

**NASA University Research Centers**  
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 Project Manager: Katrina Emery  
 Dryden Flight Research Center  
[www.nasa.gov/education/urc](http://www.nasa.gov/education/urc) 661-276-5807

**PROJECT DESCRIPTION**

The University Research Centers (URC) are multi-disciplinary scientific, engineering and/or commercial research centers at host universities from Minority Institutions (MI). URCs provide a broad-based, competitive NASA-related research capability among the Nation’s MIs that foster new aerospace science and technology concepts. Designed to expand the Nation’s base for aerospace research and development, URCs provide mechanisms for expanded participation by faculty and students of MIs in mainstream research, and increase the number of underrepresented and underserved U.S. students obtaining advanced degrees in NASA-related fields. URCs are collaborative Centers conducted in cooperation with NASA’s Mission Directorates and NASA Centers, substantially contributing to NASA’s space and aeronautics goals and objectives.

The first competition for URC was held in Fiscal Year (FY) 1991 open only to HBCUs. It resulted in five-year awards to seven universities designated as NASA HBCU Research Centers. A second competition for new awards, open to both HBCUs and Other Minority Universities (OMU), was held in FY 1995, resulting in five-year awards to four HBCUs and three OMUs designated as Minority URCs. Shortly thereafter, the HBCU Research Centers and the Minority URCs were formally combined into a single program, with the two sets of awardees designated as Group 1 and Group 2, respectively. In FY 1996, Group 1 URCs were invited to propose for a second five-year period. After extensive reviews, all seven Group 1 URCs were awarded a second five-year term. In FY 2000, the Group 2 Centers were renewed for a second five-year period after extensive reviews. In FY 2002, eleven awards were made to Group 3 URCs (four HBCUs, four OMUs and three Group 1 URCs were renewed for four years). By the end of FY 08, seven new awards were made as Group 4 URCs and in FY 09 another solicitation was announced and 6 new URCs were funded.

University Research Center	Group and Year				
	1	2	3	4	5
Institution	1991	1995	2002	2008	2009
Alabama A&M University		x			
California State University, Long Beach					x
California State University, Los Angeles			x	x	
City College of New York			x		
Clark Atlanta University	x		x		
Delaware State University					x
Fisk University	x				
Florida A&M University	x				
Florida International University				x	
Hampton University	x		x		
Howard University	x			x	
Morehouse School of Medicine		x			
Morgan State University			x	x	
Norfolk State University			x		
North Carolina A & T University	x				x
North Carolina Central University					x
Prairie View A&M University		x		x	
Southern University			x		
Tennessee State University		x			
Texas Southern University			x	x	
Tuskegee University	x		x		
University of New Mexico		x			
University of Puerto Rico, Mayaguez		x			
University of Puerto Rico, Rio Piedras			x	x	
University of Texas at Brownsville			x		x
University of Texas at El Paso		x			x

**PROJECT GOALS**

The overall goal of the URC project is to continue NASA’s commitment to achieving a broad-based, competitive aerospace research and technology development capability at MIs that will

- Expand the nation’s base for aerospace research and development by fostering new aerospace research and technology development concepts;
- Develop mechanisms for increased participation by faculty and students at MIs in the research programs of NASA’s Mission Directorates; and
- Increase the numbers of undergraduate and graduate degrees awarded to U.S. citizens from MIs in NASA-related fields.

The specific objectives for URCs are to:

- Establish significant, multi-disciplinary scientific, engineering, and/or commercial research centers at the host university that contribute substantially to the programs of one or more of the four NASA Mission Directorates described in the NASA Strategic Plan;
- Move increasingly towards gaining support from sources outside the URC project by aggressively pursuing additional funding opportunities offered by the NASA Mission Directorates, industry, and other funding agencies; and
- Improve the rates at which U.S. citizens, who historically have been underrepresented in NASA-related fields, are awarded undergraduate and graduate degrees at their respective universities in NASA-related fields.

## **PROJECT BENEFIT TO OUTCOMES**

**Outcome 1:** Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goal through a portfolio of investment. Although the URC supports all of Outcome 1, the project is specifically designed to contribute to Objectives 1.1, 1.2, and 1.5 and addresses the associated measures of output.

**Objective 1.1 Faculty and Research Support** Objective: **(Employ)** Provide NASA competency-building education and research opportunities for faculty, researchers, and post-doctoral fellows.

### **Objective 1.2 - Student Support**

Objective: **(Educate)** Provide NASA competency-building education and research opportunities to individuals to develop qualified undergraduate & graduate students who are prepared for employment in STEM disciplines at NASA, industry, & higher education.

### **Objective 1.5 – Targeted Institution Research and Academic Infrastructure**

Objective: **(Employ)** Improve the ability of targeted institutions to compete for NASA research and development work.

## **PROJECT ACCOMPLISHMENTS (FY 10 DATA)**

During FY10 the URC project has made significant progress toward developing core expertise capability while increasing student production at the graduate and undergraduate levels in fields that contribute to NASA's mission. Below are select few accomplishments for FY10.

One significant accomplishment is the number of URC-Affiliated NASA Student Ambassadors competitively selected. NASA Student Ambassadors are undergraduate and graduate interns and fellows the agency engages in NASA science, technology, engineering and mathematics, or STEM, research and interactive opportunities. Selected students represent 33 states and 81 universities from across the nation. NASA managers and mentors nominate the recipients from the hundreds of interns and fellows engaged in research and education opportunities across the agency. The NASA Student Ambassadors initiative further recognizes exceptional students. Twenty-six (26) URC-Affiliated students have been selected as NASA Student Ambassadors since the beginning of the program. This number represents 10 of the 13 currently funded projects. Fifteen (15) students were selected this year.

