University Research Centers
FISCAL YEAR 2007

Narratives

URC
City University of New York City College
New York, NY 10031

Center for Optical Sensing and Imaging

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PROGRAM DESCRIPTION
The mission of COSI is to develop methods and instruments for sensing and imaging of the earth and environment and to attract and train underrepresented U.S. citizen minority students in related science and engineering disciplines.
The scientific and technological objectives of COSI include development of optical techniques and instruments (for both in-situ and ground- and satellite-based remote applications) for:

- Atmospheric and ocean Remote Sensing monitoring
- Detection of vegetation and land cover and measurement of the temperature of ocean waters
- Development of lasers and detectors for use in remote sensing and optical communications
- Sensing microorganisms (e.g., bacteria) in the environment.

The Center initially brought together the teams of two major existing NASA institutional programs at CCNY: NASA IRA (Tunable Solid State Lasers) of the Institute for Ultrafast Spectroscopy and Lasers (IUSL), and NASA PAIR (Remote Sensing and Environmental/Climate Studies) of the International Center for Environmental Resources and Development, (ICERD) to form a complementary multi-disciplinary University Research Center.

PROGRAM RELEVANCE TO NASA
The program of the NASA URC CENTER FOR OPTICAL SENSING AND IMAGING (COSI) is relevant both to NASA's Science Mission Directorate, and to NASA's Education initiative

PROGRAM BENEFITS TO SOCIETY
The NASA COSI URC brings state of the art research capabilities to bear on important environmental concerns that are of critical importance to the nation and indeed the world, and in the process of doing so, promote the education of underrepresented minority students, primarily at the graduate level in science and technologies of interest to NASA and the nation, and is in support of NASA's Education Initiative. The research, which is in support of NASA's Science Mission Directorate, with a focus on Earth Science, is aimed at the development of enabling technologies and techniques which will permit more effective monitoring of the environment in the air, ocean and land. These technologies, while having stand alone capabilities and advantages, also, most importantly, serves to enhance the planned and existing satellite capabilities developed by NASA. It is important to add that the COSI has also played an important role in contributing to the renaissance of the City College, which is an important Other Minority University (OMU) and Hispanic Serving Institution (HSI) as a powerhouse of societal beneficial research, and as an educational resource which provides an important stepping stone for many minorities to become a truly well trained technical workforce of benefit to their communities and the nation. The Center has also enable CCNY to expand its efforts in training and graduating minority US students in the sciences and engineering by establishing a strong research, educational and outreach program to recruit, retain, mentor and train students.

PROGRAM GOALS
The mission of COSI is to develop enabling-optical-technologies, tunable laser instrumentation and methods for sensing and imaging of the earth and the environment as well as to recruit and train underrepresented minority students at the graduate, undergraduate and high school levels and to interact and/or collaborate with NASA Scientists.

The research covers two broad topics encompassing a number of projects:

- Imaging, Light Sources and Detection, and
- Optical Remote Sensing of Land, Atmosphere and Ocean

PROGRAM ACCOMPLISHMENTS
The NASA Center for Optical Sensing and Imaging (COSI) at the City College of New York was established with a mission to develop enabling optical technologies, instrumentation, and methods for optical sensing and imaging in support of current and future NASA missions for Earth and Space exploration, as well as, to attract and train U.S. citizen students in science and engineering disciplines at both the graduate and undergraduate levels with emphasis on hands-on technical training in research programs for underrepresented minority students of Hispanic and Afro-American background and thus help prepare the next generation of scientists and engineers in NASA related fields. In its fourth year of operation, COSI has continued to realize significant achievements in support of these aims in both Research and Education.

Research:
Development of cutting edge technologies in Optical Sensing and Imaging,

with significant developments in Optical remote sensing techniques, including lidars for monitoring the earth and its environment in the atmosphere and oceans; and in Imaging, and new types of lasers and detectors in support of NASA missions and needs.

Remote Sensing in support of NASA Missions:

- Development of a 5 Channel backscatter/Raman LIDAR system for aerosols and cloud profiling and CALIPSO validation.Calibration techniques for the 1064nm Lidar Channnel.Cloud Optical Depth and S (lidar) ratio analysis
- Extension of our dynamic LIDAR polarization discrimination technique for S/N improvement to a dynamic mode for wider application to scanning LIDARS.
- Exploitation of our polarization discrimination techniques for separation of fluorescence and scattering components, their characterization as function of coastal water constituents, and their impact on MODIS Chlorophyll product
- Improved land reflectance modeling using MODIS.

Other achievements include:

- 103 publications, 57 conference presentations, 1 patent granted + 5 patents (pending)

COSI also collaborates with industry and major NASA contractors such as Lockheed Martin, Northrop Grumman, Raytheon

STUDENT ACCOMPLISHMENTS

Education training and outreach accomplishment:

COSI has also gone a long way toward meeting goals for training underrepresented minority students for future participation in NASA related fields.

COSI accomplishments in the last four years include:

- Recruitment of 34 Ph.D., 24 Masters, and 35 undergraduate students,
- 4 PhD, 9 MS, and 15 Bachelor students have successfully graduated.

- Initiated three outreach programs:
  The NASA COSI Photonics Training Program (PTP)
  The NASA COSI Pilot Program, and the
  The NASA-COSI and DoD-CNP High School Summer Program

  These programs have provided hands-on training over the last four summers to 76 High School and 12 Middle School students. (Including up to HS summer 2007 program participants students for summer 2007)

- A special day entitled 'The NASA/DOD Research Day Event at CCNY', in which special keynote speakers and scientific celebrities are invited to address our students and the college community. This event along attracts around 400 students ranging from middle school to college.

- Steinway Intermediate School 141Q was encouraged to apply and won the NASA Explorer School award distinction, becoming the second explorer school in NYC.

- -NASA GSFC - NYCRI Scholars had the opportunity to conduct research under the mentorship of COSI researchers, and under the Cooperation of Dr. Frank Scalzo, Education Program Specialist for NASA GSFC at GISS.

- NASA STARS middle school students at the Mott Hall Middle School had the opportunity to participate in research during the entire academic year, under the cooperation of Ms. Susan Herzog, Mott Hall middle school teacher.

- Two students from the Harlem Children Society had the opportunity to join COSI HS Summer participants in an effort for collaboration and outreach.

PICTURES (none)

URC

University of Puerto Rico Rio Piedras Campus

San Juan, PR 00931

Center for Nanoscale Materials

Dr. Carlos Cabrera
(787) 764-0000

PROGRAM DESCRIPTION

The Center for Nanoscale Materials (CNM) was formally created on January 2003, thanks to a $6M Grant from the NASA-URC program. The mission of the CNM is to foster NASA-relevant nanotechnology research in Puerto Rico. This Center includes ten professors, from the Departments of Chemistry and Physics, eleven graduate and undergraduate students, and five postdoctoral fellows. The research topics of the Center are: Nanoscale Dielectrics for Super Capacitors (Cluster 1 Leader: Dr. Ram Katiyar), Nanostructured Materials for Flat Panel Displays (Cluster 2 Leader: Dr. Gerardo Morell), Nanoscale Materials for Regenerative Power Systems (Cluster 3 Leader: Dr. Carlos R. Cabrera). Through the CNM graduate and undergraduate students are being trained in Nanotechnology concepts, research and trends.

The main objectives of the CNM are to: (a) perform cutting-edge research in Nanotechnology focused around exploration mission-enabling technologies, (b) create a center for the exchange of ideas with NASA research centers in the field of nanoscale materials for fuel cells, displays and high-density energy storage devices, (c) to be the Puerto Rico nexus for drawing students into nanotechnology areas relevant to NASA, from graduate education to entering the scientific workforce, and to create the grounds for spin-off companies that contribute to the National Space Exploration agenda. The focus of the CNM is on the synthesis, characterization and applications of nanoscale materials that will contribute to NASA's mission and vision.

The CNM is fostering strong collaboration with the NASA's Research Centers (e.g. Glenn Research Center and Ames Research Center), Argonne National Laboratory, Purdue University, Cornell University, University of Massachusetts at Amherst, and the high tech sector.

The CNM is currently working with a non-cost extension from NASA. During 2008, the CNM will be submitting a proposal to NASA to extend the areas of research of the Center to include areas such as Li-Batteries, Gas Sensors, and Biosensors. Therefore, the CNM will be geared to develop advance materials for enabling technologies to NASA. The CNM will be the host of ADVANCE MATERIALS FOR ENABLING ENERGY AND SENSOR TECHNOLOGIES.

PROGRAM RELEVANCE TO NASA

The Center for Nanoscale Materials is working on the synthesis and characterization of nanostructured and nanophase nanomaterials that are of relevance to NASA's exploration mission. The focus is mainly on high-density energy storage, robust compact displays, and efficient fuel cell systems. For high-density energy storage, nanostructured ferroelectrics and nanocrystalline diamond materials are being studied. These materials will enhance the energy storage density as well as possess better stability under the ionizing radiation and wide temperature variation conditions present in outer space. For the next generation of robust display materials, nanoscale semiconductors, nanotubes, nanocomposites, composites of liquid crystals and polymers in nanoscale porous matrices are being studied. Finally, in fuel cell components, the emphasis is on nanostructured catalysts that may increase the efficiency and stability of catalytic reactions that are integral to fuel cell systems. The development of new lighter, more efficient and robust mission-enabling devices with the nanomaterials is foreseen. Invention disclosures have been submitted and preliminary proof-of-concept devices are expected by the end of year 2008.

PROGRAM BENEFITS TO SOCIETY

The major direct societal benefit of the Center for Nanoscale Materials is on the education, training, and development of students in the area of Nanotechnology. In the outreach activities, the CNM participated on several Nanotechnology workshops given to high schools around the island. During the Summer 2006 we had the Third Nano Summer Camp with the participation of twelve high school students. This activity included workshops, field trips, and nanotechnology research. The students gave a presentation at the end of the summer program. All had a wonderful scientific and educational experience. This summer camp also features a strong collaboration with the NASA Explorer School Program in PR that helps enhance the educational experience of middle schools students and the excitement about NASA missions transmitted by the teachers. Moreover, the Center has over 20 active graduate and undergraduate U.S. citizen students working in Nanotechnology related research directly connected to exploration mission-enabling technologies. In year 2007, from our CNM funded students, 15 BS, 2 MS and 1 Ph.D. graduated. This number is expected to increase in year 2008. We also keep in sight the fact that some of these mission-enabling technological developments fostered by the CNM may eventually find terrestrial applications to help improve the quality of life of our citizens and the economic development of our Nation.

