to support research initiatives, to conduct advanced studies for risk assessment, to investigate effective methods for interagency communications for emergency management, and to provide feasibility/effectiveness assessments of existing infrastructure security and safety methodologies by using real-life demonstrations. These studies will generally focus on three different specialized areas/issues. They are:

**1) Clearinghouse of State-of-the-Art Technologies for Infrastructure Safety and Security**

- Technology applications and equipment for multi-sensor security and safety data-gathering including optic, acoustic, chemical and biological sensors
- Advanced applications and software for multiple-source data fusion and pattern recognition
- Management applications for complex multi-agency disaster scenario simulations
- Identification and classification of major infrastructure and transportation components throughout the state of Florida
- Advanced applications for infrastructure/transportation hardening, resilience, and redundancy
- Modern techniques for rapid assessment and repair of infrastructure damage due to an episodic natural or anthropogenic event
- Assessment of the socioeconomic and environmental impact as related to temporal/permanent incapacitation of different infrastructure components
- Inventory of the various shareholders at local, state and national levels as related to various infrastructure and transportation components

**2) Selection of the Technologies through Exhaustive Field Studies and Development of Guidelines for Infrastructure Safety and Security**

- Selection of the most promising safety and security data collection and analysis technologies for testing and utilization in real-life application scenarios
- Cooperation with local, state and federal agencies to create a variety of “real-life” disaster simulation scenarios that would involve “damage” of multiple infrastructure components and incapacitation of emergency evacuation routes
- Quantitative assessment of the local and regional socioeconomic and ecological impacts of infrastructure temporal/permanent incapacitation

**3) Dissemination of Information and Findings from Studies to State Agencies and Educational Initiatives**

- Continuous updating and dissemination of information gathered from the previous two study phases to various state and local agencies through reports and other documents
- Dissemination of the non-sensitive information to the general public in form of seminars/forums
- Development of university undergraduate and graduate level classes on infrastructure safety and security issues

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**Name of Project:** **Durability of Composite Materials and Structures**

Appropriations Bill: Defense  
Agency/Account: Department of Navy/NSWC/ONR  
FY 2008 Request: \$2,000,000  
Previous Appropriations: FY05 \$1,300,000; FY06 \$1,250,000; FY07 \$2,000,000

**Project Description:**

A recently completed, congressionally mandated study reported that the annual cost of corrosion to the United States economy is approximately \$276 billion, or 3.1 percent of the nation's Gross Domestic Product. The analysis upon which this determination was made considered direct costs only and did not include such factors as: 1) shutdown, 2) loss of product, 3) reduced efficiency, 4) product contamination, 5) pollution, 6) over-design, and 7) loss of life. Consequently, the actual cost is much higher than projected. Of particular significance is that commitments to research and development and to education and training each amounted to less than one-tenth of one percent of the total cost. A case was made in the report that, with more education, corrosion costs would be significantly reduced. Further, implementation of accelerated test methods is required to test new materials in a short period of time for research and development. The durability of composite materials must be researched to enable appropriate upgrades/substitutions for traditional corrosion-prone materials, particularly with respect to materials having environmental and thermal or fire resistance.

This project requests funding to extend capacity and capabilities of the Center for Marine Materials at Florida Atlantic University to better meet this specific materials evaluation national need by: 1) acquiring nondestructive evaluation equipment for monitoring degradation of composite materials by sea water, 2) acquiring a high-load capability, servo-hydraulic test frame for static and long-term cyclic loading of test specimens, and 3) construction of composite materials exposure facilities for sea water immersion, cyclic immersion and marine atmospheres. Typical items required include ultrasonic flaw detectors, thermographic camera systems, eddy current detectors, capacitance measurements, dye/gas penetrant detectors, computer-controlled hydraulic testers, and tanks and pump systems for sea water immersion tests.

Structural and high strength steels have for the past century served as the primary construction material for both Navy and commercial ships, and their use in this capacity will undoubtedly continue to some extent into the future. However, with continued development, composite materials offer the promise of providing: 1) reduced weight and increased strength-to-weight ratio such that lighter, faster ships result and 2) reduced maintenance to counter corrosion and paint degradation. Composite materials are combinations of metals, ceramics and polymers, e.g., fiberglass (epoxy and glass), which enable combinations of properties to satisfy specific application performance needs. Testing the validity of composite materials' design properties to actual performance is a critical link in the process of implementing new materials in naval or corrosive environment applications. The Center for Marine Materials is uniquely suited to address issues that are critical to furthering the introduction of composite materials into the marine ship-building sector. The proposed funding would build upon and enhance ongoing, multi-year Department of the Navy-sponsored research at Florida Atlantic University that is directed specifically at corrosion prevention and control for marine structures through the testing of composite materials, especially those having environmental and thermal or fire resistance.

The integration of on-site testing with educational activities facilitates collaboration among various distant users and the uniquely located exposure test facility. The result will be the establishment of a marine/UV exposure test facility that meets national research and educational needs.

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<b><u>Name of Project:</u></b>	<b><u>Center of Excellence in Ocean Energy Research &amp; Development</u></b>
Appropriations Bill:	Interior
Agency/Account:	Science and Technology Research: Congressional Priorities
FY 2008 Request:	\$12,000,000 (\$36,000,000 over three years)
Previous Appropriations:	None

**Project Description:**

The proposed Center of Excellence in Ocean Energy Research & Development (COEOERD) will be a synergistic partnership among academia, industry, and government laboratories. Utilizing its combined ocean engineering expertise, extensive fabrication and testing expertise, and the large South Florida Testing Facility range, COEOERD will foster the research, design, development, implementation, testing, and commercialization of cutting-edge ocean energy technologies that are cost-competitive with existing fossil-fuel-based power generation. Ocean current, wave, tidal, thermal, and wind-over-water-based power will be focus areas. In close collaboration with COEOERD's industrial partners, promising next-generation technologies will be investigated, refined, fabricated, and tested to identify viable systems, with well understood and mitigated environmental impacts, capable of meeting the energy demands of the U.S.