### **California State University, Long Beach**

The Center for Human Factors in Advanced Aeronautics Technologies (CHAAT) became a NASA University Research Center for human factors' research and training in October 2009. It was established to expand its research on the human factors' impacts of new automation tools and air traffic management (ATM) concepts being developed for the Next Generation Airspace Transportation System, also known as NextGen, and to meet the increased demands for human factors' and other STEM professionals having expertise in areas relevant to NASA and other aerospace organizations. In our first year of operation, we made substantial progress toward meeting our objectives with respect to research and workforce development, despite significant challenges created by the current budget problems being encountered in the State of California. Our research-specific objectives are aimed at validating measures of operator performance, developing measures of operator situation awareness and workload, and using these measures to assess NextGen function allocation strategies, training needs and interface design requirements. From our first year activities, we will have presented two papers at the *29th Digital Avionics Systems Conference* on these topics and published these in the Proceedings. We have also completed two book chapters based on CHAAT work. One chapter (Vu et al., in press) describes the differences between pilots and air traffic controllers in terms of task goals, training and information requirements and the impact of changing responsibilities for separation assurance. The other chapter (Strybel, in press) is a description of task analysis tools that will be used in subsequent CHAAT projects for eliciting training requirements and interface design guidelines. Our workforce-specific objectives are to grow the Masters Science Human Factors Psychology (MSHF) Program at California State University Long Beach, and to increase the participation of underrepresented students in MSHF and CHAAT. Despite the significant challenges that have arisen because of current budget reductions from the State of California, CHAAT was very active in promoting its program and discipline during the first year of operation. Two internship programs were established and run in this first year. *The CHAAT Summer Undergraduate Research Program* exposed undergraduates from CSULB and elsewhere to CHAAT and the MSHF program. *The Engineering Girls Internship* was designed to inspire middle-school girls to pursue human factors and STEM careers.

CHAAT associates were very active in publicizing MSHF, the discipline of human factors and STEM aerospace careers. As a result of these activities, we have made significant progress in meeting our goals regarding program growth. In fact, the current number of active students in the MSHF Program will be at its highest level since its inception in 2005.

- California State University, Long Beach hosted the **5th Annual Regional Human Factors Conference**. Drs. Strybel and Vu publicized CHAAT and human factors during Fall 2009 and Spring 2010.
- With CHAAT support, PSY327, "Introduction to Human Factors," an interdisciplinary undergraduate course in human factors was offered in Spring 2010 by Dr. Strybel.
- A CHAAT-funded *Engineering Girls Internship* took place June 20-26th. This program was established to educate and inspire students to pursue careers in human factors' and STEM disciplines. Ten middle school interns (who will enter the 8th grade this fall) spent one week on campus and participated in 15 engineering/research workshops. They also attended field trips to the port of Los Angeles and the Long Beach Airport. The program was designed and led by Dr. Vu and CHAAT Associates Dr. Marayong and Ms. Gossage. Moreover, faculty and staff from the College of Engineering volunteered their time to provide engineering workshops (see Appendix I for a list of workshops and activities.) CHAAT Associates Ms. Lily Gossage and Dr. Pannada Marayong, along with CHAAT COO Dr. Vu, submitted, and subsequently won, a proposal in response to a NASA MUREP Small Projects Opportunity. PI Gossage and Co-PI Marayong took 30 fifth-grade girls from elementary schools in Long Beach with high minority enrollment to visit the *Kennedy Space Center* to attend NASA education forums, participate in hands-on activities, and experience a tour of the center.

#### **California State University, Los Angeles**

In 1994, the NASA Institutional Research Award (IRA) program established the [SPACE Laboratory](#) at CSULA for the design and fabrication/assembly of a testbed resembling the complex dynamic behavior of a space segmented reflector telescope. In 2001, the Multidisciplinary Flight Dynamics and Control laboratory ([MFDC Lab](#)) was established using funds provided by Air Force Office of Scientific Research. Current areas of research at MFDC Lab include: Intelligent Flight Control, Uninhabited Air Vehicles (UAV) Development, Wind-Tunnel Testing and Validations, Optimization of Combustion and Propulsion Systems, Bio-derived Liquid Fuel and Solid Propellant Development, Hypersonic Flight Control, and Supersonic Combustion. Effective 2003, the SPACE and MFDC Laboratories compose the NASA University Research Center, SPACE. Twelve million dollars have been allocated by NASA to support the research activities at SPACE until the year 2014. Develop state-of-the-art computing tools and techniques for modeling, control and simulation of high-performance and unusual aircraft of the future such as air-breathing hypersonic flight vehicle, variable geometry aircraft, reusable launch vehicles, and uninhabited aerial vehicles. Design a testbed resembling the complex dynamic behavior of a space telescope. Train students to a NASA research development environment to prepare them for a future employment and motivate them towards graduate studies. During the funding period 2009-2010 the SPACE Center supported a total of 56 students. 27% of students are female and 79 % are minority students.