PROGRAM GOALS

The University of Puerto Rico at Rio Piedras, through the NASA-URC program, has created the Center for Nanoscale Materials (CNM) in order to contribute NASA's vision and mission. The specific areas of investigations addressed by this Center include:

- nanocrystalline thin films for high-density energy storage devices;
- nanoscale materials for robust displays; and
- nanostructured catalysts for fuel cell applications.

The focus of the research is on the synthesis, characterization and application of nanoscale materials that contribute to NASA's Mission. The NASA directorates that are directly impacted by the Center include the Science Mission Directorate and the Exploration Mission Systems Directorate. For high-density energy storage, nanostructured ferroelectric and nanocrystalline diamond materials are being studied. These materials will provide higher energy density storage capacity and more stability against ionizing radiation and wide temperature variation. For the next generation displays, nanoscale semiconductor materials, nanocomposites, and composites of liquid crystals and polymer embedded in porous matrices are being studied. In fuel cell components, the emphasis is on nanostructured catalysts that increase the efficiency and stability of catalytic reactions integral to fuel cell systems. In this Center we are using computational molecular methods and high throughput combinatorial techniques to design and maximize the efficiency of the selected processes for the preparation and screening of nanoscale materials. The CNM envisions a strong collaboration with NASA Glenn Research Center, Ames Research Center, Argonne National Laboratory, Purdue University, University of Massachusetts at Amherst, and the high tech sector. Moreover, the CNM will have a long-term societal impact by increasing the pool of underrepresented professionals who contribute to NASA's Exploration Mission and enhancing awareness, understanding and appreciation for NASA exploration endeavors among Hispanics. Ultimately, the main goal of the program is to establish in PR a world-class Research Center on Nanotechnology that supports our Nation's Space Exploration Project by delivering new mission-enabling technologies and workforce with the associated skills.

PROGRAM ACCOMPLISHMENTS

During the year 2007 the CNM has helped to establish an Institute for Functional Nanomaterials (IFN) at the University of Puerto Rico with leverage funds from NSF-EPSCoR program. The IFN in collaboration with the CNM is committed to develop an internationally recognition research cent3er focused around specific targets relevant to NASA Exploration Mission and strongly tied to NASA Research Centers. Currently, we have had over 60 graduate and undergraduate underrepresented U.S. citizen students working in our CNM laboratories and Nanoscopy Facility. The three Clusters have been very active in meeting the goals and benchmarks proposed for the year 2007. Two invention disclosures were submitted and over 60 research articles (submitted/in press/ published) including chapters and proceedings have been published in 2007 by the CNM group. Leveraging has been possible through the submission of research grants to other federal agencies such as NSF, DOE, and DOD.

On March 2007 we had our third External Advisory Board Meeting to evaluate year 2006. The report was sent to the TRC Chair and discussed with our Dean and Chancellor. In addition, on November 2007, we had our Fifth Annual Technical Review Committee (TRC) site visit. A formal presentation of the CNM was given to the TRC. These presentations included poster presentations from the students and a tour of the facilities and laboratories of the CNM. The CNM continues to give training to students and postdoctoral fellows on the use of TEM and FIB. In year 2008 we intend to double the number of hands-on users for both instruments, the TEM and FIB.

During the summer 2007 we had the 4rd Nano Summer Camp with twelve high school students. This activity included field trips, workshops, and research. At the end of the summer, the students had to give a formal power point presentation to the CNM of their summer experience and research. The Nano Summer Camp has become one of the top programs offered to high schools in Puerto Rico.

STUDENT ACCOMPLISHMENTS

Currently the CNM has over 20 graduate and undergraduate students doing research in Nanotechnology relates projects. Our students have been the instrumental part of the CNM accomplishments. They are very active in presenting their results in international and national meetings. In addition, they have been the highlight of the External Advisory Committee and the Technical Review Committee site visits. In both reports the committees acknowledge the high quality, knowledge, and professionalism of the CNM students. Every month, the students have meetings in which they present their results and projects to the CNM community. Over 20 students have taken the transmission electron microscopy workshop and have taken the Nanotechnology graduate course. The CNM students are very instrumental in the CNM Nano Summer Camp for High School Students.

PICTURES (4 images)

URC
Fisk University
Nashville, TN 37208

Fisk University Center for Photonic Materials and Devices

Eugene Collins
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PROGRAM DESCRIPTION
The Fisk University Center for Photonic Materials and Devices aims at performing research and developing technologies relevant to NASA's mission, focusing in the field of Photonics, the field of science and technology that resulted from combining the traditional fields of optics and electronics. In particular, the Center has focused its research on one of the most promising branches of Photonics' one that produces new materials or improves the production of known materials, which are the initial state of development of the latest technologies. In the past year, our research has focused on the issues of SiC surface and interface structure modification and formation of nano-structured graphitic structures using novel methods, including (a) to understand carbon nanotubes formation on SiC surface, and (b) to explore novel technique to grow metal-free carbon nanotubes on SiC. The program also seeks to motivate young people to do science by way of its outreach activities.

PROGRAM RELEVANCE TO NASA
Space exploration has very demanding requirements on materials employed by all missions. They include materials functionality, durability, stability, light weights, and low energy consumption, to name a few. Therefore, it has been and will be the high interests of NASA to find the materials which have aforementioned properties. Thus, nanophase materials will have long lasting and potential impact to space exploration which sits well with NASA's mission. One of the projects at the Materials Science and Application Group (MSAG) is the development of gamma-ray detectors for future gamma- ray space telescopes such as the Energetic X-ray Imaging Survey Telescope (EXIST) [http://exist.gsfc.nasa.gov/] that will study the phenomena of gamma-ray bursts. Other projects involve solar cell technology improvements, which have application for power sources on satellites. Finally, one of our projects will develop carbon-nanotube related devices for electronic devices that can operate in adverse environments.

PROGRAM BENEFITS TO SOCIETY
The significance of the nanophase materials research can't be over emphasized in any scientific aspect from materials science, chemistry, engineering, biology, and medicine. It has been predicted to revolutionize the society like electricity and plastic in the current society. In the next 10-15 years, this will be major impact on the economy. It will be a trillion-dollar industry and needs millions of nanoworkers in the marketplace. Virtually there is no single research institution or department without anyone performing nanoscience research and education.

Applications of the devices investigated include medicine, biophotonics, astrophysics, remote sensing, nuclear nonproliferation, homeland security and aviation safety. Collaborations with national labs, other universities and industry are benefiting students seeking summer internship opportunities. The program provides a create a pipeline leading to a Bachelors, masters or PhD degree in an area relevant to NASA's mission

PROGRAM GOALS
The goals of the program are to attract an increased number of traditionally underrepresented students, participate in research related to space science and to create a pipeline leading to a masters or PhD degree in an area relevant to NASA's mission.

PROGRAM ACCOMPLISHMENTS
The program was successful in obtaining NASA-funded projects. The graduate students supported by the Center for Photonic Materials and Devices participated in research and received degrees. Some students working in the center worked toward completing their degrees. Additionally, several papers were accepted for publication in refereed journals.

STUDENT ACCOMPLISHMENTS
Students have continued to actively participate in research relevant to space science. In addition to research, this program has an outreach component (visits at middle schools with an inflatable, portable planetarium) and a curriculum enhancement component. NASA supported GUSTO and THRUST Outreach activities during the summer 2006 for girls and boys ages 9-15 to improve skills for entering scientific fields.

PICTURES (2 images)

URC
University of Texas at Brownsville
Brownsville, TX 78520

Proposal to create a Center for Gravitational Wave Astrophysics at The University of Texas at Brownsville

Dr. Mario Diaz
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PROGRAM DESCRIPTION
The purpose of the program was to create and develop the Center for Gravitational Wave Astronomy (CGWA) at the University of Texas at Brownsville (UTB).

This center was created in January of 2003 to augment existing research activities at UTB. It has three major research focuses: gravitational wave data analysis, gravitational wave sources modeling and phenomenological astrophysics of gravitational radiation sources. This research is relevant to the NASA Space Science Enterprise of charting the evolution of the universe and understanding its galaxies, stars, and their dynamics and evolution. An aggressive management and human development strategy, including a dedicated office of student development within the center, will ensure that there is a maintained focus on the production of undergraduate and graduates students competency in disciplines related to the NASA space science strategic enterprise in particular.

PROGRAM RELEVANCE TO NASA
One of the most exciting new developments in physics is the imminent advent of gravitational wave astronomy - viewing the cosmos not with light and its electromagnetic brethren, but rather with ripples of gravity, or gravitational waves. Viewed in this way, the universe will reveal details that cannot be observed by any other means, and many of its most enigmatic constituents, such as black holes, will be amongst the most visible objects in the sky. The Laser Interferometer Space Antenna (LISA) is a proposed joint NASA/ESA mission to observe gravitational waves from a space-based platform. The mission consists of three identical spacecraft located in an equilateral triangle 5 million km on a side in a heliocentric orbit. The spacecraft carry the optical components of a Michelson-Morley interferometer, which will measure the passing of gravitational waves of astrophysical origin in the tenth of a Hertz to a tenth of a milliHertz band. A recently convened scientific panel from the National Research Council charged with a review of the NASA Beyond Einstein program determined that LISA is an original and bold mission concept which will open up an entirely new way of observing the universe with immense potential to enlarge our understanding of physics and astronomy in unforeseen ways. LISA, in the committee's view, should be the flagship mission of a long-term program addressing Beyond Einstein goals.

The research carried on at UTB's CGWA is centered on data analyses techniques and astrophysical problems that are central to LISA mission. Data analysts rely on source modelers and astrophysicists to predict features of gravitational wave signals that will allow them to be extracted from instrumental noise. Source modelers rely on astrophysicists and data analysts to guide them in modeling the sources that are most likely to be observed. Astrophysicists use source modeling and signals extracted by data analysts (or the lack of such signals) to refine their astrophysical theories. The CGWA represents research expertise in all three of these theoretical disciplines, with a focus on LISA research.

PROGRAM BENEFITS TO SOCIETY
Because UTB is a Hispanic serving institution, with a student body approximately 90% Mexican-American, by involving undergraduate and graduate students in these research activities the CGWA naturally meets the human resource development objectives of the URC program. This center is already impacting a sizable and dynamic population. More than 3.5 million people live in the 32 Texas counties of the border region, and this population is expected to double by 2030. In fact, the population in the Texas border region is increasing at twice the rate of Texas as a whole. According to the U.S. Census Bureau, the region contains three of the ten fastest growing metropolitan areas in the United States. This population is almost entirely Hispanic (Mexican-American) and therefore representative of one of the most underrepresented minorities in science and technology.

The existence of a University Research Center in physics and astronomy at UTB is playing a key role in solidifying and advancing a strong graduate program in physics.
The center will therefore not only provide the requisite resources to develop minority expertise in fields of interest to NASA, but it will aid UTB in ensuring that it has the continued ability to develop such expertise.