COEOERD is to be based at Florida Atlantic University's SeaTech Facility, which is strategically located next to the most energy-dense waters in the continental U.S. Directly offshore, the Gulf Stream (the most energy-dense ocean current) lies at its closest location to land along the entire eastern seaboard, with speeds of five knots, and pumps nine billion gallons of warm water per second through the Straits of Florida. Furthermore, water temperatures of 30 °C at the surface and 14 to 4 °C at water depths of 250–400m, respectively, just offshore SeaTech, provide a high potential for ocean thermal energy and complementary systems such as distributed cold-water-based air-conditioning systems. Most forms of renewable energy are subject to intermittency, such as times when the wind does not blow, the sun is not shining, and the ocean is calm. The Gulf Stream is always flowing and the thermal gradient is always present offshore Florida, ensuring a continuous supply (a 100% capacity factor) of clean energy. This unique location is also situated near a major electric load (usage) center (South Florida), a capable marine industrial base, a deep water port (Port Everglades), and a large offshore testing range (the South Florida Testing Facility); also, SeaTech shares facilities with a major government ocean engineering lab (the Naval Surface Warfare Center Carderock Division) and a respected oceanographic academic institution (Nova Southeastern University Oceanographic Center – NSU OC). In addition, FAU is a leader in the existing South Florida Ocean Measurement Center, comprising FAU's SeaTech, the U.S. Navy, and NSU OC. A rich and continuous supply of energy near a major load center coupled with local research capability make South Florida the ideal place to develop and refine technologies that may initially be uneconomic or unfeasible elsewhere. Hence, the COEOERD will leverage Florida's unique location and expertise to develop and refine technology that will be exported to locations throughout the world. The COEOERD will thus provide a base to make the U.S. the leading renewable energy producer worldwide.

**Expected Outcomes:**

COEOERD will become the world's leading center for the exploration and development of ocean energy technologies. It will involve experts from around the United States, fostering nation-wide collaboration. Harnessing the ocean's energy will also provide a degree of energy independence for the U.S. and create a new economic sector and associated industries with potential for tens of thousands of jobs and billions of dollars in revenue. The COEOERD will establish the U.S. as the clear leader in key emerging technologies for harnessing ocean energy, with the potential to dwarf the world's oil and coal sector.

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Harbor Branch Oceanographic Institution, FL  
Nova Southeastern University Oceanographic Center, FL  
Virginia Tech, VA  
University of California at Berkeley, CA  
University of Miami, FL  
Florida State University, FL  
University of Florida, FL  
University of Hawaii, HI

#### **Industrial Partners**

Florida Power and Light, FL  
Ocean Renewable Power Company, FL  
Aquantis LLC, CA  
Clipper Windpower, CA  
Oceaneering International Inc, MD  
Ocean Power Technology, FL  
LeTourneau, TX  
Lockheed Martin, MA, MS

#### **Government Partners**

NAVSEA, Carderock, MA  
U.S. Department of Energy,  
National Renewable Energy Laboratory,  
NOAA,  
Office of Naval Research

**Name of Project:** **Florida Initiative for the Advancement of Teaching (FIAT)**  
Appropriations Bill: Labor/HHS/Education  
Agency/Account: Fund for the Improvement of Postsecondary Education  
FY 2008 Request: \$3,000,000 (\$15,000,000 for five years)  
Previous Appropriations: None

**Project Description:**

The United States faces an unprecedented teacher shortage. In particular, Florida faces a shortage of nearly 30,000 teachers for academic year 2006-2007. This trend is expected to continue at a rate of nearly 20,000 teachers annually for the next ten years. Florida's teacher shortage is compounded by the problems of teacher recruitment and retention. The Florida Initiative for the Advancement of Teaching (FIAT) will provide effective, research-based, comprehensive, coordinated, integrated, flexible, and scalable solutions for improving Florida's PK-20 educational system by preparing, recruiting and retaining quality educators in sufficient numbers for Florida schools. A primary function of FIAT will be to identify, evaluate, assess, report and recommend action on key research and policy questions facing the Florida Department of Education and the Florida Legislature in planning and funding for education in year one and thereafter. FIAT will provide effective, research-based projects that are scalable statewide for preparing, recruiting and retaining quality educators in sufficient numbers for Florida schools.

The primary functions of FIAT include: 1) Expanding the Potential Teacher Pool; 2) Educator Training Initiatives; 3) Research and Evaluation Initiatives; and 4) Organizational and Strategic Planning Activities. The FIAT program has been broken down into three projects: Project Good FIT (First Introduction into Teaching); Project SMaRT (Substituting with Mentors and Realistic Teaching); and Project AIT (Accelerated Induction into Teaching). The projects are not novel in the field of education, but the key to their effectiveness lies in linking them together to create a systematic method of educating, training and retaining highly qualified classroom teachers.

Project Good FIT is one means of addressing Florida's teacher shortage by identifying potential teachers in their freshman and sophomore years in college. Project Good Fit is designed to encourage freshman and sophomore students who identify education as their major and to bring them into the profession. From their first semester, freshman and sophomore teacher education majors are given the opportunity to have paid professional experiences in schools as Instructional Interns. Project Good FIT is designed to establish, maintain, and enrich their connections with the teaching profession.

Project SMaRT is designed to improve learning opportunities for students in schools while providing professional development experiences and financial support for education majors. Project SMaRT is an innovative program that redirects a portion of the millions of dollars that school districts currently "invest" in substitute teaching -- usually resulting in minimal instructional benefits for K-12 students. SMaRT students work with mentors to maintain curriculum progress and academic rigor in the assigned classes on days the regular teacher is absent.

The AIT program will place highly qualified student teachers in their own classrooms and provide them with direct, daily, intensive support by Master Mentors. The AIT program will assist school districts in addressing acute teacher shortages, provide high quality instruction for students, and reduce the overall need for alternative certification placements. By placing student teachers in classrooms with Master Mentors, the AIT program will reduce the overall need for substitutes and improve the quality of teaching for PK-12 students. AIT will not cost the district any additional resources.

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**Name of Project:** **Diversity and Alzheimer's Disease (AD): A Model for the Care of Minority and Disadvantaged Older Adults at Risk for AD and Related Dementias**

**Appropriations Bill:** Labor/HHS/Education  
**Agency/Account:** Administration on Aging, Research, Demonstrations, and Training  
**Request, FY 2008:** \$2,000,000  
**Previous Appropriations:** None

**Problem:** Although some strides have been made in the diagnosis and treatment of Alzheimer's Disease (AD) and related dementias, there remains a huge disparity in the information and treatment that reach minorities and the disadvantaged. The Alzheimer's Association has noted significant deficits in both research and treatment of AD in minority and disadvantaged older adults at risk for AD. Despite the advances achieved with the majority population, minority elders have been underrepresented in the research done and have not benefited from the new diagnostic and treatment approaches now available. Additionally, available data are contradictory, showing extremes of low to very high incidence in African American and other minority populations. Furthermore, the screening tools and diagnostic tests currently in use may have significant cultural bias, leading to serious over or under diagnosis in minority elders. It follows, then, that effective models for prevention, community education and affordable treatment have not been developed for minorities and the disadvantaged.