#### **Delaware State University**

The project's goals and objectives are: (1) To establish a NASA-URC Optical Sciences Center for Applied Research (OSCAR) and integrate it with the Center for Research and Education in Optical Sciences and Applications (CREOSA) funded through the NSF-CREST, (2) To conduct research that is centered on three main topics: (i) Planetary Science, (ii) Space Communications & Navigation, and (iii) Astrobiology to support the goals of NASA's Exploration Systems Mission Directorate (ESMD), the Science Mission Directorate (SMD) and the Space Operations Mission Directorate (SOMD), (3) To develop optical instrumentations for space operations infrastructure; space atomic clock and optical gyroscope, polarimetric laser detection and ranging (LADAR), and an augmented reality visor interface for human-robot interactions and emergency medical support of astronauts, (4) To conduct research and the development of Mars exploration using ChemCam Mars Rover LIBS instrument, and a remotely-operated laser scanning confocal microscope for in situ analysis of extraterrestrial environment, (5) and To work in close collaboration with Goddard Space Flight Center (GSFC), NASA/NSSTC Astrobiology Laboratory, and Jet Propulsion Laboratory (JPL), Los Alamos National Laboratory (LANL), Northwestern University, and industry partner, Juxtopia® on various projects. During year 1 of the project October 1, 2009- September 30, 2010, the following activities were performed to accomplish the year 1 goals:

- Hosted NASA Grant Kick-off Meeting on 11/9-10/2009 and invited all collaborators to attend the meeting in person or by teleconference at Delaware State University
- Ordered supplies and equipment needed for various projects
- Finalized sub-award agreements for the collaborators
- Hired one graduate student for year 1 of the grant and an undergraduate student for the academic school year of fall 2009 and spring 2010 to set-up laboratory experiments, and conduct research
- Hired 11 undergraduate students and 1 high school student to participate in the summer research program at CAOSS, DSU for the period of June 1- July 31, 2010
- Hosted a collaborative 2010 Summer Research Symposium at the Martin Luther King Student Center at DSU on 7/29/2010 with the Center for Integrated Biological and Environmental Research (CIBER), Center for Research and Education in Optical Sciences & Application (CREOSA), Delaware Experimental Program to Stimulate Competitive Research (EPSCoR), Ronald E. McNair Post-Baccalaureate Achievement Research Program (McNair), Research Engineering Apprenticeship Program (REAP), NSF-Research Experiences for Undergraduates (REU), and Science and Mathematics Initiative for Learning Enrichment (SMILE)

Experiments related to various projects are being conducted at CAOSS and other collaborating research laboratories. Much of the research on these projects is at its infancy. Some of the works done so far have been published in referred journals/conference proceedings. Bryan Greenly, a Physics major, was offered the opportunity to participate in a semester-long internship at the NASA Langley Research Center, in the Nondestructive Evaluation Sciences Branch. This came following completion of a 10-week summer internship with the LARSS (Langley Aerospace Research Summer Scholars) Program. One of nearly 200 interns who attended the program over the summer, Bryan will continue working on the project he began with his mentor, Dr. William C. Wilson, an electronics engineer: writing programming that will facilitate automating wireless microsensor research for the Integrated Vehicle Health Management (IVHM) Project – a major, multi-faceted project at NASA. He spent the fall 09 term at Langley, and resumed studies at DSU during Spring semester 2010. (While at DSU, Bryan is involved in research on laser-induced breakdown spectroscopy.)

#### **Florida International University**

*WaterSCAPES: Science of Coupled Aquatic Processes in Ecosystems from Space* is a NASA Group 4 University Research Center (URC) based at Florida International University under a FY2008 Cooperative Agreement Notice. This URC focuses on an integrated set of research and education activities centered on the coupled interaction between the hydrologic cycle and vegetation dynamics at the scale of ecosystems, analyzing the spatial and temporal changes of this interaction and determining the influence of these changes on water cycling, vegetation structure, biomass dynamics and biodiversity. The focus of *WaterSCAPES* is motivated by NASA's Science Mission Directorate fundamental question: *How is the Earth changing and what are the consequences for life on Earth?*, and specifically seeks to address the stocks and fluxes of water, nutrients and vegetative biomass through a quantitative approach that combines remote sensing observations (radar and optical), mathematical modeling of ecohydrologic processes and field ecophysiological experiments. The overarching scientific objective of the proposed URC is to develop a quantitative understanding of how wetland ecosystems are changing over time and space.

Being in Miami, FIU is already engaged with one of the largest underrepresented student populations in STEM fields in the US, so diversity in science and engineering in our country is expected to be highly favored by this URC.

This report documents the progress of the *WaterSCAPES* URC activities during the Year 2, of activities. The key activities that have been completed can be summarized as follows:

- *Research Projects:* five research projects have been initiated in the Florida Everglades, and a total of twenty (20) students were recruited to work on these projects as part of their degree requirements at FIU.
- *Education Activities:* A new graduate course in *Ecohydrology* was offered in the Fall 2009 semester at FIU. A new graduate course in *Remote Sensing in Hydrology* was offered in the Spring 2010 semester. A new graduate course in *Surface Hydrology* has been developed and will be offered in the Academic Year 2010-2011.
- 5 FIU students participated in summer internships at NASA-Goddard on June 1, 2010. The intern cohort this year was composed of three (3) doctoral students and two (2) undergraduate students.

- *Outreach Activities:* We have designed a web site for the *WaterSCAPES* URC, and have initiated an outreach campaign consisting of periodic newspaper columns, presentations to local schools and the general public. We also organized and conducted a STEM competition event for high school students in the greater Miami area that took place on February 20, 2010.
- *WaterSCAPES* has established a series of performance metrics system to assess the performance of the URC, using quantitative information that aggregate into key indicators of research and education activities. Quantitative performance under these indicators has been obtained in the different areas of evaluation and corresponding performance metrics.
- During Year 2, twenty two (22) peer-reviewed scientific journal publications have been published as a result of the research conducted by the URC team members and students; a number of additional publications are in preparation.
- Six (6) research proposals have been submitted to other agencies for funding to complement and further strengthen the research and education activities that are the subject of the *WaterSCAPES* URC. These proposals have been submitted to the National Science Foundation, the Interamerican Development Bank and NASA 9IDS Program).

### **Howard University**

Howard University is leading a transformation of the atmospheric sciences -- a discipline where minorities who have been traditionally underrepresented, will become acknowledged academic leaders and scientists in the field. Producing scientific leaders and experts requires an advanced graduate program that engages students in research on the vanguard of the discipline.