PROGRAM GOALS
The general goals of the program are:

- The creation of the Center for Gravitational Wave Astronomy
- To increase the research capacity of the original group of scientists who formed the center.
- To develop a level of sustainable funding.

The goals at the research level are:

- to contribute algorithms and techniques to be use for LISA data analysis.
- to understand better the origin and evolution of certain sources (like binary compact systems) which LISA will seek to detect and study.

At the educational level the goals are to:

- strengthen science and technology programs at The University of Texas at Brownsville,
- increase the number of Hispanic graduates in basic science at the Ph.D. level,
- increase the number of Hispanic undergraduates science and technology programs and
- increase the general scientific literacy of the region, providing a fertile environment for the establishment of high tech border industries.

PROGRAM ACCOMPLISHMENTS

The program accomplishments are many and significant:

One of the most notable research accomplishments by CGWA scientists has been the development of the first complete evolution of the collision of two black holes. This is a difficult problem, which was considered one of the major challenges in the field of numerical relativity. The method developed by the CGWA numerical relativity group (Manuela Campanelli, Carlos Lousto and Yosef Zlochover) produced these results simultaneously and independently with the numerical relativity group at NASA GSFC. The result was highlighted in the 771 issue of Physics News Update (the American Insitute of Physcis newsletter).

Other very important achievement is the signature of an agreement with NASA GSFC in support of the UTB doctoral program.
The CGWA faculty has secured several grants from NASA and from NSF.
In particular we can highlight:
Dr. Jenet, a scientist at the CGWA, has received the prestigious NSF Career award. The CGWA with Mario Diaz as PI has also received the highly competitive NSF CREST award for almost $5 million dollars:
Expanding Interdisciplinary Research which will expand interdisciplinary research including scientists from the Computer Science and Mathematics department.

At he fourth Annual meeting of TAMEST (The Academy of Medicine, Engineering and Science of Texas) Dr. Diaz, CGWA director was an invited speaker in a special plenary session on our current knowledge of the universe presided by Nobel prize laureate Steven Weinberg to talk about gravitational wave astronomy.
The center has expanded from a group of originally five faculty members to fifteen scientists with faculty status. Of these twelve are fulltime tenured or tenure track faculty members from UTB and three are visiting scientists, one from Erlangen University in Germany and two from Texas Southern University, one of two Texas' HBCUs.

Center faculty, postdocs and students have presented more than fifty seminars and talks at conferences and universities in eleven states (California, Texas, Florida, Colorado, Washington, Washington DC, Pennsylvania, New Mexico, Wisconsin, Louisiana, and Michigan) and five countries (Mexico, Australia, United Kingdom, Argentina and China).
Center faculty has participated in panel reviews for NASA and NSF and served as chairs or members of international scientific conferences. Faculty and scientists from the center have visited several other institutions and attended conferences and made presentations on behalf of the center and its activities and keeping very active collaborations particularly with scientists in Germany, Australia and China.

STUDENT ACCOMPLISHMENTS

The CGWA has sustained a very successful education and outreach program. Over the past four years it has supported two dozen undergraduate students, several of whom have received B.S. degrees in STEM fields, about fifteen graduate students, ten of whom have received an M.S. in physics fields, and as stated before the first PhD in physics. What is more notable, our first Ph.D. in physics, Ms. Cristina Torres has received employment offers from several major research universities and has already accepted a postdoctoral position at CALTECH.

According to our data she is the fist Hispanic American to graduate with a doctorate in physics in Texas in the last four years.
A postdoctoral scientist Dr. Bernard Kelly who was employed at the Center immediately after his graduation (with a PhD from Penn State) and performed research in the CGWA for two years, has been hired last year as a scientist at the NASA Goddard Space Flight Center. The CGWA has also organized, for three years in a row, a Summer School in Gravitational Wave Astronomy. Every year more than thirty students from all over the country and a few from overseas have attended the program, where world class scientists have introduced advanced undergraduates and graduate students to the discipline.

The CGWA has also organized two national workshops training

undergraduate and graduate students from all over the US in grid computing techniques. In 2006 it organized jointly with Nanjing University from the People's Republic of China the first Chinese Summer School in Gravitational Wave Astronomy, which was repeated in 2007. And just a few months ago a group of students under the direction of Assistant Prof. R. Jenet started developing the first Arecibo Remote Command Center (ARCC). The ARCC is a virtual control room where researchers and students will control the world's largest single dish radio telescope at the Arecibo observatory.
The summer of 2007 the CGWA has organized the second Summers School Ambassadors program for local High School students. This past year NSF awarded a grant to support the organization of the summer school for the next three years and then the department of Education supplemented this funding to extend the number of students supported in this program.
Fifteen students have attended several national and international conferences. Five graduate students have presented papers at international conferences.

PICTURES (5 images)

URC
North Carolina Agricultural and Technical State University

Greensboro, NC 27411

The Center for Aerospace Research: A NASA Center of Excellence

Dr. Frederick Ferguson
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PROGRAM DESCRIPTION

The Center for Aerospace Research (CAR) conducts interdisciplinary research for the purpose of building engineering design tools that will lead to the effective development of the next generation of subsonic, supersonic and hypersonic aircraft and space craft. The center is currently focused on the development of numerical and experimental methods geared towards the demonstration of its capabilities. In addition, CAR computational and experimental facilities provide support to the MS and PhD students in the College of Engineering at NCAT in aero-related projects.
At the undergraduate levels, the center currently supports two faculty and 10 graduate students. In addition, it directly supports the aerospace related teaching activities in the Mechanical and Chemical Engineering Department. Through the expertise of its staff and resources, CAR currently offers four aerospace related courses. Theses courses are as follows: Aerodynamics (MEEN415), Aircraft Performance (MEEN417), Aerospace Structures (MEEN567) and Propulsion (MEEN556). In addition, CAR developed and currently maintains a senior level capstone design class; namely, Senior Aero-Design (MEEN573 and MEEN574). The Aero-Design Course is a two-semester course that concludes with the development of a remote control aircraft model that competes in the Society for Automotive Engineering (SAE) Annual Design Competition. Thanks to CAR support, NCAT students have successfully participated in the SAE Annual Aero-competition for the last six academic years.

PROGRAM RELEVANCE TO NASA

The technologies being developed in CAR are very important to the strategic interest and technological goals of the Aeronautics and Space Transportation Technology Enterprise of NASA. The Software Safety-Critical Systems project sponsored by NASA KSC in the past resulted in practical ideas that have wide applications in ongoing NASA research computational models for human factors in the International Space Station Project. Potential benefits of this research include a better understanding of the micro-gravity work-related environment and its impact on human-automated system interface. CAR has made great strides in the development of a Computational Fluid Dynamic Tools with the capability of solving a wide range of fluid dynamic related problems. This line of research in CFD will enable an accurate prediction of the behavior and design of structures under adverse conditions, which will lead to the prevention of catastrophic failure in access to space systems. In addition, CAR has developed novel configurations that can potentially serve as the baseline for the development of integrated ramjets and scramjets that can potentially be used in future single-space-to-orbit vehicle designs. In general, the results of research in propulsion have potential applications in both High Speed Civil Transportation Systems and Hypersonic Vehicle Designs. The overall outcome of CAR research efforts will enable the design of advanced controllers that will greatly enhance the safety, stability and performance of high-speed aircraft.

PROGRAM BENEFITS TO SOCIETY

CAR scientists are conducting joint research with NASA field centers, such as, Glenn and LARC, and DoD Related Labs, such as, WPAB in Dayton. CAR is also collaborating with private aerospace industries, such as Lockheed-Martin and Boeing. Over the 2007-academic year our researchers have submitted and won research proposals from Wright Patterson Airforce Base. Currently, all CAR research related projects received funding from NASA LARC and associated industrial partners to meet the following program goals:

- Increase the number of US citizens trained in the field of NASA related disciplines, placing special emphasis on diversity by recruiting women, underrepresented minorities and persons with disabilities.
- Encourage collaborations among faculty, colleges, universities, businesses, industries, and continue to strengthen the national network of faculty, colleges and universities with interest and capabilities in aeronautics, astronautics and space science technology.
- Encourage interdisciplinary research programs that are relevant to the US Aerospace Industry and promote programs in aeronautics, astronautics and space science for research, education and public service.

PROGRAM GOALS

CAR seeks to serve as a national asset, contributing significantly to the accomplishment of aeronautics and astronautics technology research, education, and public service. The center mission rests with three permanent goals that guide its program, namely,

- Goal 1. Recruit and train United States citizens for careers in the above-mentioned areas, placing special emphasis on diversity by

recruiting women, underrepresented minorities, and persons with disabilities.

- Goal 2. Encourage collaborations among faculty, colleges, universities, businesses and industry, state and federal governments, and continue to strengthen the national network of faculty, colleges and universities with interests and capabilities in aeronautics, astronautics, space science and technology transfer.
- Goal 3. Encourage interdisciplinary research programs that are relevant to the US Aerospace Industry and promote programs in aeronautics, astronautics, space science and technology research, education and public service.

PROGRAM ACCOMPLISHMENTS

The Center of Aerospace Research is proud of the following achievements:

- The Researchers of the Center have successfully partnered with six universities to form the NASA supported National Institute for Aerospace (NIA) as part of a competitive solicitation out on Langley Research Center. As a result of this effort, NCAT has developed a NASA LARC research center in high performance computing.
- The Researchers of the Center have successfully partnered with NASA LARC to start a Journal dedicated towards Research Findings in Structural Health Monitoring.
- The center has supported the graduation of over 10 PhD students in the MCEN Department over the last five years. During its December 2007 graduation ceremonies, three of the seven PhD graduates were supported either in part of fully by CAR.
- The Center has developed a Reconfigurable Computing Laboratory with support from EGLIN AFRL Funding.
- The Researchers of the Center have successfully partnered with small business to secure STTR Contracts.
- The center started the very first in-service summer workshops for High School Students and Teachers at NCAT. These workshops are now regularly supported by faculty at NCAT.

STUDENT ACCOMPLISHMENTS

The accomplishments of CAR student researchers are reflected in the number of publications and presentations made by its students over the last academic year. In the majority of the publication materials generated recently, a PhD student served as the lead author in each presentation and/or conference publication. A list of the publications generated over the last year follows:

- Frederick Ferguson, Terry L. Corbett, Jr., Stephen Akwaboa, and Haile Lindsay, The Development of Waveriders From an Axisymmetric Flowfield, AIAA 2007-847, 45th American Institute of Aeronautics and Astronautics Aerospace Sciences Meeting and Exhibit, Reno, NV 2007.
- Frederick Ferguson, Gafar Elamin CA numerical solution of the NS equations based on the mean value theorem with applications to aerothermodynamics, The 9th International Conference on Advanced Computational Methods and Experimental Measurements in Heat and mass Transfer, Wessex Institute of Technology, New Forest, UK , July 2006.
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PICTURES (none)

URC
Tuskegee University
Tuskegee, AL 36088

Center for Food & Environmental Systems for Human Exploration of Space (CFESH)

Dr. Walter Hill
(334) 727-8157

PROGRAM DESCRIPTION
CFESH is conducting research in plant growth and development, food processing and product development to provide a source of fresh palatable, and reliable food for astronauts on extended space explorations. In addition, the Center trains undergraduate and graduate minority scientists and engineers to increase and diversify the professional pool in these disciplines.