This lag in reaching minority and disadvantaged older adults is long overdue for correction. We need reliable information on the extent of this problem in minority elders and how it impacts their lives and their families' lives. To design culturally appropriate prevention and treatment strategies, we need to have a solid understanding of their values and beliefs about AD. Most importantly, we need to develop more effective ways of reaching minority and disadvantaged older adults with information that will further their understanding of the disease and reasons why early diagnosis and treatment are now worthwhile. Then, we need to offer these services in an acceptable and accessible fashion.

**Proposed Project:** The purpose of this project is to develop and implement new, more culturally appropriate models of community education, screening and treatment of African American, Afro-Caribbean and Hispanic older adults at risk for AD. To achieve the dual goals of obtaining more reliable data and bringing service directly to this population, we propose a participatory action research approach in which we reach out to the minority community using expert, culturally diverse teams at Florida A&M University (FAMU) and Florida Atlantic University (FAU).

**Goals and Objectives of the Proposed Project:**

This project will focus on: a) cognitive assessment of African Americans living in the rural Big Bend counties of North Florida, and Afro-Caribbean and Hispanic elders living in Dade, Broward and Palm Beach counties in South Florida, b) development of culturally appropriate treatment systems for African American, Afro-Caribbean and Hispanic elders and follow-up programs, c) Development of support systems for caregivers in minority, rural and underserved areas.

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**Name of Project: Florida Area Coastal Environmental Initiative (FACE Initiative)**

Appropriations Bill: Interior/EPA  
Agency/Account: Science and Technology Research: Congressional Priorities  
FY 2008 Request: \$3,600,000  
Previous Appropriations: None

**Project Description:**

The coastal reefs contribute as much as \$4 billion annually to the economy of South Florida, and, as a result, the vitality and protection of these reefs is of critical importance. They are also of national interest, being one of the few coral sites in the mainland United States. Over the past 20 years, changes in the reef communities have been observed, the dynamics of which are not well understood. It has been suggested that excessive nutrients of terrestrial origin are a potential contributor to the problem.

The Florida Area Coastal Environmental (FACE) initiative is intended to develop the science that will lead to better management of the coastal zone by quantifying the sources of nutrients, including, but not limited to, the impacts of:

- 1) On-site treatment and disposal systems (OSTDS)
- 2) Canal discharges
- 3) Deep ocean upwelling
- 4) Subsurface groundwater discharges
- 5) Ocean outfalls
- 6) Atmospheric deposition

Additional contributors that have been identified, but not yet studied extensively, include impacts from ports, beach renourishment, and dredging activities, as well as biological changes (loss of algal consumers in the food chain) and contributions of climate change, weather patterns such as El Niño, hydrodynamic transport from the Gulf of Mexico, and the flow of Caribbean waters into the Florida Current.

At this time, only one of the six main sources has been studied (ocean outfalls). The others have not been monitored, and their contributions and impacts remain as yet unknown. FAU will focus its efforts on the sources likely to contribute the most nutrients (from a mass loading perspective) to the coastal ocean on an ongoing or episodic basis, all of which can be readily compared on a mass-balance basis to the ocean outfall contribution. The Department of Civil Engineering in the College of Engineering & Computer Science and the Florida Center for Environmental Studies (CES) at FAU are uniquely positioned to undertake this effort because of their familiarity with local governments, local utilities' work on the outfall issues, and ongoing research that will contribute to the long-term FACE collaboration with NOAA and the Florida Water Environment Association Utility Council (FWEAUC).

The Laboratories for Engineered Environmental Solutions (Lab-EES) at FAU in conjunction with FWEAUC, the Florida Department of Health, and USEPA are currently conducting collaborative research studies to quantify the potential contribution of OSTDS in Florida, and FAU is carrying out preliminary research to begin to understand the phenomenon of deep ocean upwelling. FAU is also in the process of gathering data that will provide important information needed to understand the significance of discharging large volumes of nutrient-laden surface waters into the marine environment. FAU has an established link with the University of Miami Rosenstiel School of Marine and Atmospheric Science (UM/RSMAS) and several other key university partners that would participate in this study.

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<b><u>Name of Project:</u></b>	<b><u>Center for Caring to Reduce Health Disparities</u></b>
Appropriations Bill:	Labor-HHS
Agency/Account:	Center for Disease Control / Public Health Improvement and Leadership
FY 2008 Request:	\$1,500,000 (\$6,000,000 over three years)
Previous Appropriations:	None

**Project Description:**

FAU's Christine E. Lynn College of Nursing has a tradition of caring for people in South Florida who suffer health disparities by nature of their insurability status (education and/or income) and race or ethnicity. For more than a decade, the College has been engaged in service to address the pressing health problems of the people of South Florida. This Center will honor the caring tradition of the College as well as national goals expressed in *Healthy People 2010*, which proposes to "eliminate health disparities among segments of the population, including differences that occur by gender, race or ethnicity, education or income...." The Center for Caring to Reduce Health Disparities will promote service-research-learning by:

1. **supporting faculty** to build knowledge about the best approaches to care for underserved populations and by **supporting students** who are interested in learning more about health disparities. This goal will be achieved by:
  - identifying students who are interested in being mentored by faculty-researchers who are studying populations suffering health disparities
  - supporting the work of six core faculty members studying people suffering health disparities and adding faculty with health disparity expertise/interest. Current work includes decreasing: substance use in Native American adolescents; HIV/AIDS in Caribbean-American adolescents; anger/aggression in ethnically diverse adolescents; and pregnancy in rural teens. Access to health care for uninsured Florida residents and the incidence of hypertension and diabetes in Haitian elders are other critical areas of study for faculty members. This broad range of health disparity interests provides the base for service-research designed to improve health outcomes; it also provides a foundation for service learning, whereby the integration of students into community work will enrich educational experiences and enhance student understanding of health disparities, thus enhancing the quality of care delivered to the people of South Florida.
2. **developing multidisciplinary collaborative relationships** for service-research-learning about caring for underserved populations by:
  - identifying one colleague from another discipline who will engage with each nursing faculty-student team to begin the development of multidisciplinary collaborative teams of faculty and students with specialized knowledge about health disparities. The collaborating colleague will be encouraged to include a student from his/her discipline as a member of this team.
3. **establishing a structure for ongoing service-research-learning** focused on health disparities by:
  - building the base needed by the College to apply for National Institute of Nursing Research (NINR) National Institutes of Health (NIH) funding for the Center through the P20 mechanism at the completion of this Project funding.

In summary, this project draws on the College's long-existing strength of providing care and extends this service mission with a more structured service-research-learning approach addressing health disparities. The work of the Center is intended to improve health outcomes for underserved people in South Florida and to inform teaching through service learning and the integration of health disparities knowledge into the curriculum. This approach will give nursing students the opportunity to develop creative approaches for reducing health disparities for South Florida residents who are receiving less than adequate health care because of their insurability status, socioeconomic status, race or ethnicity.