The Howard University Beltsville Center for Climate System Observation (BCCSO), a Group 4 NASA University Research Center at Howard University, is playing a pivotal role in assisting Howard's unique program to establish the capacity to make sustainable research contributions that are valuable to NASA Science Mission Directorate's (SMD) long-term goals and in helping to provide a diverse well-qualified workforce to achieve those goals. To that end, BCCSO leverages a talented cadre of atmospheric science, physics, chemistry and engineering faculty that have been assembled at Howard and important partnerships at NASA Goddard Space Flight Center and other universities. As a result, BCCSO is met its second year research and educational goals. As reported within key accomplishments include:

- Support of two intensive field campaigns at the Howard University Beltsville Campus directly relevant to BCCSO science goals. These studies integrate multiple sensors to achieve objectives within multiple BCCSO science goals. For example, coordinated upper air soundings, lidar observations (Wind, Raman, and Micropluse), flux measurements, and radiometer measurements during the 2010 support objective in atmospheric composition, GPM, etc.
- Progress on scientific investigations leading to publications. A number of publications are under development in each of BCCSO's areas of study.
- Progress on implementation, planning and coordination of proposed research goals.

For example:

- Collaborations with The Pennsylvania State University (PSU) on atmospheric composition have leveraged a set of observations that will enhance this area of study for BCCSO.
- Successful leveraging of funds to enhance power at the site to accommodate multiple mobile NASA lidars.
- Proposal by the local FOX television to provide funding for software and equipment to better enable integration of the FOX C-Band Doppler at the site in research.
- Hosting a successful undergraduate summer internship program, where ten interns worked directly with our Principal Investigators, Howard University faculty, and collaborators on proposed BCCSO research projects.
- Support of two summer interns from The Pennsylvania State University to conduct research under the direction of Dr. Jose Fuentes (Subawardee).
- Support of eight graduate students one of whom completed his PhD in May 2010 and are now employed as a BCCSO postdoctoral fellow.
- Recruitment of four graduate students admitted to the Howard University Graduate School of Arts and Sciences with focus in atmospheric science, electrical engineering, and chemistry. Two of the four students participated in our 2009 summer internship program.

### **Morgan State University**

- Dr. Carl White of Morgan State University was the recipient of the 2010 Faculty Research Award established by the NASA Office of the Chief Information Officer. His work with NASA's Minority University Research and Education

Program, which ultimately supports NASA's Space Operations Mission Directorate role in supporting NASA's Space Mission Directorate and Earth Science Mission Directorate missions, has been recognized as outstanding by the NASA Office of the Chief Information Officer. The Faculty Research Award seeks to recognize University Faculty Members using innovation in their NASA-related research.

- URC student Richard Carr and Dr. James Whitney presented at the Committee On Space Research (COSPARs). The Scientific Assembly of the Committee on space research is the biggest interdisciplinary conference on space science worldwide. The 38<sup>th</sup> Assembly will take place in the beautiful Hanseatic city of Bremen. From 18th to 25th July 2010, 2,500 participants are expected to join this international event taking place in the Fair and Congress Center Bremen.

### **North Carolina A & T University**

The Center for Aviation Safety (CAS) was envisioned after the key principles stated in the National Aeronautics R&D Policy report prepared by the Presidential Council of National Science and Technology in which NASA, FAA, DoD and other related agencies participated. Among the seven key principles, aviation safety and education are the two key elements. The aviation safety belongs to NASA's Aeronautics Research Mission Directorate (ARMD) while the education belongs to all directorates of NASA. The goals of the CAS is to understand the fundamental problems and challenges of the aviation safety and develop new materials, models, tools and technologies for safe operation of aviation system, while providing quality education to produce world-class aerospace engineers. Aviation safety is a complex subject, it spans from human safety to vehicle safety including many complex issues. The specific challenges that are addressed in the CAS are: damage tolerance and durability of composite structures, lightning control and mitigation, radar signal communications; icing and deicing, fire and toxicity, vehicle health management, airflow hazards (wind shear, microburst, turbulence), and combustion and alternate fuels. These challenges are addressed through three research tasks: (1) Advanced Composite Materials and Structures, (2) Integrated Vehicle Health Management, (3) Advanced Aeromechanics and Propulsion and one educational task: Aerospace Engineering and Outreach. Accomplishments during the first year are: (1) Established many new laboratories (Thermal Characterization, Bio Fuel Laboratory, Icing Laboratory), (2) Procured and test verified new equipments (High Speed Imaging equipment, Digital Image Correlation System, Thermal Characterization FlashLine 2000, upgraded GC-MS and Elemental Analyzer), (3) Recruited 26 UG and graduate students and engaged them in aviation related research, (4) Initiated or continued research in Advanced Composites and Structures, Integrated Health Management of Vehicles, and Aeromechanics and Propulsion, (5) Published five journal articles, 14 conference papers and 33 presentations at conferences and other media, (6) Several faculty members involved in Ph.D. committees of international institutions and (7) Cosponsored international conference on composite materials (<http://www.ICC-CFT2011.com>). The unique technology developed during the first year is the development of compression test specimen for foam type materials (carbon foam). In addition, the center conducted one short course and High School Apprenticeship Program in collaboration with ARO in the summer of 2010. The center leveraged NASA funding with other funding from DoD and private agencies to enhance the research activities, engaging additional students and mentor them. The number of students supported by non-NASA funding is equal in number. The center convinced A&T to provide in-kind support to research and educational activities through partial financial support for equipment and equipment maintenance and laboratory space. CAS initiated partnership with NC Central University and two community colleges in NC for both educational and technical collaboration. The center plans to continue the proposed research and educational tasks with additional collaborations from industries and international institutions. The research initiated in Year-1 is expected yield more quantifiable results in the following years in terms of technology, students graduation and their placement and additional enhanced activities.