PROGRAM RELEVANCE TO NASA
CFESH has delivered key information and technologies to NASA including space flight experiments and protocols for integrated tests in cooperation with JSC and KSC.

PROGRAM BENEFITS TO SOCIETY
CFESH has provided interdisciplinary research experience for over 300 underrepresented minority undergraduate and graduate students majoring in science and engineering fields and has provided effective outreach to the public on NASA programs in partnerships with K-12 students, teachers, museums and the media. Several of our trainees are actively engaged in research and development within NASA, the aerospace and defense industries or academia.

PROGRAM GOALS
The goal of CFESH is the development and refinement of information, technology and systems for crop growth, processing, utilization and recycling that addresses the goals and education objectives defined in the NASA Strategic Plan to help achieve NASA's overall vision and mission.

PROGRAM ACCOMPLISHMENTS
Food Crops and Controlled Environmental Systems (FCE): FCE focused on salad crops and sweet potatoes. We completed response surface studies evaluating the interaction between space station level carbon dioxide and irradiance on growth of 4 carrot cultivars. Tap and fibrous root growth was influenced by irradiance, while shoot growth was influenced by CO2. We completed canopy photosynthesis studies with 4 sweet potato cultivars and both biomass and net photosynthesis increased with CO2. Gene expression profiling and the physiological role of t-zeatin riboside (tZR) were used to investigate storage root development. ZR levels from 5-45 pmol/ml were obtained. Lyophilized storage tissues had higher t-ZR compared to fresh tissues. NCC-58 had marginal t-ZR fluctuations while TU-82-155 was consistent two weeks after planting. Increase in t-ZR was delayed 2 weeks for J6-66 vs. NCC-58, while that in D-3 was low. t-ZR in TU-82-155 fibrous roots were low vs. storage roots. cDNA-AFLP technique was used on TU-82-155 and NCC-58 with 16 new primer pairs. Generated Transcript Derived Fragments (TDF) patterns of gene expression included up-regulated expression, decreased expression, transient expression and constitutive expression (house-keeping genes). Transient and up-regulated expressions are good candidates for storage root development. About 60% of the TDFs were physiologically regulated either up or down or transiently induced, while 40% were expressed constitutively. Failure of plant growth equipment is inevitable. The duration of failure will impact plant responses. Maintaining adequate food production will be the critical issue following a failure since staple and some salad crops require in excess of two to three months to produce edible biomass. A series of experiments to quantify the response and recovery of photosynthesis in two sweet potato cultivars to 14 days of darkness indicate a small positive indirect effect of darkness on net photosynthetic rates of TU-82-155 (but not NCC-58), mediated through increased stomatal conductance.

Food Processing and product Development (FPD): FPDs activities addressed two objectives relating to raw or extruded sweet potato products. Extended shelf life studies with the sweet potato cereal (RTEBC) indicate few changes in chemical or physical properties and sensory analysis was positive. Eight volatile organic carbons -alcohols, acids, aldehydes, alkanes, alkenes, esters, ether and ketones were identified during sweet potato bread baking; pullulanase and isomerase studies with the sweet potato starch syrup were completed.

Education and Outreach (EO): Scientists mentored 10 summer high school students in various research activities, and continued work on the CFESH/National Park Service/Carver Museum exhibit. We established a hydroponic vegetable project at the Bullock County (Alabama) Vocational High School with agricultural science students.

STUDENT ACCOMPLISHMENTS
Two of our graduate students published results of their research in peer reviewed refereed journals, while one under and 2 graduate published papers in peer reviewed conference proceedings of the International

Conference on Environmental Systems (ICES). Undergraduate and graduate students presented research findings at local, national or international conferences such as NCERA-101 Committee on Controlled Environment Technology and Use, Institute of Food Technologists (IFT), International Conference on Environmental Systems (ICES), International Food and Nutrition Conference, American Society for Horticultural Science (ASHS, and HBCU-UP 7th national research Conference. One graduate student, Lashelle McCoy interned in the Space life Sciences Lab at Kennedy Space Center during the summer of 2007.

PICTURES (none)

URC
Clark Atlanta University
Atlanta, GA 30314

High Performance Polymers and Composites Center

Dr. Eric Mintz
(404) 880-6886

PROGRAM DESCRIPTION

The Clark Atlanta University (CAU) High Performance Polymers and Composites (HiPPAC) Center has, with the NASA technical review committee (TRC) support, developed the infrastructure and focus necessary to carry out innovative research in high performance polymers and composites to address problems important to the aeronautics and space transportation industries. The basic research and technology results of the HiPPAC Center play a vital role in ensuring the safety, environmental compatibility, and productivity of the air transportation and space systems and in enhancing the security and economic health of our nation.

The future holds great promise for the development of strong, adhesively bonded, lightweight polymeric composite and nanostructured composite materials. Major applications are growing rapidly in the military, automotive, construction, aerospace and modern consumer markets. Thus we expect continued, vigorous, basic and applied research opportunities in the areas of emphasis of the HiPPAC Center. For NASA, in particular, the need for high strength, low weight advanced materials and structures has never been greater. There is an equally strong interest in the research areas of the HiPPAC Center in other federal agencies. High performance polymers and composites are high priority research areas of this nation's high technology global competitors. To maintain a competitive edge, the United States needs integrated research and technology centers that collaborate with their counterparts in industry. Thus, the goal of the HiPPAC Center is not only to study high performance polymers and composites, but also to affect technology transfer of these materials from the laboratory to the marketplace. Also, a major objective of the HiPPAC Center has been to increase the number of minority students earning advanced degrees in materials chemistry and physics, and engineering, thus producing professionals to meet our nation's technical manpower needs.

The HiPPAC Center has strengthened CAU's undergraduate and graduate programs in materials science and engineering and related areas in the physical sciences, mathematics, and engineering. The Center has allowed a core group of researchers and students in materials chemistry and engineering to be productive in R&D and to obtain the specialized equipment to develop a nationally competitive research and development program. The faculty of the HiPPAC Center have and will continue to leverage the NASA University Research Centers (URC) program funding by conducting productive and well-funded R&D programs.

PROGRAM RELEVANCE TO NASA

The increased demand for high performance materials for aerospace and military transportation and mission is accelerating the need to extend the capabilities of current materials systems. High performance composites are capable of providing innovative ways of satisfying these demands. Over the past decade, the CAU NASA HiPPAC Center has worked closely with its NASA Technical Review Committee to ensure that the focus and scope of the Center meet NASA goals and objectives.

The Center's research and technology program make important contributions to ensuring the safety, environmental compatibility, and productivity of air transportation and space systems. Our research efforts complement the R&D objectives of the NASA LaRC Composites and Polymers Branch and Mechanics of Materials Branch, and the NASA GRC Polymers Branch and Materials

The future holds great promise for the development of strong, adhesively bonded, lightweight polymeric composite and nanostructured composite materials. Major applications are growing rapidly in the military, automotive, construction, aerospace and modern consumer markets. For NASA, in particular, the need for high strength, low weight advanced materials and structures has never been greater. There is an equally strong interest in the research areas of the HiPPAC Center in other federal agencies. High performance polymers and composites are high priority research areas of this nation's high technology global competitors. To maintain a competitive edge, the United States needs integrated research and technology centers that collaborate with their counterparts in industry. Thus, the goal of the HiPPAC Center is not only to study high composites and electro-optical materials, but also to affect technology transfer of these materials from the laboratory to the marketplace. A major objective of the HiPPAC Center has been to increase the number of minority students earning advanced degrees in materials chemistry and physics, and engineering, thus producing professionals to meet our nation's technical manpower needs.

High performance polymers and composites are high priority research areas of this nation's high technology global competitors. To maintain a competitive edge, the U. S. needs integrated research and technology

centers that collaborate with their counterparts in industry. Thus, the goal of the HiPPAC Center is not only to study high performance polymers and composites, but also to affect technology transfer of these materials from the laboratory to the marketplace. Also, a major objective of the HiPPAC Center has been to increase the number of minority students earning advanced degrees in materials chemistry and physics, and engineering, thus producing professionals to meet our nation's technical manpower needs.

PROGRAM BENEFITS TO SOCIETY

The future holds great promise for the development of strong, adhesively bonded, lightweight polymeric composite and nanostructured composite materials LEDs and electro-optical devices. Major applications are growing rapidly in the military, automotive, construction, aerospace and modern consumer markets. Thus we expect continued, vigorous, basic and applied research opportunities in the areas of emphasis of the HiPPAC Center. There is an equally strong interest in the research areas of the HiPPAC Center in other federal agencies. High performance composites and nonostructured composites are high priority research areas of this nation's high technology global competitors. To maintain a competitive edge, the United States needs integrated research and technology centers that collaborate with their counterparts in industry. Thus, the goal of the HiPPAC Center is not only to study high performance composites, nonostructured composites, and materials for LEDs and electro-optical devices, but also to effect technology transfer of these materials from the laboratory to the marketplace. Also, a major objective of the HiPPAC Center has been to increase the number of minority students earning advanced degrees in materials chemistry and physics, and engineering, thus producing professionals to meet our nation's technical manpower needs.

PROGRAM GOALS

The HiPPAC Center research goals include development of electroluminescent and photoluminescent polymers for light-emitting diode (LED) devices that are easier to fabricate and therefore less expensive than current liquid crystal display technologies. Development of nanoscale controlled supramolecular materials for Electro-Optic and Photorefractive as well as Near Infrared (NIR) Applications. Synthesis and characterization of new high performance polymers for aerospace applications. Fictionalization of carbon nanotubes for applications in nanostructured composites. Development of methods for the Fabrication of nanocomposites by resin transfer molding (RTM) and vacuum-assisted resin transfer molding (VARTM). Development of structure property relationships and modeling and mechanical characterization of polymer nonocomposites

In addition to the research goals of the program a major objective of the HiPPAC Center has been to increase the number of minority students earning advanced degrees in materials chemistry and physics, and engineering, thus producing professionals to meet our nation's technical manpower needs.

PROGRAM ACCOMPLISHMENTS

Research at the HiPPAC Center is focused on the processing and mechanical behavior of high temperature polymeric composites, mechanical behavior of porous materials including foams and aerogels, development of polymer based nanocomposites and the synthesis of organic and polymeric materials for optical and electronic applications.