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## **OTHERS**

**Name of Project:** **Center for Remote Sensing of US Exclusive Economic Zone**  
Appropriations Bill: Defense  
Agency/Account: ONR (Office of Naval Research)  
Request, FY 2008: \$4,000,000 (\$20,000,000 over five years)  
Funding Distribution: Florida Atlantic University \$2,000,000  
University of Texas \$2,000,000  
Previous Appropriations: None

### **Project Description:**

The proposed Center for Remote Sensing of U.S. Exclusive Economic Zone will focus on the development of remote acoustic sensing technology that provides scientists with an unprecedented capability to investigate in detail the sedimentary structures on the continental shelf and slope. Florida Atlantic University will be responsible for developing the new acoustic technologies for imaging the sedimentary structures and remotely measuring sediment properties. The University of Texas will be responsible for conducting field experiments utilizing FAU's new acoustic sensing technology and cutting-edge coring technology, recently developed with ONR and UT sponsorship, to investigate a wide range of scientific issues of importance to the United States regarding the resources and risks along our ocean margins. These issues include:

- Understanding of geohazards within the sediments of the upper continental slopes. Gas hydrates in particular are a potential source of instability if they disassociate into gas. Slope instabilities can lead to underwater landslides and tsunamis. Gas hydrates are also potential sources of greenhouse gas, which may contribute to global warming.
- Understanding the resource potential within the shallow sediments of the US EEZ. Gas hydrates are a large possible source of energy, although the technology for tapping that resource remains elusive. Shallow sand reservoirs are also an important resource, which can be utilized for beach and barrier island replenishment.
- Understanding the acoustic response of the seabed in US waters. This issue is of particular relevance to homeland security and the U.S. Navy because of the importance of using active sonar methods to hunt for submarines and mines.
- Understanding the relationship between the sedimentary record on the U.S. continental margin and changes in sea level over the past 20,000 years. Such work has relevance to understanding the effects of present day climate change along our coastlines, such as in predicting how our economically critical estuaries respond to rising sea level.

The new technologies are expected to provide major scientific advances in these areas, along with opportunities for future funding to a wide range of government and industry-sponsored researchers in the United States. The proposed research will be leveraged off the existing efforts in acoustic remote sensing within the Center for Acoustics and Vibration in the Department of Ocean Engineering at Florida Atlantic University and efforts in seismic mapping and sampling of sediments at the Institute for Geophysics, Jackson School of Geosciences at the University of Texas.

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**Name of Project:                    Computational Clinical Imaging in Diagnosis and Treatment of Breast Cancer**

Appropriations Bill:            Military Construction  
Agency/Account:                Quality of Life, Research and Development  
FY 2007 Request:                \$3,000,000 (\$12,000,000 over five years)  
Previous Appropriations:        None

**Project Description:**

The Charles E. Schmidt College of Science at Florida Atlantic University, in conjunction with the Center for Breast Care at the Women's Center, Boca Raton Community Hospital (hereafter referred to as the Center for Breast Care), is establishing a Center of Excellence for the Development of Computational Clinical Imaging. This Center has, as its initial emphasis, the perfection of revolutionary new techniques to aid clinicians in the diagnosis and treatment of breast cancer.

The first focus of the project work plan will be on the following key clinical concerns, which would derive immediate major benefits from the development of new computational tools.

1. Women with suspicious mammography findings need further evaluation to determine the nature of any lesion(s). The clinician needs specialized aids for proper diagnosis and therapy selection. We will develop such aids.
2. Women at high risk for breast cancer could potentially benefit from early MRI evaluation done in conjunction with screening x-ray mammography. We have demonstrated this in an article of the *American Journal of Roentgenology* titled "Assessment of Suspected Breast Cancer by MRI." We are enhancing the computational tools discussed in the article to aid in identifying the benefits of this diagnostic approach and evaluate the results in clinical trials.
3. Early diagnosis and detection of breast cancer is the single most powerful tool in fighting this disease. We will augment data from MRI for both diagnosis and the guiding of biopsies by incorporating digital 3-dimensional data from both positron emission tomography (PET) scanners and from high-resolution ultrasound – modalities that are just becoming available clinically. We will evaluate the overall cost benefit in clinical trials.
4. Chemotherapy may be required after breast cancer surgery, under traditional clinical guidelines. We will extend our work in MRI computational imaging to quantify the creation of new blood vessels (a measure of tumor vitality) as an indication of the efficacy of selected chemotherapy.
5. The clinician needs clear direction in integrating newly developed and validated technologies into the usual workflow. It is imperative that we not produce data overload but rather precisely described, clinically relevant information. Further, computational clinical imaging techniques that are developed need to be packaged for the use of less experienced breast radiologists who treat far fewer patients than are seen by radiologists at the Center for Breast Care and other major facilities. We will perfect, integrate and package appropriate software aids to make these new technologies universally accessible.

South Florida's demographics and the anticipated international prominence of the Center for Breast Care place it in a unique position to evaluate new approaches on a longitudinal basis. The Center also expects to partner with the medical imaging industry to commercialize the technologies, bringing their benefits to women everywhere.

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**Name of Project:** **Demystifying and Correcting the Science taught to Elementary Students Using Researchers in the Classroom**  
Appropriations Bill: Labor/HHS/Education  
Department/Agency: Fund for the Improvement of Postsecondary Education  
FY 2006 Request: \$4,000,000 (\$12,000,000 for three years)  
Previous Requests: None

**Project Description:**

This program would involve Florida Atlantic University (FAU), Florida Agricultural and Mechanical University (FAMU), Florida State University (FSU), and the University of Florida (UF), in an initiative to examine and change the ways that physical science is taught at the elementary school level. The goal of the program is to engage elementary children in more technical science concepts using an interdisciplinary approach. The program would use a three-pronged approach – integrated learning, technical skills and scientific reading skills – to improve the scientific thinking of elementary school children.

The pilot projects designed by the lab schools affiliated with FAU, FAMU, FSU and UF would teach “good” science around established standards in an interdisciplinary way. Scientific knowledge is constantly changing. In fact, the body of science changes every two years through research. The program would use a panel of experts, including university professors and industry scientists, in a science discipline to look at grade level expectations. The panel would then make recommendations on the areas that would be addressed by the students.

The curriculum and lesson plans developed would provide students with a virtual researcher in the classroom to teach physical sciences, measurement and scientific critical thinking – all areas in which elementary students seem to test poorly, according to the International Assessment of Progress. These projects undertaken by the laboratory schools are designed to:

- develop standards-based curricula in a wide range of science areas;
- provide professional development for teachers in science;
- increase elementary student access to technology and online resources in science;
- create strategies for accelerating the academic progress in science and technology; and
- develop new approaches to measuring the impact on student learning.