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#### **North Carolina Central University**

The objective of the NASA University Center for Aerospace Devices Research and Education (NASA-CADRE) at NCCU is to provide a framework for broadly based, competitive, multidisciplinary science and engineering research that will advance NASA Science Mission Directorate (SMD) programs. CADRE leverages newly developed experimental techniques and predictive computation methods to meet confluence of needs in the scientific community and industry for advanced sensing systems based on novel materials and device architectures. Intra- and inter-institutional collaborations (NASA Ames, NASA Glenn, NASA Goddard, Jefferson National Laboratory, UNC, NCSU, Duke and Cornell University, Wake Technical Community College, Durham Technical Community College, and IBM) advanced by the center will further develop a research infrastructure able to address some of the most important questions in modern astronomy, physics and materials science. The research focus on the following projects: 1) Development of nanoscale materials for advanced optoelectronics devices - high efficiency photovoltaic cells and infrared photodetectors (project leader M. Wu); 2) Development of a new type of polarimeter for high-energy gamma-ray astrophysics - a powerful new instrument for addressing fundamental physics of astronomical sources (project leader B. Vlahovic) ; 3) Development of a novel neutrino detector and nuclear astrophysics research - it will lead to new physics and nuclear astrophysics discoveries (nuclear reactions in the Sun, stars formation) by allowing the detection of previously unobservable interactions of neutrinos with matter (project leader M. D. Markoff); 4) Development of an original highly sensitive and selective type of biochemical sensor that will advance biochemical detection capabilities and NASA exploration mission (project leader J. Sexton); 5) Development of cooperative autonomous intelligent mobile robotic systems which are important for all NASA missions and NASA Mission Directorates (project leader A. Tokuta); and 6) Seed projects: a) Modification of amorphous solar cell material by laser irradiation; and b) Control of optical propagation by metallic nanostructures, which can improve coupling of light into optoelectronic devices (project leader Y. Tang). In the last year, CADRE has been awarded 12 grant awards \$2,765,313, 53 Peer Review Publication, and 44 Conference Presentations .

#### **Prairie View A & M University**

The five-year, \$5 million NASA-PVAMU Center for Radiation Engineering and Science for Space Exploration (CRESSE) remains on track with forward-looking research to merge new materials and technology into innovative radiation shielding systems that will help protect critical scientific and electronic instruments, and keep astronauts safe from harmful radiation during future human and robotic missions in deep space.

The CRESSE mission as a National Aeronautics and Space Administration (NASA) University Research Center (URC) is to utilize its core intellectual, academic and physical infrastructure to thoroughly investigate the scientific and engineering challenges of space radiation that acutely impact the national efforts to someday safely return scientists, engineers and explorers to such space destinations as near earth asteroids (NEAs), Mars and beyond.

Through December 2013, the Center's prime objectives focus on leading-edge radiation research to discover new shielding materials while educating students through research and course content with studies critical to NASA's diverse workforce needs. CRESSE research is directly applicable to reliability issues relating to space flight instrumentation and to astronaut health and safety during future NASA missions. CRESSE research involves experimental and theoretical radiation modeling studies that utilize particle accelerator facilities at:

- NASA Space Radiation Laboratory (NSRL) at Brookhaven National Laboratory,
- Proton Synchrotron at Loma Linda Medical Center, and
- Los Alamos Neutron Science Center (LANSCE) at Los Alamos National Laboratory.

Currently, the CRESSE research goal concentrates on the development of multiple testbeds designed to simulate planetary surfaces so that realistic space radiation experiments can be created on Earth using proton and neutron beam facilities throughout the country.

CRESSE research also has the potential to significantly impact on other high profile areas including medical, national defense, homeland security and energy production. Studies and lessons learned hold promise for future collaborations with the National Institute of Health, the Department of Energy, the Nuclear Regulatory Commission and the Department of Homeland Security.

CRESSE researchers represent some of the nation's foremost scientists in the fields of:

- Space Radiation Environment Modeling,
- Radiation Transport Modeling,

- Space Radiation Instrumentation and Dosimetry,
- Space Radiation Effects on Electronics, and
- Micro-composite Fabrication Using *In Situ* Materials.

Researchers are charged by NASA with providing relevant and reliable data on radiation dosimetry, shielding, modeling and its long-term effects on space vehicle electronics. These experiments are intended to increase the Technical Readiness Level (TRL) of new instruments that measure radiation NASA Center for Radiation Engineering and Science for Space Exploration 2 fields in environments of prime interest to NASA.

CRESSE's educational goal deals with the training of students in radiation engineering and science with the objective of increasing and contributing to the pipeline of underserved minorities qualified to step confidently into the aerospace workforce. The Center ultimately intends to support three doctoral, twelve masters and approximately 20 undergraduate researchers, augmented by other PVAMU researchers and collaborating departments.

The research goal includes the maximization of the *Technical Readiness Level (TRL)* of radiation instrumentation for human and robotic missions, optimizing the return value of CRESSE for NASA exploration. The outcomes and knowledge enhance a variety of science and engineering disciplines vital for the safety and reliability of future space exploration missions that could be negatively impacted by the various space radiation environments.