Research at HiPPAC on resin transfer molding of high temperature composites in collaboration with GRC and LaRC makes significant contributions to programs at those two centers on the development of processable resins and composites. This work will continue to be important for programs in Aeronautics (Supersonics and Hypersonics), Exploration (thermal protection systems, radiators and hot section components for Crew Exploration and Launch Vehicles) and Science (radiators and thermal protection systems). Future applications in this area include the development of materials for the Crew Exploration and Launch Vehicle programs.

A new addition to the research portfolio at HiPPAC is the development of polyimide/zeolite nanocomposites. This area is of particular interest to GRC, which has had a strong effort in the development of high temperature polymer nanocomposites for applications in Aeronautics (airframe and engine components for Supersonics, airframe components and TPS for Hypersonics), Exploration (TPS, cryotank materials) and Science (TPS, radiators) missions. In addition to GRC, this work is also of interest to JSC for use in the Crew Exploration and Launch Vehicles.

The HiPPAC Center has worked closely with NASA LaRC and GRC to understand and characterize the mechanical properties of polymer foams and polymer cross-linked aerogels. The HiPPAC has established a unique and important capability and is making significant contributions to in-house research efforts at LaRC in polymer foams and GRC in polymer cross-linked aerogels. Understanding the mechanical behavior of these materials is critical for their development for use in Aeronautics (acoustic damping, ballistic impact protection), Exploration (cryotank, habitat and EVA suit insulation) and Science (cryotank insulation). Work is also being conducted on the synthesis of ordered mesoporous silica. This work has potential applications in the development of membrane materials for the water and air purification and as gas separation membranes.

Outstanding progress continues to be made in the development of nonlinear optical dyes and luminescent materials. The development of near IR sensor dyes is of particular interest to GRC for use in biological applications. In addition, the development of materials for OLEDs is of particular interest for potential use in solid state lighting for habitats, vehicles and EVA suits for Exploration.

STUDENT ACCOMPLISHMENTS

Achievements include refereed papers and presentations at national conferences by students. Several students that conducted research in the HiPPAC Center are currently working for NASA and NASA contractors, making valuable contributions to the aerospace enterprise and serving as role models for future generations of scientists from under represented groups in science and engineering fields.

PICTURES (none)

URC
California State University-Los Angeles

Los Angeles, CA 90032

Center for Structures, Propulsion, Aerospace, and Control Engineering

Dr. Keith Moon Young
(323) 343-4500

PROGRAM DESCRIPTION

The Center for Structures, Propulsion, Aerospace and Control Engineering (SPACE), at California State University Los Angeles College of Engineering, Computer Science, and Technology was established in 2003 on a $6 million, five-year grant by NASA. This Center, the first and only NASA University Research center (URC) established on a CSU campus, studies engineering and technology challenges related to NASA's aeronautics and space exploration enterprises.

PROGRAM RELEVANCE TO NASA

The URC provides crucial support to the Aerospace Technology Enterprise efforts to develop technology bases for many of NASA's priorities by combining the College's Multidisciplinary Flight Dynamics and Control Lab (MFDC Lab) with SPACE (Structures, Pointing and Control Engineering) Lab to conduct multidisciplinary research in several areas of interest to NASA, including hypersonics, intelligent flight control, propulsion systems for atmospheric flight and space vehicles, systems unmanned air vehicles (UAV), space telescope technology, digital computation, and nonlinear modeling of complex structures.

PROGRAM BENEFITS TO SOCIETY

In addition to research and development, the URC program has devoted significant resources to educational programs that increase the number of degrees awarded to students who have been underrepresented in NASA-related fields. This is possible because CSULA is a federally designated Title III institution. In addition to Dryden Flight Research Center that is the URC's affiliated NASA center and JPL the other supporting center, there are several university and industry partners with subcontracts and/or non-cost based collaboration and partnership including the University of Southern California, California State University, Long Beach (CSULB), Boeing and Northrop Grumman.

PROGRAM GOALS

The URC makes possible the collaboration of the colleagues from the Multidisciplinary Flight Dynamics and Control Lab (MFDC Lab), and the Structures, Pointing and Control Engineering Lab (SPACE Lab). Multidisciplinary research has been conducted in several areas of interest to NASA. Such research areas include hypersonic, intelligent flight control, propulsion systems for atmospheric flight, and space vehicles, structure and pointing control, system identification of large scale decentralized systems, and digital engineering. The URC has the goal to develop students (with emphasis on minority/underrepresented) to participate in the undergraduate and graduate research with topics of interests. The URC graduates are expected to be employed in the NASA research centers and the surrounding aerospace industry.

PROGRAM ACCOMPLISHMENTS

- Design, construction, and purchase of state of the art instrumentation and data acquisition systems.
- Continuous proposal preparation for supplemental funding.
- Student initiated and developed presentations and papers submitted to nationally recognized conferences and journals.
- Showcase the research outcomes in several outreach, open house events to encourage students to choose majors in the STEM disciplines

STUDENT ACCOMPLISHMENTS

Since its establishment, the URC has supported electrical and mechanical engineering students varying from undergraduate to Ph.D. levels. The participating students have published numerous journal articles and over 60 conference papers. The URC students have received awards in the regional thesis/undergraduate design competitions.

PICTURES (5 images)

URC
Hampton University
Hampton, VA 23668

Hampton University Aeropropulsion Center

Dr. Morris Morgan
(757) 728-6974

PROGRAM DESCRIPTION
The Hampton University Aeropropulsion Center was created in January 2003 under the NASA grant NCC 3-1037. The Center is composed of two divisions: the Research Division and the Education Division. The Research Division consists of staff and researchers who are residing in one of the four key research pillars. These pillars are leaded by the internationally recognized researchers who are the Co-Investigators of the Center and are highly qualified in several very important fields: Pillar I - Aeropropulsion and Aeroacoustics (Dr. Alexander Gonor, Research Professor), Pillar II - Hypersonic Propulsion (Dr. Ates Akyurtlu, Professor), Pillar III - Sensor Development (Dr. Donald R. Lyons, Professor), Pillar IV - Modeling and Simulation of Combustion Systems (Dr. Morris Morgan, Professor). The pillar leaders are also effective educators and mentors for both undergraduate and graduate students. The Director and Principal Investigator of the center is Dr. Morris H. Morgan, III. In addition, experts from the NASA Glenn and Langley Research Centers and the teams of scientists from well known Russian institutions such as the Institute of Mechanics, Moscow State University, and the Institute of Theoretical and Applied Mechanics, Siberian Branch of the Russian Academy of Sciences, participate in the activities of the center.

The research conducted at the Aeropropulsion Center has four main thrusts. First, to consolidate Hampton University's engineering, science, and technology resources for the solution of globally important problems together with other U.S. universities, governmental agencies and industrial partners, as well as with foreign institutions. Second, efforts are directed to the generation and development of new ideas and concepts for the improvement of air-breathing propulsion systems, specifically, towards the engine and vehicle concepts as well as fuel cell technology proposed and under development at the NASA agencies. Third, the examination and verification of proposed concepts is conducted using NASA's and other institution's experimental test facilities. The fourth thrust is to develop novel sensors and methods for collecting and measuring data under the conditions of the proposed research.

PROGRAM RELEVANCE TO NASA
This project will essentially impact the Aerospace Propulsion field. In particular, the fulfillment of this project is directed towards the achievement of the NASA's Strategic Goal 3, "Develop a balanced overall program of science, exploration, and aeronautics consistent with the redirection of the human spaceflight program to focus on exploration", specifically, Sub-Goal 3E, "Advance knowledge in the fundamental disciplines of aeronautics, and develop technologies for safer aircraft and higher capacity airspace systems". Many of the proposed ideas and methods for their realization are original, patentable, and are related to the above mentioned strategic goals. These include the numerical and experimental studies of the scramjet engine with telescope inlet and pylons for mixing, combustion, and thrust improvements, numerical and experimental studies of the hypersonic star-shaped inlet with fuel injection, and the new accurate experimental method for determining the injectant mass fraction distribution in a supersonic turbulent flow mixing region.

This program is a natural extension of the whole set of projects conducted by the HU Aeropropulsion Center jointly with the NASA Glenn and Langley Research Centers under current and previous grants. It is in this precise area, where the US aircraft industry, academia, and government are in great need of trained professionals and which is a high priority goal of the Minority University Research and Education Program (MUREP), that the HU Aeropropulsion Center can make its most important contribution.
The partnership between the Aeropropulsion Center, NASA GRC and NASA LaRC, Villanova University School of Engineering Alliance, the Institute of Mechanics at Moscow State University in Russia, and the Institute of Theoretical and Applied Mechanics, Russia, is continued being an extension and development of the previous partnering research under several NASA and Civilian Research and Development Foundation (CRDF) grants.

PROGRAM BENEFITS TO SOCIETY
This program benefits the society by providing solutions to the very important problems of the aeronautics field and by establishing the infrastructure for aero-technology research and undergraduate and graduate studies at Hampton University.

The research conducted at the Hampton University Aeropropulsion Center has four main thrusts. First, to consolidate Hampton University's engineering, science, and technology resources for the solution of globally important problems together with other U.S. universities, governmental agencies and industrial partners, as well as with foreign institutions. Second, efforts are directed to the generation and development of new ideas and concepts for the improvement of air-breathing propulsion systems, specifically, towards

the engine and vehicle concepts as well as fuel cell technology proposed and under development at the NASA agencies. Third, the examination and verification of proposed concepts is conducted using NASA's and other institution's experimental test facilities. The fourth thrust is to develop novel sensors and methods for collecting and measuring data under the conditions of the proposed research. This research builds on the existing strengths of Hampton University in the aero-technology and related fields. The multidisciplinary strengths existing across the campus provide unique synergy for the center and strong partnerships with other institutions provide additional leverage to this initiative.

The education aspects of the research are focused on three objectives. First and foremost, it develops broad based curricula that will support the development of undergraduate and graduate programs in aero-technology at Hampton University. The second objective addresses concerns about the lack of African Americans pursuing the Ph.D. degrees in engineering. The final objective is to develop an infrastructure that will support a new Ph.D. program in engineering at Hampton University.