After testing the curricula in the lab schools, the same curricula would be tested in the local school districts in the catchment area. Finally, in collaboration with National Science Teachers Association (NSTA), a website would be developed for teachers nationally to use to expand their curricula.

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**Name of Project:**                    **Engineering Healthcare Informatics and Technology: Cost Effective Healthcare Delivery in Communities.**

Appropriations Bill:                    Labor/HHS/Education  
Department/Agency:                    Administration on Aging  
FY 2008 Request:                        \$3,000,000 (\$9,000,000 over three years)  
Previous Appropriations:                None

**Project Description:**

Advances in information technology are impacting the health care industry in major ways, with integrated technologies for medical imaging, data mining and electronic health records all highly focused on distinct diagnoses, treatments and outcomes, with increased cost and decreased effectiveness and safety. The complex story of the life of person and family in community are lost; the ideal of comprehensive health care is unknown in the world of today. Persons call for more humane care delivery; the country calls for decreased health care costs. The clear need is for comprehensive, high quality health care delivery with improved access at lower costs. We propose to embark on a unique interdisciplinary effort to create a new information system, devices and technologies to directly impact and enhance healthcare delivery in community settings. Expertise of engineering, nursing and biomedical sciences will be directed to innovative ways to humanize care while improving the efficiency, quality and accessibility of that care in a fundamentally new ways.

Florida Atlantic University (FAU) is in a unique position to undertake this project due to rapid growth of diverse populations, including increasing numbers of the elderly in its south Florida service area. The FAU Christine E. Lynn College of Nursing Community Wellness Centers provide comprehensive, cost effective health care for persons and families in multi-cultural communities. Services are directed to well-being, early intervention and ongoing care for persons with or at risk for chronic health problems with a focus on hypertension and diabetes; education and research are integrated with practice in neighborhood settings. In collaboration with partner members of the Palm Beach County Community Health Alliance, the venue of the Centers provides for developing and testing an innovative health care informatics system and advanced devices to assist persons to care for themselves at home and continue their contributions to the community.

In the first phase, the research will be carried out by the FAU's College of Engineering & Computer Science in partnership with faculty from the College of Nursing and the Charles E. Schmidt College of Biomedical Science. The objectives of the first phase include:

- Identifying and developing creative usage of (wired as well as wireless) information infrastructure in saving lives. Exchanging multimedia (audio, video, and data) information between the patient and the health care facilities is very helpful in critical and emergency situations. Remote and real-time ultrasound scans of the patient's kidneys, heart, or other organs may make the difference between life and death. This is also very useful in monitoring the condition of homebound patients and delivery health care.
- Developing innovative technologies (including the use of robotics) for the rehabilitation of patients with physical or other disabilities. The focus will be on improving quality of life for the elderly and disabled.
- Organizing a multidisciplinary team that will study, create, use and evaluate nursing language that reflects concepts of a Community Nursing Practice Model and then evolving a healthcare informatics software program designed to support a comprehensive multidisciplinary healthcare practice in a variety of settings, including the home. The program will have a focus on data from the distinctive practice of nursing, including family medical and social history, as well as comprehensive plans for overall care needed for chronic health problems.

- Creating diagnostic and treatment measures for use in the Centers with data transmitted to medical centers for reading, diagnosis and return of information to the Centers for use in treatment and long-term care design.
- Developing health care workforce and sharing research results with the scientific communities through conferences and journal publications.

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<b>Name of Project:</b>	<b><u>Florida's Marine Biota – A Novel Resource to Combat Bioterrorism</u></b>
Appropriations Bill:	Commerce, Justice, Science
Agency:	NOAA
FY 2008 Request:	\$3,000,000 (\$9,000,000 over three years)
Previous Requests:	None

### **Project Summary:**

This collaborative project involving researchers at Florida Atlantic University and Scripps Florida will discover and develop new therapeutics directed at agents of bioterrorism. A number of diseases are potential threats in bioterrorism strikes; however, it is clear that the most likely biological threat is bacteria. The U.S. has already witnessed the use of *Bacillus anthracis* (anthrax) in acts of terrorism, and our current arsenal of antimicrobials to treat victims of such threats is inadequate. Given the propensity of bacteria to become resistant to antibiotics, *Bacillus anthracis* and other bacterial threats such as *Staphylococcus aureus* (skin and bloodstream infections) and *Pseudomonas aeruginosa* (pneumonia, meningitis) could rapidly become biological threats without effective treatments. This would clearly put the U.S. in a position of great weakness.

We propose to “mine” Florida’s marine biota to discover new antimicrobial compounds that can be used to treat infections arising from bioterrorism attacks. The premise for this is the observation that marine invertebrates such as sponges are extremely prolific sources of anti-microbial therapeutics. Florida Atlantic University was recently awarded seed funding to establish the Center of Excellence in Biomedical and Marine Biotechnology. The Center has ongoing collaborative projects aimed at the discovery and development of novel therapeutic agents using Florida’s marine life as the source of new metabolites. Presently, the Center is engaged in a search for marine natural products with applications in the treatment of cancer, cardiovascular disease and inflammatory disorders. This proposal aims to add a new component to the Center to address the growing threat of bioterrorism. The location of Scripps’ new research center in proximity to FAU’s Center of Excellence has created unparalleled potential for drug discovery. Thus, this proposal leverages the world-class resources of FAU’s Center of Excellence and Scripps Florida to establish a unique program directed at the discovery and development of agents active against threats of bioterrorism. Given the extremely high incidence of potential antibiotics in such marine organisms as sponges, together with this new collaboration, we feel an obligation to aggressively pursue this project.

### **Background:**

Florida Atlantic University’s Center of Excellence in Biomedical and Marine Biotechnology represents a synergistic blend of faculty involved in ocean engineering, marine biotechnology and related interdisciplinary fields of chemistry and biology whose common goal is the discovery and development of new medicines. The enormous and largely untapped biodiversity of Florida’s coastal waters provides the raw materials for this drug discovery program engineered by Center faculty, who provide the leadership and expertise. The focus of the Center has been drug targets related to cancer, cardiovascular disease and inflammatory disorders. The expansion of The Scripps Research Institute to a site in close proximity to FAU’s Center of Excellence represents a rare opportunity to establish a coordinated research program encompassing the combined expertise of these facilities. This new collaboration, together with the unparalleled pharmaceutical resource within Florida’s marine life, provides a unique opportunity for the rapid discovery and development of new agents as a critical component of our nation’s homeland security efforts.