- CRESSE researchers led by Dr. Gersey processed and analyzed parts of the data set taken by investigators during the June NSRL experiments and used the data to develop presentations for the COSPAR 2010 Scientific Conference in Bremen, Germany in July.
- Dr. Saganti presented two invited papers as part of the 7th Annual Asia Oceania Geosciences Society meeting in Hyderabad, India in July, a session that followed his presentation at the 21st Annual NASA Space Radiation Investigators' Workshop at Port Jefferson, NY in May. At the 2010 COSPAR International Conference, Dr. Saganti served as scientific organizer and co-convenor for the Planetary Science Session and chaired the PS-07 session at the same gathering.
- Six PVAMU Mechanical Engineering students took part in the NASA Lunabotics Mining Competition as their Senior Design Project in the 2009-10 calendar year. The May 2010 competition was designed to promote the development of interest in space activities and in STEM academic fields. PVAMU was the only team from a Historically Black College and University participating in the competition which featured 29 registered teams.
- The award announcement for the National Science Foundation's Center of Research Excellence in Science and Technology (CREST) was made, making official the funding for Dr. Aghara's Center for Energy and Environmental Sustainability (CEES) at Prairie View A & M University.

### **Texas Southern University**

When space shuttle Atlantis STS-129 launched, it carried a flight experiment developed by students of Texas Southern University in Houston to study how microbes grow in space. NASA's Office of Education selected Texas Southern University as a 2008 University Research Center to establish a Center for Bio-nanotechnology and Environmental Research. Undergraduate and graduate students at the center developed NASA's University Research Center Microbial-1 experiment to evaluate the morphological and molecular changes in *E. coli* and *B. subtilis* bacteria. BioServe Space Technologies at the University of Colorado is providing management support and hardware for the experiment as part of the STS-129 space shuttle mission on November 16, 2009. Each component of the experiment was designed for easy reproduction in the classroom, providing hands-on experience to students. CBER faculty, scholars, and fellows in collaboration with faculty from TSU's Department of Education and Center for STEM Education and Outreach developed workshops based on the URC Microbial-1 flight experiments for K-6 and 7-12 students as well as pre-service and in-service teachers. This space shuttle flight experiment was a proof-of-concept model for the URC project designed to give students real-world space flight experience. The URC Microbial-1 experiment provided the university students the opportunity to design, monitor and execute the study in laboratories, as well as near real-time on the space shuttle. Social Media led by NASA CBER fellows and scholars will be utilized throughout the flight experiment to provide real time status of experiment and student experiences. A webcast will be held from Kennedy Space Center featuring the URC Project Manager, TSU's President, 2 CBER Students and the Principal Investigator <http://dln.nasa.gov/dln/content/webcast/> CBER scholars and fellows presented flight and post-flight experiments during the regularly scheduled CBER Seminar Series.

### **University of Puerto Rico, Rio Piedras'**

The Center for Advanced Nanoscale Materials (CANM) is an interdisciplinary and multicampus research and education University Research Center (URC) partnership project between NASA and the University of Puerto Rico. CANM-NASA-URC brings together thirteen researchers from three different campuses and four different departments to work on research projects relevant to NASA in collaboration with NASA Glenn Research Center (GRC), NASA Ames Research Center (ARC), and Jet Propulsion Laboratory (JPL), in areas that correspond primarily to the Exploration Systems Mission Directorate and secondarily to the Aeronautics Research Mission Directorate. CANM is making a strong contribution to the objectives of the NASA Education portfolio assigned to URCs: Faculty and Research Support, Student Support, and Targeted Institution Research and Academic Infrastructure. CANM is improving the ability of three Hispanic-serving institutions strategically distributed across the Jurisdiction to enhance their research competency in areas of relevance to NASA and compete for NASA research and development work. The research that is undertaken by CANM is organized into four Interdisciplinary Research Groups (IRGs) aligned with the NASA Vision for Space Exploration: Life Support Systems; Advanced High Energy Materials; Non-Carbon Based Sensors; and Carbon-Based Sensors and Bio-Sensors. A mechanism has been implemented to advance the evolution of research projects along the Technology Readiness Level (TRL) scale from TRL 1 to 3 in coordination and collaboration with NASA and JPL scientists. Projects reaching TRL 3 will be jointly evaluated to determine whether they merit to be developed into TRL 4 and above by transferring them to a NASA Center or JPL. Innovation, testbeds, and commercialization are being fostered by CANM, while supporting students and faculties research projects. *This year the CANM had a total of 48 participating students (undergraduate and graduate students, 58% female). Nine Graduate Students are in NASA Research Centers this summer; five at NASA Ames Research Center, two at NASA Glenn Research Center, one at NASA Langley Research Center, and one at JPL. Two patents, 45 publications, and 37 presentations have been the outcome of the CANM during this last year.*

### **University of Texas at Brownsville**

The major goals of the Center for Gravitational Wave Astronomy project are:

1. To expand the research focus of the CGWA to include an experimental program concentrating on LISA instrumentation while maintaining current research excellence in astrophysics, data analysis, and radio astronomy.
2. To support undergraduate and graduate students through stipends and scholarships to increase representation of local and minority students in NASA-related fields.
3. To maintain and enhance current outreach programs to encourage regional high school students to pursue higher education degrees in NASA-related fields.

Significant progress has been achieved regarding **goal 1**: Since the approval of the grant a competitive, state-of-the-art research facility for precision metrology using optics and interferometric techniques has been created. A former classroom was remodeled and renovated to provide a more than 1200 sqft working and research environment. This optics laboratory is on the brink of being fully operational. It holds two clean-room environments with optical tables in a laser safe environment. Lasers, measurement devices like network analyzers, oscilloscopes, etc. as well as precision optics 1064nm laser await their application for the proposed research topics. Additionally UTB administration approved the creation of two new tenure-track faculty positions in the CGWA and the department of Physics and Astronomy.

After a worldwide search two excellent candidates have accepted offers to join UTB: Prof. Gianpietro Cagnoli, a world renowned experimentalist in gravitational wave detection who is currently at the INFN in Florence Italy, and Prof. Karen Martirosyan currently at the University of Houston, who is an expert in material science. They will both be participating in the experimental efforts related to LISA instrumentation. Concerning goal 2 the CGWA has extended its support for undergraduate and graduate students. It has created the CGWA scholars program incorporating more students at the undergraduate level.