PROGRAM GOALS

The goals and objectives behind the Hampton University Aeropropulsion Center are summarized below. These outlined objectives are consistent with the University's mission to develop first-class cutting edge research programs. The focus of this center initiative is to expand the scope of research and concentrate the efforts of key HU researchers who are presently spread across several disciplines at the University. We believe the synergy to be gained through the Aeropropulsion Center can be profound. The specific goals are:

- Foster a cadre of well trained/diverse group of professionals who can contribute to the development of new technologies that will improve the aerospace posture of the nation.
- Provide an infrastructure that can serve as a vehicle for the development of a stable contract/grant base for the aeropropulsion and related research.
- Provide novel specialized training for persons who wish to have more than a cursory understanding of aero-technology.
- Develop an endowed funding base that will attract talented and diverse student body to the aero discipline.
- Facilitate the development of a Ph.D. program in engineering that will build on existing strengths in mathematics and physics programs at the University that now offers the Masters in Applied Mathematics and Ph.D. in Physics, respectively.
- Catalyze the development of structured undergraduate and graduate curricula in aerospace technology that will serve as a nucleus for a broad based mechanical engineering program at the undergraduate level and Ph.D. program in engineering at the upper level.

PROGRAM ACCOMPLISHMENTS

The research was focused on a wide regime of problems in the propulsion field as well as in experimental testing and theoretical and numerical simulation analyses for advanced aircraft and rocket engines. Research projects include:

- Numerical and experimental studies of the supersonic star-shaped inlet with fuel injection. Three-dimensional numerical simulations of the axisymmetric inlet where the front part was replaced with a four-petal star were conducted at the Aeropropulsion Center using the NASA CFD code VULCAN. The optimum geometry of the inlet as well as the locations of fuel injectors was determined. A physical model was designed and manufactured by the Aeropropulsion Center's partner, the Institute of Theoretical and Applied Mechanics, Siberian Branch of the Russian Academy of Science, in Novosibirsk, Russia (ITAM/RAS). This institution works together with Hampton University through the Civilian Research and Development Foundation Grant Assistance Program. The team at ITAM/RAS manufactured the model and conducted experimental tests in the hot-shot wind tunnel at the free stream Mach number 6. A very good agreement with the results of CFD numerical simulations was obtained.
- A new method for experimental determination of the injectant and species mass fraction and concentration distributions at supersonic turbulent mixing with multi-species co-flow was developed. These distributions are found based on the utilization of a standard traversing rig with static pressure, pitot pressure, and temperature probes and particle image velocimetry (PIV) measurements.

Publications and presentations: a) AIAA paper 2006-8147 was presented at the 14th AIAA/AHI Space Planes and Hypersonic Systems and Technologies Conference in Canberra, Australia, November 2006; b) AIAA paper 2007-0640 was presented at the 45th AIAA Aerospace Sciences Meeting and Exhibit in Reno, Nevada, January 2007; c) AIAA paper 2008-0095 was presented at the 46th AIAA Aerospace Sciences Meeting and Exhibit in Reno, Nevada, January 2008; d) A presentation "Hampton University Aeropropulsion Center" was made at the 14th Annual HBCUs/OMUs Research Conference in Cleveland, Ohio, July 2007.

STUDENT ACCOMPLISHMENTS

Many undergraduate and graduate students actively participate (or participated in the previous years) in the research activities of the Hampton University Aeropropulsion Center. They are all well trained in theoretical and

experimental research methods by utilizing the center's educational and research resources. They also attend research conferences to gain more experience and present the results of their work. For example, several students attended the annual HBCUs/OMUs Research Conference at the Ohio Aerospace Institute/NASA Glenn Research Center, Cleveland, Ohio, as well as the annual AIAA Aerospace Sciences Meeting and Exhibit in Reno, Nevada, and made presentations and posters about their work. Several undergraduate students, after their graduation from Hampton University, are now pursuing graduate degrees in such colleges as Virginia Commonwealth University, University of Michigan, University of North Carolina at Chapel Hill, and Clemson University. Others are working at NASA LaRC, US Navy, Northrop-Grumman, Lockheed Martin, Verizon Corporation, and Kraft Foods. Among students that are currently studying at HU and related to the Aeropropulsion Center are Liting Huang, Linda Cornett, Craig Hanley, Nellone Reid, and Jasmyn Davis. Several students earned their degrees during this academic year. All students are active participants in the Aeropropulsion Center projects, including numerical and experimental tests, papers preparation, and they all attend courses directly or indirectly connected with their research under this project.

PICTURES (4 images)

URC

Southern University and Agricultural and Mechanical College at Baton Rouge

Baton Rouge, LA 70813

The Center for Coastal Zone Assessment and Remote Sensing

Dr. Michael Stubblefield
(225) 771-4724

PROGRAM DESCRIPTION

Southern University's Center for Coastal Zone Assessment and Remote Sensing (CCZARS) conducts research in areas pertinent to the SSC's mission. The CCZARS provides among other things:

- Remote Sensing Applications and Training
- GIS/GPS data collection and warehousing
- Coastal Education Outreach Program
- Coastal and Marine Fisheries Resource Evaluation
- Undergraduate and Graduate Research Experiences

The CCZARS conducts studies that assist in the assessment of the wetlands, and other environmental habitats of the Gulf of Mexico that are essential to the development and healthy maintenance of its fisheries. This research also provides an early detection system of the declination of habitat conditions prior to their loss to enable better, more successful management of the Gulf of Mexico's environmental habitat. The CCZARS conducts remote sensing, and spatial and temporal studies/assessments that provide information regarding the Gulf of Mexico's coastal zone habitat changes, water quality, vegetation distribution and composition and wildlife habitat composition. The CCZARS also performs studies to determine the Gulf of Mexico's assets at risk and damage estimation, as well as monitor the coastal change in the Gulf of Mexico region as it occurs. Multispectral scanner data are used to determine the affect of saltwater intrusion in the estuarine areas as well as the effect of wetlands dredging and/or damage/loss on the growth of seagrass in the Gulf of Mexico. Storm Surge Modeling is applied as a tool to assess the problem of hypoxia in the Gulf of Mexico.

The CCZARS conducts remote sensing, spatial and temporal studies/assessments, and topographic and land use/land cover mapping of coastal zones. Chlorophyll sensors are also incorporated to assess vegetation health in coastal zones. The information provided in the form of land loss maps, habitat change maps TMDL monitoring, surface maps, and early detection systems assists in the decrease of health risks from vector borne diseases, pollution and environmental degradation, improvement of water quality, ecological health and enhancement of flood management and forecasting capabilities for the Gulf of Mexico region. The CCZARS conducts analysis of how land cover/land use change dynamics associated with urban sprawl have impacted local/regional growth and environmental health. The information provided through this analysis gives CCZARS the opportunity to assist local/regional/national governments in planning efforts to respond to and manage urban sprawl and in the development of more sustainable/ habitable urban environments. The CCZARS also applies remote sensing under the guidelines of Non-point source Education for Municipal Officials (NEMO) to train municipal and/or local/regional officials.

PROGRAM RELEVANCE TO NASA

CCZARS supports the Earth Science Applications at NASA's Stennis Space Center (SSC) under program NRA 02-OEOP-01. The CCZARS is also assisting NASA and other federal agencies in addressing the initiatives set forth in other legislative mandates such as the Coastal Zone Management Act, 1972, the Endangered Species Act, the Federal Sustainable Fisheries Act/Magnuson-Stevens Fisheries Management and Conservation Act (SFA/MS-FCMA), the Coastal Barrier Resources Act (CBRA), the Coastal Barrier Improvement Act of 1990 (CBIA), the Clean Water Act (Sections 319 & 404), the Water Resources and Development Act (WRDA), the Farm Bill, the Conservation and Endangered Species Act, Federal Noxious Weed Act, National Environmental Protection Act and the Marine Mammal Act.

PROGRAM BENEFITS TO SOCIETY

The CCZARS is engaging the participation of other state and federal institutions and programs. Because the coast and wetlands of the State of Louisiana and throughout the United States' coastal regions are being depleted at alarming rates, this project provides on-going, comprehensive studies and partnerships between research institutions, government and industry to effectively address this problem. With a service institution such as the CCZARS in place, the Gulf of Mexico is aided in its struggle to obtain assistance in the preservation of its coastal wetlands, while maintaining a unique balance with commerce. The CCZARS further assists coastal states as they continue to address the initiatives set forth in the Coastal Wetlands Planning, Protection and Restoration Act [P.L. 101-646 (1990)] and the Coastal Impact Assistance Program, as well as issues addressed in possible future legislative actions such as the Conservation and Reinvestment Act (CARA). Continued research and monitoring will assist in better understanding the problem hypoxia poses to the Gulf of Mexico and its environment. Through education, training and outreach, this project also

helps support Health, Safety and Environmental issues in other coastal areas across the United States.

PROGRAM GOALS

The CCZARS goals are divided into four Research Thrust Areas. Each areas goal is listed below:

- The goals of the Fisheries Habitat (FH) thrust were as follows: (1) To establish The Center for Coastal Zone Assessment and Remote Sensing (CCZARS) in which the FH thrust is an essential component; (2) To conduct fisheries habitat assessment research studies within the Davis Pond region, and (3) To develop a Remote Sensing/GIS/GPS research infrastructure that is capable of serving as a focus for the conduct of various fisheries habitat assessment studies along the Louisiana and Texas Gulf Coast.

- The goals of the Coastal Change thrust were to investigate: (1) complex interactions among climate change, natural disturbance, and land use change, (2) effects of climate change on coastal ecosystem processes at multiple spatial and temporal scales, and (3) long-term coastal change monitoring program with continuing effort in developing accurate baseline information for assessment, restoration, and adaptive management.

- The goals of the Land Use/Land Cover Change thrust were: (1) To establish the Coastal Zone Assessment and Remote Sensing Program (CCZARS) in which the LULCC thrust is an essential component. (2) To conduct coastal assessment research studies within the Davis Pond region, including the coastal zone region extending west to the Louisiana-Texas boundary. (3) To conduct a landuse/landcover classification study in t he region known as Cancer Alley, which stretches from Baton Rouge, LA to New Orleans, LA, including the river parishes, and (4) To develop a remote sensing /GIS/GPS research infrastructure that is capable of serving as a focus for the conduct of various coastal assessment studies related to landuse and landcover change along the Louisiana Gulf Coast.

- The goals of the Urban Sprawl thrust were: (1) To identify and characterize urban sprawl impact on the Urban Ecosystems of the Gulf Coastal communities; (2) To quantify the urban ecosystem health (urban forest, soil water, air, etc.); (3) To monitor and assess the environmental changes of urban areas in Louisiana Coastal zones; (4) To identify and test remediation strategies for coping with the sprawl stresses; and (5) To provide educational and outreach efforts in Safety, Preservation, Remediation, and Utilization of Urban Environments.