### **The Need:**

Currently available “standard” antimicrobials (e.g. ciprofloxacin, penicillins, tetracyclines, erythromycin, chloramphenicol) are the primary defense against pathogenic organisms that are likely to be used in bioterrorism. For the last thirty years, the antibiotic vancomycin has been the last line of

defense against bacterial strains that are resistant to most of the other antibiotics. Unfortunately, the utility of this drug has been limited because of the emergence of vancomycin-resistant bacterial strains, most notably in *enterococcal* and *staphylococcal* nosocomial pathogens.

Promising candidates for reverting multi-drug resistant bacteria are natural product antibiotics. Some of these natural products exhibit strong activity against methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant *enterococci* (VRE), two important human pathogens. Occurrence of multidrug-resistant pathogens and urgent demands for new and more potent antimicrobials place such natural products at the center of the attention for the development of new antibacterial agents.

There is clearly a continued need to develop new therapeutics that will be effective against such biological threats for the following reasons: (a) to combat against the development and use of pathogens engineered to be resistant to “standard” antimicrobials, and (b) to overcome the possibility that the widespread use of “standard” antimicrobials in the event of real or perceived acts of bioterrorism will result in the development of microbial flora resistant to “standard” antimicrobials. This will lead to the reality that infectious diseases, including life-threatening ones, will no longer respond to known antimicrobials.

### **The Potential:**

Marine organisms have been shown over the past 10 to 20 years to be the source of a range of new chemical structures with novel therapeutic activities. Of great relevance to this proposal is the observation that filter-feeding invertebrates such as sponges are extremely prolific sources of new anti-microbial agents. This is undoubtedly due to the fact that such organisms concentrate large amounts of bacteria as they filter sea water for sustenance. Thus, for such filter-feeders to survive, they must produce a potent chemical defense to provide protection against these marine bacteria. Each species of sponge produces its own chemical defense. In effect, we aim to harness the active chemicals used in a sponge’s defense during “coral reef chemical warfare” that have evolved over millions of years, and use these therapeutically to protect human life against the threat of bioterrorism. Sponges and other filter-feeding invertebrates have produced some of the most potent natural products known to science, and this resource is therefore an outstanding source of new antibacterial compounds.

### **The Plan:**

We propose to “mine” Florida’s marine biota to discover new antimicrobial compounds that can be used to treat infections arising from bioterrorism attacks. This proposal aims to identify antimicrobial agents present in marine organisms that have the potential for inhibiting microorganisms that are potential/real agents of bioterrorism. Thus, the proposal described in this document leverages the significant resources of FAU’s Center of Excellence and Scripps Florida toward the discovery/development of new medicines active against threats of bioterrorism.

The general research plan involves:

1. *Collections of marine invertebrates.* We have established a “library” of over 100 organisms that will be used for this project. To ensure a robust program, we will add 200 organisms to this collection each year. Collections will be made primarily by SCUBA, allowing scientists to collect with minimal impact to the reefs. We will also use an ROV (remotely operated vehicle) to collect organisms at depths down to 2,500 ft. This will provide us with access to organisms that have never been studied and are expected to provide great diversity of bioactive natural products. Our collections will focus on Florida’s coastal waters, thus allowing for the controlled development of one of our state’s greatest natural resources.

2. *Phase I screening of a "library" of natural product extracts from collections of marine macro- and micro-organisms from Florida's coastal waters and surrounding areas.* Extracts will be fractionated using a new paradigm in natural products chemistry developed by one of our scientists. The fractions will be tested for antibacterial activity using a variety of methods such as the microbroth dilution technique, disk diffusion assays and, to a lesser extent, agar dilution methods.
3. *Phase II screening of "hits" from Phase I.* Fractions that are found to be active in the initial screening will be subjected to a bioassay-guided purification and the resulting pure compounds subjected to an expanded antimicrobial screening. We anticipate that 150 fractions will be screened each quarter and expect to select ca. 20 pure compounds for the expanded screening.
4. *Development of sustainable production methods of "actives" from Phase II.* One critical issue in the development of natural products as therapeutics is the matter of their supply. One of the strengths of our program is our ability to address this issue from a number of different approaches. Our team of synthetic chemists will, as appropriate, design and implement chemical syntheses of lead molecules. Here we use the latest methods to efficiently assemble the target structure. We also have the capability to develop "biological production" processes of marine-derived molecules. This can involve the cloning of biosynthetic genes into a fermentable organism or the identification of a microbe within the invertebrate source as a renewable supply of the molecule.
5. *Development of depsipeptide antibiotics.* Our goal is to develop a synthetic path to highly potent naturally occurring cyclic depsipeptide antibiotics and their analogs. We will employ solid phase peptide synthesis in combination with combinatorial chemistry approach to elucidate structure-activity relationships and to find new potent compounds of this class. Given the 20 amino acid building blocks, even small cyclic peptides offer enormous diversity and potential for design and development of new and more potent antibiotics. This approach will permit us systematically to screen hundreds of millions to billions of peptides for the identification of optimal peptide(s) active against multi-drug resistant bacteria including *B. anthracis*, VRE and MRSA. The most active cyclic peptides will be synthesized, fully characterized and the nature of the interaction with their bacterial target and their therapeutic potential will be elucidated. The information gained from this research will help us to further exploit cyclic depsipeptides potentials as lead compounds for the development of new and more potent antibiotics.
6. *Optimization of drug properties.* Some of the lead compounds identified from the above Phase II screening or synthetic depsipeptides may not have ideal drug properties. The goal of medicinal chemistry is to optimize such properties using our extensive experience and expertise in this area. Thus, a natural product lead compound, though stable in *in vitro* assays, may be metabolically unstable *in vivo*. It may not have sufficient solubility or bioavailability necessary for successful drug development. More important, the initial lead may possess undesirable side effects that need to be eliminated or minimized. Medicinal chemists will identify these liabilities, design and synthesize new analogs to address the issues while maintaining the antimicrobial activity of the lead. The successful outcome will be novel, safe and effective antibiotics that are economically feasible to manufacture.
7. *Development of a "Medicines from the Sea" outreach program.* In our current global climate there are many threats to national health and security, including agents of bioterrorism. The general populace is not well educated about such issues or well positioned to understand evolving scientific research endeavors and make informed voting decisions. The mission of our outreach program is to radically improve scientific literacy in all age groups using the enticing theme of "medicines from the sea" as a means of engaging our audience. Emphasized are activities designed to advance interest and invite participation in marine science and biotechnology as the research frontier with tremendous potential for impacting quality of life for generations to come.