Regarding goal 3 this last year has seen a significant increase in the educational and outreach efforts as evidenced in the quality and quantity of activities sustained by the CGWA as evidenced in the educational and outreach report.

2010: (NSF CREST in 2007, URC Group 5 2009); 16 faculty members: 12 in Physics & Astronomy, 2 in CS, 1 in Mathematics, 25 undergraduate and 20 graduate students supported; More than 50 articles and papers p/year published.

### **University of Texas at El Paso**

The first year of work under the cooperative agreement with NASA has been productive in terms of both education, inspiring interest in science, engineering and math, as well as the technical progress to deliver valuable research data and bodies of

knowledge in propulsion and ISRU. The ascent from the previously established Combustion and Propulsion Research Lab (CPRL) to the Center for Space Exploration Technology Research (cSETR) required a systematic change in operations and management. As such, the first quarter of the year saw the hiring of a research manager and student coordinator, and the formation of pivotal policies and processes that will guide operations of each objective in cSETR. These policies included project management, data management, codes of conduct, safety and quality assurance. Some of these policies have been attached as appendices for reference. The Center leveraged off these standard processes to establish 16 tasks under the ISRU and Propulsion effort. cSETR employs an average of 34 students per semester sponsored by NASA. That is in compliment to other fund sources (Department of Energy, Department of Defense, Aerospace Industries) that combine to well over twenty research projects and an average of over 60 students totaling the Center. Half of those students are graduate or doctoral students and each has been able to attend workshops, lectures and visit external sites to broaden their understanding of aerospace sciences. Regarding broadening of horizons, cSETR research assistants provided their time and effort to ignite interest in science and engineering in the local community and schools. cSETR staff also made visits and presentations to local schools, participated in University programs focused on K-12, gave tours and presentations at the laboratories of cSETR, and similar activities for elementary to graduating high school students. The Center also sponsored an essay contest that resulted in middle school students being rewarded with a visit to NASA WSTF.

The first year of the research conducted at cSETR has been split between literature studies, design efforts and preliminary experimentation. The design phases of many apparatuses will allow experimentation in the future and also provide a solid base for sustainability and capacity building. Examples of this infrastructure include a two stage ejector and vacuum chamber to allow for continuous testing at simulated altitudes, an optically accessible microcombustion chamber and many other exciting and empowering structures. The research itself was not all design however, as cSETR has successfully assessed the equations of state, transport properties, and thermo-physical properties for methane and will use that assessment in the experimentation and setups to follow. The ISRU projects have also progressed, not only in literature and image surveying / review, but preliminary experimentation. For instance, initial use of photosynthesizing bacteria did not show significant leaching of Lunar or Martian Basalt in initial experimentation and will allow the group to redirect subsequent inquiries to assess bioleaching and biosequestration.

Capping this effort is the curriculum and programmatic development of a master's program in aerospace engineering and the successful establishment of a doctoral program in energy science and engineering. This will allow for more graduate students to learn, compete and become contributing members of the aerospace and energy fields. This effort is a parallel compliment to the workshops, lectures and other learning opportunities that cSETR and NASA have been able to provide.

The first year effort of cSETR has been productive in establishing standard processes and operating procedures to ensure personnel safety, data integrity and overall good stewardship of the NASA investment in a growing and underrepresented workforce. cSETR plans on instituting the next phase of operational efficiency, which is a continuous improvement program. The Center has already impacted the lives of over 70 students and contributed to the inspiration and future building of countless others.

A quick recap of the cSETR efforts with regard to the threefold objectives are as follows:

**Goal 1: Advance research in non-toxic propulsion and in-situ resource utilization (ISRU)**

- o The Center has actively engaged in over 20 research projects, with NASA contributing or solely sponsoring 16 of those projects.
- o The research is progressive but also fundamental to development of a body of knowledge in propulsion and ISRU that will be valuable to the scientific community and future aerospace applications.
- o The infrastructure being developed and built during the first year of effort will allow for experimentation under the currently proposed scope of work and for future applications and research as well.
- o cSETR has been in active contact with leading aerospace entities like NASA WSTF, Jacobs Technology, KyuTech University (Kyushu, Japan), and Boeing, among others. cSETR has also met with its External Advisory Board (comprised of leading personnel in some of the most prominent aerospace companies).

**Goal 2: Inspire, excite, and engage undergraduate and graduate students, especially those from underrepresented groups, in the study of aerospace sciences**

- o The Center has thus far contributed to the employment of over 70 students.
- o NASA through cSETR actively sponsors an average of 34 students per semester.
- o Of the NASA sponsored research assistants, over 80% are from underrepresented groups.
- o cSETR sponsored or participated in numerous local school visits, University outreach programs, tours and similar activities in the promotion of science, engineering, math and aerospace sciences.

**Goal 3: Build sustainable research capacity and infrastructure in aerospace sciences**

- o cSETR is putting personnel and policies into place to contribute to sustainability by maintaining standard best practices, data integrity and safety assurance.
- o The Center is actively developing testing apparatus, infrastructure and knowledge bases that will support future sustainability as well as present initiatives.
- o The University is funding renovations to the laboratories to make them more modern, reconfigurable and modular. This will further advance the sustainability of the laboratories through capability building and modernization.
- o cSETR has active and funded projects from a variety of sponsors, including Department of Energy, Department of Defense, Department of Education and industry task orders from Jacobs, Lockheed Martin and Boeing to compliment the investment NASA has given. The fund diversification contributes to sustainability, as well as the broadening of experience.