PROGRAM ACCOMPLISHMENTS

N/A

STUDENT ACCOMPLISHMENTS

N/A

PICTURES (6 images)

URC
Norfolk State University
Norfolk, VA 23504

Center for Research and Education in Advanced Materials

Dr. Sam-Shajing Sun
(757)823-2993

PROGRAM DESCRIPTION
In this university research and education center project, a faculty team with different yet complementary expertise at Norfolk State University (NSU, a major Historically Black College and University in the nation) established a Center for Research and Education in Advanced Materials (CREAM). The CREAM brings together faculty with established publication histories and extensive experiences in guiding student research in advanced materials science and engineering, particularly in the investigation and development of novel nano-structured and lightweight materials for optoelectronic, spintronic, magnetic, and renewable/clean energy applications. The CREAM research focuses on the modeling, synthesis, processing, and spectroscopic studies of integrated nano-structured materials with organic/inorganic and dielectric/metal interfaces, and their unique nonlinear optical, photo emission, photovoltaic, magnetic, and radiation-protective properties. We are developing novel techniques for processing of transparent gain ceramics, photonic composites, and supra-molecular macromolecules based on nanotechnology. Details of the projects are described in proposal and in the annual reports.

PROGRAM RELEVANCE TO NASA
The proposed projects are closely related to the research and educational objectives of NASA missions and enterprises. For instance, lightweight photovoltaic materials and materials for thermal and radiation protection are related to all five NASA Enterprises, transparent gain ceramics and random laser material for optical signal processing and remote sensing are related to Earth and Space Science and Technology Enterprises, nano-structured electronic and optical materials and fabrication processes for novel lightweight optoelectronic devices are related to Earth and Space Science and Technology Enterprises, Biological and Physical Research.

PROGRAM BENEFITS TO SOCIETY
- The project established a key research/educational infrastructure in critical science and technology areas of renewable and clean energy generation and energy conservation, nano technology, and future generation lightweight and high capacity electronic, optoelectronic, spintronic, magnetic materials and devices. This infrastructure includes formation of a high caliber faculty team with complementary expertise, and a state of the art research and education facility.

- The research findings/results from this center project in the form of journal publications, presentations, lectures, new books, and new or advanced curricular developments, will directly benefit the scientific/technical community and the society at large.

- The students or young scientists, particularly under-represented minority and women who are trained in this project will contribute significantly to the technical working force in high tech industry in areas of renewable energy, optoelectronics, and nano technology and engineering.

PROGRAM GOALS
The primary educational goal of the program is to enhance and strengthen the advanced education and training of students, particularly the underrepresented groups (i.e., minority and women) in renewable energy and nano science and technology, optoelectronic and spintronic materials and device engineering, and to prepare them for positions of leadership in those emerging areas of frontier science and technology. NSU is in the process of implementing a Ph.D. program in Materials Science and Engineering focusing on the above mentioned area, building upon the strength of our existing MS programs in Materials Science, Optical Engineering and Computer Science. This cooperation will allow us to further expand our recruiting efforts among minority students. The program will complement and strengthen the ongoing research and educational projects at NSU in the key area of nanomaterials and nanotechnology by enhancing the research potential of existing faculty, providing capital equipment, student support resources, and adding tenure-track faculty. These improvements will enable the university to sustain its unique advanced materials and engineering program and to support NASA educational and research missions permanently.

PROGRAM ACCOMPLISHMENTS
- On research, all originally proposed key research components have been generating new and better results, and summarized separately in the annual progress report. Research generated new knowledge have been documented in over 40 publications and over 35 national/international conference presentations during the 2006-2007 year (including invited talks/seminars/lectures and student presentations). More research collaborations or joint efforts were

established, and several new research/educational grants and contracts from other agencies were awarded. The PI (Professor Sam Sun) has been invited to serve the editorial board of a new international journal: Research Letters in Materials Science.

- On education, the NSU Ph.D. Program in Materials Science and Engineering was finally approved by the State Council of Higher Education for Virginia (SCHEV) on September 12, 2006 and by NSU's regional accrediting body, the Commission on Colleges of the Southern Association of Colleges and Schools (SACS) in July 2007. The new Ph.D. program has been officially running at NSU since the fall 2007 semester. Ph.D. program establishment is one of the key educational goals of CREAM. The CREAM Educational Hub effectively coordinated all graduate and undergraduate student research and educational activities and also formed a student management infrastructure base in CMR and in the Ph.D. program. During the last year, six graduate students involved in CREAM related projects defended and obtained their MS degrees. Out of the seventeen students who graduated in the last two years, eight are now in Ph.D. programs in materials science related fields, and nine hold technical or teaching jobs. In the fall 2006 and spring 2007, CREAM directly supported four graduate students (after URC budget cut); three were under-represented female minority graduate students. Of the three, two graduated, one is currently attending NSU's Ph.D. program in MSE, and the other has been employed by the U.S. Patent and Trademark Office. In the past year, almost every graduate student attended and presented at least one paper at scientific conferences.

- On infrastructure, all CREAM participants and their labs/offices have now been moved into the brand new and state of the art research building Marie V. McDemmond Applied Research Center (MVM-ARC) at RISE campus.

- A seminar series with distinguished scholars/speakers from all over the world were well received by both faculty and students in the Materials Science graduate program. The topics of seminars covered broadly in advanced materials, nanotechnology, photonics, electronics, spin-tronics, renewable energy and their industrial prospective, etc.

STUDENT ACCOMPLISHMENTS

During the past year, about nine graduate students and ten undergraduate students were supported or benefited directly by the CREAM funds. At least seven graduate students who were involved in CREAM projects obtained their Master degrees in Materials Science during the 2006-07 academic year. Five of them entered PhD programs, one is now a patent examiner at the US Patent and Trademark Office, and another is teaching chemistry at the college level. Students co-authored a significant fraction of the project relevant publications and presentations. CREAM supported graduates have been getting job offers, or have been admitted at advanced academic programs at following places: Lockheed Martin Corp. (defense R&D), Norfolk Shipyard (defense engineering), CAN (defense R&D), IBM Corp. (materials R&D), Dow Corning Corp. (polymer R&D), Du Pont Crop. (polymer R&D), Leiner Health Products (health care engineering), Churchland High School (Education), University of Washington (PhD program), University of Maryland (PhD program), University of Florida (PhD program), University of Connecticut (PhD program), Vanderbilt University (PhD program), Virginia Tech (PhD program), University of Virginia (PhD program), Old Dominion University (PhD program), Georgia Tech (PhD program), University of Rochester (PhD program), etc.

PICTURES (none)

URC
Howard University
Washington, DC 20059

Terrestrial and Extraterrestrial Atmospheres (CSTEA)

Dr. Demetrius Venable
(202) 806-6249

PROGRAM DESCRIPTION
The Center for the Study of Terrestrial and Extraterrestrial Atmospheres (CSTEA) is located at Howard University and encompasses four Departments -- Atmospheric Sciences, Chemistry, Mechanical Engineering, and Physics and Astronomy. The Center is comprised of seven Principal Investigators, that is, faculty members from these departments.

The strategic focus of the Center for the Study of Terrestrial and Extraterrestrial Atmospheres is to establish at Howard University a self-supporting, world class facility for the study of terrestrial and extraterrestrial atmospheres with special emphasis on the training of underrepresented minorities in aerospace-based sciences and engineering. To this end, CSTEA cites as its primary objectives:

- to make significant contributions to the understanding of the basic chemical and physical processes that characterize planetary atmospheres;
- to develop instrumentation and implement field experiments in collaboration with NASA, other federal agencies and laboratories; and
- to continue to cultivate an environment for the recruitment, retention, and matriculation of traditionally underrepresented minorities interested in the fields of study mutually addressed by NASA and CSTEA.

The research program of the Center is streamlined to focus primarily on the terrestrial atmosphere. and the lead field installation is Goddard Space Flight Center (GSFC). The Laboratory for Atmospheres is the primary sponsoring unit within GSFC. The Center consists of the Laboratory for Experimental Atmospheric Chemistry, the Climate Radiation Group, and the Lidar Remote Sensing Group.

PROGRAM RELEVANCE TO NASA
The research mission of NASA's Earth Science Enterprise (ESE) is to develop a scientific understanding of the Earth system and its response to natural and human-induced changes in order to enable improved prediction capability for climate, weather, and natural hazards. The research mission of CSTEA is fully consistent with this mission statement. We seek to understand forcing, response, and impact of global earth system change on a regional scale, in particular, climate and air quality through observation and modeling. The five thematic questions that currently guide CSTEA research are:

- How is the global earth system changing?
- What is the primary forcing of the Earth system variability?
- How does the Earth system respond to natural and human-induced changes?
- What are the consequences of change in the Earth system for human civilization?
- How well can we predict future changes in the Earth system?

Pertinent NASA questions and CSTEA themes that address these are given below.

NASA Interest: How is the global earth system changing?
CSTEA Theme: Climate and air quality changes on a regional scale

NASA Interest: What is the primary forcing of the Earth system variability?
CSTEA Theme: Clouds, aerosols, hydrologic process impact on the energy budget

NASA Interest: How does the earth system respond to human induced changes?
CSTEA Theme: Response of regional climate and air quality to local/regional meteorological phenomena

NASA Interest: What are the consequences of change+ in the earth system for human civilization?
CSTEA Theme: Regional air quality and climate impact on public health

NASA Interest: How well can we predict changes in the earth system?
CSTEA Theme: Prediction of future changes in regional climate air quality

PROGRAM BENEFITS TO SOCIETY
CSTEA and, thus, Howard University have and will continue to benefit the community, NASA, the nation, and the world. Particularly, during this reporting period four students, who had received some level of CSTEA support since 2003, received the doctor of science degree -- three in

Atmospheric Sciences and one in physics. Three of these four students are employed in STEM areas.

PROGRAM GOALS
What are the Goals of the Program CSTEA cites as its primary objectives:

- to make significant contributions to the understanding of the basic chemical and physical processes that characterize planetary atmospheres;
- to develop instrumentation and implement field experiments in collaboration with NASA, other federal agencies and laboratories; and
- to continue to cultivate an environment for the recruitment, retention, and matriculation of traditionally underrepresented minorities interested in the fields of study mutually addressed by NASA and CSTEA.

PROGRAM ACCOMPLISHMENTS
Since CSTEA is no longer provided with new funds from NASA, the primary intent of the program at this time is the successful completion of the current students. The program only conducts research in areas of interest to NASA that will directly lead to the completion of the students' degree programs. Four students completed the Ph.D. this year. Two students remain in the program and are expected to graduate within the next 12 months.

STUDENT ACCOMPLISHMENTS
Four students completed the Ph.D. this year. Two students remain in the program and are expected to graduate within the next 12 months.

PICTURES (none)

URC

Morgan State University

Baltimore, MD 21251

Center of Advanced Microwave Research and Applications

Dr. Carl White
(443) 885-3913

PROGRAM DESCRIPTION

The Center of Advanced Microwave Research and Applications (CAMRA), under the auspices of the NASA headquarters Office of Equal Opportunity Programs, Minority University Research and Education Programs, is a NASA University Research Center located at Morgan State University within the School of Engineering.