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**Name of Project:**                    **Secure Free Space Quantum Communication Technology:  
QKD with Orbital Angular Momentum Photons**

Appropriations Bill:                    Defense  
Department/Agency:                    DARPA/CCIT  
FY 2008 Request:                        \$1,200,000  
Previous Appropriations:                None

**Project Description:**

This project will directly support the Coherent Communications, Imaging and Targeting (CCIT) Program that, in part, will utilize new advances in digital diffractive optics to provide powerful new capabilities for secure communication up-links. The goal of this project is to integrate a new quantum optical technology into existing command, control and communication operational systems. In particular, we propose to use the high-dimensional Hilbert space of orbital angular momentum (OAM) photons to substantially increase the bandwidth while simultaneously decreasing the fidelity threshold of the quantum communication channel as compared with the use of the 2-dimensional space of photon polarization. The novel feature of quantum communication is that it absolutely neutralizes the ability for enemy eavesdropping, and the novel feature of this project is the utilization of the vast number of quantum states of the OAM photons. Our approach will allow at least a hundred-fold increase in communication bandwidth or information flow rate over more traditional techniques. Such a quantum communication system is well within the scope of current technology: in fact similar approaches are even being explored commercially in Europe. The wide applicability of such a technology can deter identity theft from financial communication systems, aid in homeland defense counter measures, provide maximally secure communication channels for U.S. drug enforcement agencies, and provide ground-to-space and ground-to-ground transfer of secure cryptography keys for defense communications.

New capabilities can now be achieved by utilizing recent advances in electro-mechanical optical super-mirrors (known as spatial light modulators, or SLMs) as well as holographic wave front control being developed under the Joint Technology Office. These SLMs allow for seamless transfer or hands-off digital radar target acquisition data. The high data-rate optical communications project will exploit the characteristics of SLMs to dynamically generate OAM quantum states of photons. Using SLMs to change the OAM of photons in real-time as opposed to simply modulating the amplitude of light waves allows for significant improvement in data-carrying capacity. The program will also develop system level architectures for secure free space optical communication networks. We have demonstrated digital production and sorting of these OAM photons in our laboratory in collaboration with the Air Force Research Laboratory.

Faculty members in FAU's Charles E. Schmidt College of Science have extensive experience in conducting research on all aspects of secure quantum communication and cryptography, and have close research ties with the Air Force Research Laboratory's Directed Energy Directorate. We are leveraging a multi-disciplinary, multi-College team consisting of optical experts from Engineering, quantum experts from Physics and cryptography experts from Mathematics. We have a prototype design of an OAM photon sorter operating within the Department of Physics using blazed holograms to create these unique photon states. We propose here a three-phase project to develop a tabletop OAM communication demonstration and the eventual integration of an OAM communication system with the AF's Starfire Optical Range facilities.

**Phase 1 Goal:** *Create, manipulate and sort OAM states produced from a Gaussian laser beam using SLM technology in a laboratory setting at FAU and at the AFRL.*

**Phase 2 Goal:** *Produce a tabletop demonstration of quantum communication utilizing OAM states of single photons.*

**Phase 3 Goal:** *Integrate our arrangement into the SOR facilities in coordination with the AF and DoE and assess the potential for DoD-wide field deployment.*

*This project provides unique educational outreach and training opportunities for our students. The collaboration between the AFRL and Florida Atlantic University (FAU) will enable the training and recruitment of advanced students and postdoctoral fellows in this field of free space quantum communication and quantum optics. The FAU Department of Physics has an established graduate program and currently supports the research of more than 22 Ph.D. students. The Physics Department has numerous students conducting research at government laboratories. In addition to the training of students in this free-space communication area, the Department of Physics proposes, under this effort, to provide a set of courses to be presented to scientists at the AFRL, LANL, and to FAU students utilizing our distance learning facilities. We have already begun such a program with LANL, and it is the top thrust area in the Academic Plans for our College. These courses will be on (1) An Introduction to Quantum Information and Communication, (2) Advanced Topics in Quantum Optics: Orbital Angular Momentum States of Photons and their Applications. Florida Atlantic University is a distributed campus university with campuses in six locations along the Treasure Coast, and it is considered a minority institution by the government (NIH Score Proposal). It has developed, and is continuing to develop, an extensive program in distance learning. One of the seven strategic goals for the University is to support modern classroom and distance learning technologies and teaching techniques. This proposal will leverage University funding in this area and provide tangible recruitment and distance learning training to the AFRL.*

Following the guidelines of the DARPA's CCIT program, the AF, Army, and DoE's current activities in Quantum Key Distribution (QKD) and free-space quantum communication projects, FAU, in collaboration with researchers from the AFRL, proposes to utilize spatial light modulators and integrated electronics, with pixel flatness of fractions of a wavelength, 98 percent fill factor, eight bits of phase resolution and ten micro-second response time to help in the development of target acquisition and hand-off to SLM arrays. In this area, FAU's primary responsibility will be to develop a concept for unambiguous resolution and detection of OAM states, conduct computer modeling of OAM quantum state manipulation, and design prototype tabletop laser transmitters and receivers. With the facilities at SOR, we will integrate our technology to develop a prototype system with high-speed parallel electronics and demonstrate ground to space communication links and Adaptive Optical (AO) restoration of the spatial wave front coherence properties of these states. The Secure Free Space Quantum Communication Technology using Orbital Angular Momentum Photons is managed by a project director and three senior faculty members; one is responsible for the theoretical and computational modeling, and the other for the optical experimentation. The director of the project assumes overall responsibility for the project, and the three faculty contacts will be responsible for its day-to-day operation.

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<b><u>Name of Project:</u></b>	<b><u>Study of Catastrophic Disasters and Population Displacement</u></b>
Appropriation Bill:	Labor/HHS/Education
Department/Agency:	Public Health Improvement and Leadership
FY 2008 Request:	\$2,500,000 (\$7,500,000 for 3 years)
Previous Appropriations:	None

**Project Description:**

State and county policies have focused primarily – and rightly – on short-term and localized displacement triggered by disasters. However, Hurricane Katrina made it clear that we may now be entering an era of long-term and long-distance displacement. The State of Florida is poorly equipped to address the relocation, land development, infrastructure, and market problems associated with widespread long-term displacement.

The Federal Emergency Management Agency (FEMA) announced the allocation of up to \$400 million dollars in competitive grant funds to the states of Florida, Alabama, Mississippi, Louisiana and Texas, which were impacted by the hurricane season, for an alternative disaster housing pilot program(s). This type of construction focus lacks a factual basis about the magnitude of the disaster-related housing displacement problem in Florida. Specifically, there is a clear need for a comprehensive examination of populations predisposed to displacement, dilemmas associated with providing long-term but temporary housing, and state-level policies for housing, emergency assistance, planning, and land development. No one has done this type of comprehensive pre-assessment.