**PROJECT CONTRIBUTIONS TO PART MEASURES**

**Outcome 1.1 Faculty and Research Support-** Minority institutions can compete more successfully for the best and brightest faculty and students and as a result position themselves to supply NASA with a cadre of qualified researchers to address the needs of human resources at NASA and at other scientific organizations currently and in the future. Faculties at MIs are better able to participate in advanced research opportunities that enhance their teaching capability in STEM related areas and support the teaching-learning process.

**Outcome 1.2 Student Support-** Research opportunities at the MIs allows the institutions to recruit more aggressively talented students from high schools and undergraduate universities to matriculate at MIs to pursue and complete undergraduate and graduate degrees in STEM disciplines.

**Outcome 1.5 Targeted Institution Research and Academic Infrastructure-** Increased support from sources outside of the URC project assist with the sustaining of research activity at the host institution with NASA, other federal agencies and industry.

The URC project funded 13 Institutions a total of \$13 million dollars in FY 2010. As a result, the following accomplishments were made:

URC Indirect Participants		14,399
URC Direct Supported Participants		657
Employed by		
NASA		12
Aerospace Industry	38	
STEM Academia		102
STEM Industry		6
Non STEM		8
New Courses Developed		48
Students Reached in New Course	5,535	

**IMPROVEMENTS MADE IN THE PAST YEAR**

- Two mechanisms are employed to review the progress for each awarded URC. First, a NASA Technical Review Committee (TRC) composed of representatives from the NASA Mission Directorates and NASA Centers. The NASA Technical Monitors have primary responsibility for assembling technical experts throughout NASA and chair the TRC. The TRC will be responsible for conducting a site visit and review annually, ensuring that the project goals are being met, advising the URC on technical requirements, facilitating the flow of information between the URC and NASA, and promoting greater involvement of URC personnel in NASA activities. Secondly, annual reports, which include key performance metrics, are required. The improvement this year pertained to standardizing the site visit review schedule and process for all URC site visits.

## **PLANS FOR FY 2011 (Select)**

### **ANNUAL PROJECT DIRECTOR'S MEETING**

NASA URC will host its 2011 Project Director's meeting February 7-9, 2011 at Morgan State University in Baltimore Maryland. The Project Director's meeting will provide pertinent information regarding NASA's mission and programs, as well as highlight URC success, best practices and lessons learned. URC Project Directors' and their colleagues, NASA scientist and engineers will attend and give presentations.

### **STUDENT LEADERSHIP SERIES (SLS)**

The design of URC allows for a wide diversity of students to become student leaders, not just those serving in traditional leadership roles. The Student Leadership Series (SLS) is a competency-building education and research opportunity designed for URC scholars. SLS will train and prepare students for entry into the professional STEM community and help to expand research opportunities within their sphere of influence. SLS seeks to train and motivate students to develop and/or strengthen their communication and leadership skills, ultimately resulting in increased research conference participation leading to improved research presentations and scholarly publications.

Student leaders enrolled in STEM disciplines within any of the URCs will complete monthly online course modules, participate in training and research-based webinars, and engage in research dialogue that contributes to the STEM body of literature **at least once per semester** (preferably outside of the host institution). In doing so, students are expected to be able to speak from the facts and research-based knowledge about STEM education.

### **PROFESSIONAL DEVELOPMENT OPPORTUNITIES**

URC students have previously participated and are strongly encouraged to continue participation in professional meetings and/or conferences. (ie the International Astronautical Congress).

**The 62<sup>nd</sup> International Astronautical Congress in Cape Town, South Africa** - NASA URCs have announced its intent for URCs scholars to participate in the 62nd International Astronautical Congress (IAC) and requests that full-time graduate students attending its HBCUs respond to the "Call for Abstracts." The IAC – which is organized by the International Astronautical Federation (IAF), the International Academy of Astronautics (IAA), and the International Institute of Space Law (IISL) – is the largest space-related conference world-wide and selects an average of 1000 scientific papers every year. The upcoming IAC will be held October 3-7, 2011 in Cape Town, South Africa. NASA's participation in this event is an on-going effort to continue to bridge NASA with the astronautical and space international community.

Student's abstracts must be related to NASA's ongoing vision for space exploration and fit into one of the following categories: Science and Exploration, Applications and Operations, Technology, Infrastructures or Space and Society.

### **PROJECT PARTNERS**

NASA research priorities are defined by the Mission Directorates—Aeronautics Research, Exploration Systems, Science, and Space Operations and implemented at the 10 NASA Centers. Each Mission Directorate covers a major area of the Agency's research and technology development efforts. All URCs have developed collaborations and partnerships with NASA Centers, universities, industry, and other government agencies when such collaborations enhance the ability of the URC to achieve its objectives, to leverage significant sources of additional funding, and/or to obtain essential services not available at the URCs home campus. Below is a select list of partners/collaborators:

- **Industry:** BAE Systems, Boeing, Northrop Grumman, Southern California Edison, Space Systems, LLC, BioServe Space Technologies, Juxtopia, Draper Lab
- **Academia:** University of California, Irvine (UCI), University of Southern California (USC), Rice University, University of California, San Diego (UCSD), University of Houston-Downtown (UHD), Pasadena City College (PCC), Glendale Community College (GCC), University of California Santa Cruz, Norfolk State University, Texas A & M University, Jackson State University, Stanford University, University of Colorado, Boulder, CO, Northwestern University

- **Government:** NSF, NOAA, USDA, Los Alamos National Laboratory (LANL)
- **NASA Affiliated Labs/Centers:** 10 NASA Centers and JPL, NASA/NSSTC Astrobiology Laboratory , NASA Flight Deck Display Research Laboratory (FDDRL), Space Center Houston
- **Organizations/Other:** STEM Women of Color Conclave, San Jacinto College on Black Male Initiative, Harris County Crime Lab, SECME, Howard University Weather Camp (WC)