In light of these challenges and clear gaps, we are proposing a multi-year initiative that will achieve the following:

- Estimate the magnitude and nature of the potential displaced-persons problem in the State of Florida, using indicators drawn from earlier studies of vulnerability as well as indicators specific to housing and policy conditions. Year one (1) will focus on hurricane events. Future years will focus on human-made disasters;
- Survey households as a means of estimating their willingness to return to a disaster site after a long forced absence, as opposed to resettling permanently elsewhere;
- Assess how existing local and state-level policies associated with housing, emergency assistance, planning, and land development enhance or reduce vulnerability and displacement; and
- Create and launch an interactive clearinghouse to disseminate a comprehensive matrix of housing, population and socioeconomic indicators and comparative maps of displacement potential.

**Beneficiaries and Future Funding Prospects**

Beneficiaries of this research span state, county and local agencies involved with emergency management, homeland security, disaster planning, evacuation, sheltering, mental health infrastructure planning and housing reconstruction. Not only will this research seek to remedy defects in current policy approaches, it will also look ahead at factors likely to affect future events.

The proposed initiative will generate numerous useful products in a variety of formats, including:

- Measures and definitions of long-term displacement due to natural and human-made events, and the political, economic, and social factors that can affect long-term displacement and housing ;
- A displacement index that can be used for estimating the housing impacts of hurricanes and other types of disasters;
- Survey results from household decisions to evacuate, resettle and return to the disaster area;

- A checklist of items that should be considered during the mitigation, preparedness and recovery phases of emergency planning for planning and emergency-management practitioners;
- A checklist and color maps of “problem spots” that should inform pre- and post-disaster funding needs assessments and coordination; and
- An interactive map, indicators and index Internet clearinghouse.

This project requests funding to launch and complete this unique and comprehensive population displacement initiative. Beyond project funding, this initiative will be sustained financially on its own merit from public and private sector sources and from other states wishing to conduct similar detailed studies.

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<b><u>Name of Project:</u></b>	<b><u>Technologies for Law Enforcement</u></b>
Appropriations Bill:	Commerce, Justice, Science
Agency/Account:	Bryne Grant
FY 2008 Request:	\$3,000,000 (\$9,000,000 over three years)
Previous Appropriations:	None

**Project Description:**

Incidents of computer crime are rising at an alarming rate, and they involve more and more sophistication in terms of the technologies used. As a result, the burden of performing proper forensics on information systems is switching from law enforcement to include corporate IT and information security professionals. This project will focus on research, simulation, and evaluation of various technologies, systems, and tools for law enforcement, training, and education. The project team will consist of researchers from two departments at FAU, the Computer Science & Engineering, and Criminology & Criminal Justice Departments, and researchers from the Boca Raton Police Training & Professional Development Center. The project will unite federal agencies, academia, and industry to solve problems related to law enforcement. This project will be linked directly to a new training facility, The International Center for Leadership & Development, which will provide a venue designed to equip future leaders with skills that will ensure the safety of communities, states, and nations. The City’s initial investment of \$22 million in the enterprise will create an environment that will be open to public safety professionals all over the world.

Research topics, which will be the part of this project, include:

**Cyberforensics Institute (or Lab)**

We aim to create an infrastructure to support the education and training of criminal justice students and practitioners in the Southeastern and Southern Florida areas in the domains of cyberforensics and digital evidence. Specific areas of training will include: computer hardware, software, and networks; forensic analysis of computer hard drives to preserve the viability, integrity, and legitimacy of evidence; encryption; critical infrastructure and homeland security threats stemming from cybercrime; protection of evidence on physical and removable media; legal issues involving the collection; preservation, and presentation of evidence in court; nuances of the environment of cyberspace; procedural requirements that must be followed related to computer crime investigations; interpretation of the technological details of the crime commission; and cooperation and collaboration issues across jurisdictions.

**The Etiology of Computer Crime – An Exploratory Study**

Practitioners and scholars throughout history have identified certain causative and correlative elements that play a role in the manifestation of traditional crime. Following the identification of such predictors of crime, law enforcement has been able to enact policy to bring about positive societal change by mitigating their influence on the phenomenon.

**Identity Theft and Internet Fraud Awareness and Education**

Identity theft and Internet fraud in the form of “phishing” continues to be a rampant problem in Florida, and anecdotal evidence points to tremendous victimization among South Floridians, who are disproportionately older, less technologically savvy, and wealthier than other demographic groups. This population has not been completely satisfied with how local law enforcement has responded to their complaints of identity theft and phishing. In order to best serve them and attract and maintain their symbolic and substantive support, informed strategies are required to 1) increase awareness of Internet frauds and scams, 2) promote familiarity with technical solutions they can implement on their desktop, and 3) improve the relationship between law enforcement and this population so the latter is comfortable contacting the police and has confidence in their response. This will ideally be

accomplished through focus groups, training seminars, and easily integrated desktop-based software solutions that can be rolled out to this user-base on auto-install CD-ROMs co-developed, branded, and approved by FAU and local agencies.

### **Courtroom of the Future**

The new training facility will house traditional classrooms as well as specialized rooms where new technologies may be explored. This “courtroom of the future” will be equipped in such a way as to provide a venue for such innovative training as: Training sworn officers and civilian personnel in criminal case testimony; Training sworn officers and civilian personnel in civil case testimony; Training court administrators in merging advanced technology with courtroom management; Training expert witnesses by using enhanced technology to better present expert opinions; Training civil practice attorneys in the use of enhanced technology in the courtroom; Training prosecutors in the use of enhanced technology in the courtroom; and Developing an awareness among jurists and training jurists in the potential for trial enhancements through advanced technologies.

### **Mobile Video Technologies for Law Enforcement**

This project will research and develop technologies to enable law enforcement officials to carry out their duties safely and effectively. The key elements of the system are: 1) wearable cameras on officers that record the events during law enforcement activities, 2) mobile video units in vehicles that receive and process the video from the wearable camera, and 3) video servers and services available at headquarters locations. The key challenges in each of the areas are related to (a) wearable camera and communication units, (b) mobile unit operation, and (c) headquarters units.

### **Biometrics for Secure Networks**

The training center will benefit from the availability of an extensive range of biometric services including integration strategy, IT system design, procurement support, design and integration. Our faculty takes an integrated view of biometrics, looking at the aspects of operations that affect and are affected by biometric capabilities. A sound understanding of organizational requirements, biometric technology, standards and compatibility issues is the foundation for successful implementation.

### **The 3D Imaging and Video Technologies**

In this part of the project we will investigate and develop techniques, technologies, and algorithms needed to create and analyze 3D images and 3D videos provided by multiple cameras, with a specific focus on homeland security applications.

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