CAMRA's vision is to lead the nation in Shaping Engineers for Tomorrow's Changes.

CAMRA will always strive to be a world-renowned research center specializing in integrated microelectronics emphasizing microwave technology, engineering research and management.
CAMRA commits its resources to developing both research and education in an interdisciplinary environment enabling growth, enhancements and a sustainable mission.

CAMRA's mission is:
To provide NASA's future Science and Exploration missions with a technology base for the production of microwave components and systems while carefully integrating the direct involvement of MSU faculty, other researchers and students in cutting-edge research projects and obtaining hands-on laboratory experiences. With the use of innovative models and scientific methods, CAMRA will develop a pipeline of undergraduates, particularly minority students, involved in research and educational activities that would develop critical thinking and adaptable skills, enabling them to obtain advanced applied degrees in Engineering. These engineers will not only aid NASA in its future missions but will contribute to the development of a diverse, globally-engaged, engineering workforce.

CAMRA accomplishes this mission by:

- Recruiting and bringing together a diverse and unique talent pool of researchers, professionals and educators from all disciplines.
- Developing an interdisciplinary environment enriched with an interdisciplinary theoretical and practical background in simulation and application-based engineering.
- Empowering students with ideas fueled with passion, dedication, and commitment to acquire advanced degrees and adaptable skills, in the area of microelectronics emphasis on microwave technology engineering research and management.
- Developing high quality engineers who will manage both human and capital resources effectively and efficiently in order to provide just-in-time products and services to a constantly changing global economy.

CAMRA is an adaptable and flexible organization; having to easily adapt to external and internal environmental changes. CAMRA is divided into research branches and administrative offices. The CAMRA consist of three technical branches and one educational branch.

Technical and Educational Research Branches:

- Center of Microwave, Satellite and RF Engineering (COMSARE)
- Semiconductor Center for Electronic Devices and Circuits (SCEDC)
- Signal and Sensors (SIGSENS)
- Academic Training Management Office (ATMO)

Five Offices:

- Public Relations
- Finance & Contracts
- Internal Evaluation
- Technology Transfer
- Operations Research Management

PROGRAM RELEVANCE TO NASA

As stated in its mission, CAMRA strives to impact NASA's workforce diversity issues by recruiting, successfully matriculating, and advising undergraduate and graduate degree recipients, predominately those from under-represented groups. In addition, CAMRA, through its affiliated research branches, provides NASA/GFSC solutions relevant to issues impacting their Space Exploration and Space Science missions.

PROGRAM BENEFITS TO SOCIETY

Through the educational programs and services offered by the Academic Training and Management Office, CAMRA interacts with several secondary schools within Maryland and Pennsylvania to improve the science, engineering and mathematics (SEM) education of pre-college students, and to enhance their interest in pursuing careers in these areas. Students who

participate in these programs and services are more prepared to matriculate through a SEM degreed program and thereafter enter into the technological workforce.

PROGRAM GOALS

Goals of Executive Staff/ATMO

- Incorporate the operations management office as CAMRA's central process unit.
- Build partnerships to generate revenue.
- Continue to build a sustainable quality pipeline of students.
- Goals of Research Centers
- Develop the HHR engineering model and prototype for calibration and field deployment.
- Develop and design a prototype DSDR.
- Continue development of the Nexus Modeler Integrated Device Modeling.
- Continue to research current and emerging PA design techniques, including advancement in device technology, device modeling, and integration techniques for SSPA applications.
- Develop and leverage relationships with foundry partners to access advanced fabrication processes to develop SSPA modules.
- Develop advanced transistor models for Gallium Arsenide (GaAs) and Gallium Nitride (GaN) devices for SSPA development.
- Develop fundamental and advanced techniques required for development of L, S, X, and Kaband power amplifiers using MIC and MMIC architectures.
- Design, fabricate and test various MIC and MMIC power amplifier design architectures for development of deployable SSPA modules for targeted applications.
- Build the expertise of advanced device design modeling using TCAD and circuit level design tools through research.
- Infuse semiconductor device/circuit design into curricula.
- Increase funding and collaborative efforts.

PROGRAM ACCOMPLISHMENTS

Over the 2006-2007 review period, CAMRA has made tremendous strides in accomplishing the goals set forth in the 2007 Renewal proposal. This section provides highlights of these accomplishments.

Technical Research Accomplishments:

- (Radiometer Technology)
- Successful development of a handheld microwave radiometer (HMR) engineering model and prototypes for calibration and deployment using both commercial off-the-shelf (COTS) parts and student-designed MIC-based circuits;
- Development of an L-band direct sampled digital radiometer approach implementing advanced radio frequency (RF) analog front-ends and advanced digital processing back-ends;
- Research work culminated in a Doctor of Engineering (D. Eng.) recipient (Dr. Eric Chikando, May 2007).
- (Ka-Band Receiver Technology Solid State Power Amplifier (SSPA) Technology)
- Submission for fabrication and preliminary characterization of a high-efficiency Ka-band GaAs-based monolithic microwave integrated circuit (MMIC) SSPA;
- Study of GaN-based technology for implementation in SSPA applications;
- Study of power combining methodologies for improved high power amplifier applications;
- Development of novel methodologies for extraction of model parameters for GaN-based field-effect transistors (FET);
- Extraction and validation of artificial neural network field-effect transistor (ANNFET) models for GaN transistors operating at L-band;
- Nexus Modeler - Integrated Device Modeling Environment
- Development of infrastructure including standardization of practices such as unit testing, requirements definition, and code documentation;
- Development and documentation of preliminary marketing plan for Nexus Modeler;
- Modularization of all baseline applications;
- Education Service and Research (ATMO) Accomplishments:
- First cohort graduated;
- Eric Chikando received his D. Eng degree;
- 50% of scholars have 3.4 GPA's;
- Academic advisement fully integrated within ATMO;
- ATMO received $150K from Maryland Depart of Education for robotics outreach;

STUDENT ACCOMPLISHMENTS

- Eric Chikando received his D. Eng degree;
- 50% of scholars have 3.4 GPAs;
- Graduated first cohort consisting of 7 scholars.
- 3 graduates have gone onto graduate study in engineering, 2 have accepted offers for employment in the engineering community, 1 accepted employment at the US Patent and Trademark Office, and 1 has entered dental school.

PICTURES (none)

URC

Texas Southern University

Houston, TX 77004

The NASA Research Center for Biotechnology and Environmental Health

Dr. Bobby Wilson
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PROGRAM DESCRIPTION

The deleterious effects of the space environment on humans continue to be a challenge for NASA's long-term space travel missions. Crew members in a microgravity environment routinely experience immune system deregulation and loss of bone and muscle. The proliferation of microorganisms presents human health risk and often contaminates and compromises life support and important technological systems. Exposure to low-dose radiation is additive and is potentially carcinogenic. With NASA's current mission plans to return to the moon, to Mars, and beyond, it is increasingly important to understand the basic mechanisms involved in these toxic effects and to devise realistic strategies to protect human space travelers. With the emerging research capacity in molecular biology and nanotechnology, scientists in the NASA Research Center for Biotechnology and Environmental Health (RCBEH) at Texas Southern University will address the above mentioned life support needs for NASA's long term space travel.

The RCBEH has two primary research focus areas -- The Genotoxicology studies of the effects of toxic agents on biological systems in the micro-gravity environment. These studies use technologies and approaches which examine the basic structure of the gene, changes in gene expression, detection of DNA damage and repair, and uses of genetic information in nanotechnology applications. The second research focus, Microorganisms studies, is concerned with bacterial, viral, and fungal organisms, which may contaminate the life-support area of the spacecraft. The microbial studies investigate the means of identifying them and how to protect space travelers from their toxic effects.

The following are research projects within the RCBEH program:

- Identification of Major Space Genes: This project will identify major genes and major cellular pathways that are altered by microgravity.
- Utilization of Antimicrobial Natural Products for Management of Microorganisms in Space Life Support System: This project will investigate the possibility of embedding natural antimicrobial chemicals into materials and fabrics, including membrane and filter materials for water purification, to prevent the growth of microorganisms.
- Studies with a-Tocopherol on Microgravity-induced Oxidative Stress: This project will use both in vitro and in vivo systems to investigate the effect of antioxidants on microgravity-induced oxidative stress.
- Management of Microorganisms in a Closed Environment: This project will focus on yeast cells as a model for nanotechnology and functional genomic studies.
- The Effect of Radiation and Microgravity on the DNA Repair Capacity of Lymphocytes: This project will use the host-cell reactivation assay to determine the effects of radiation on DNA repair capacity in both G1 and microgravity environments.

PROGRAM RELEVANCE TO NASA

The focus of the NASA Research Center for Biotechnology and Environmental Health is to investigate the environmental toxicology of space travel, using the cutting edge research tools of molecular biology, materials chemistry, nanotechnology, and computer modeling of molecular systems. The RCBEH is closely aligned with the strategic aims of the NASA Exploration Systems Directorate. Specifically, RCBEH aligns with the goals of the Human Systems Research and Technology program, the Human Health and Performance element of (1)understanding the effects of the spacecraft environments on humans and other organisms; and (2) development standards and countermeasures to optimize crew health, safety, and productivity. Further RCBEH alignment is with the NASA Life Support and Habitation Technologies and Knowledge program, which is interested in space cell biology as it relates to the transition of terrestrial life to low gravity environments and to the exploration of space. We contribute to this NASA interest by addressing the fundamental role of gravity and cosmic radiation on vital biological, physical, and chemical systems in space; and (b) exploring new technologies designed to identify and mediate the toxic components of space travel.

PROGRAM BENEFITS TO SOCIETY

The NASA Research Center for Biotechnology and Environmental Health has served as a focal point for intra-institutional growth and training in NASA-related technical fields as well as for increased research collaborations with other institutions and with industry. RCBEH advances knowledge and the understanding of space-related subjects and research by providing an unprecedented level of research capacity and opportunity for the underrepresented minority populations that TSU serves. TSU is an emerging research institution and RCBEH has impacted the University's research infrastructure and capacity by strengthening the research programs and

producing stronger graduates who enter professional research positions. RCBEH accelerated the transformation of TSU from an emerging research institution to a very competitive research intensive institution that realizes excellence of education for the underprivileged. RCBEH is a great asset to the general welfare and quality of our society by training young minority professionals for the workforce, thus, enabling the U.S. to continue its competitiveness in the global economy.

PROGRAM GOALS

The RCBEH research goals are the following: 1) understanding the effects of the spacecraft environments on humans and other organisms; 2) developing standards and countermeasures to optimize crew health, safety, and productivity (NASA's Exploration Systems Directorate). However, the institutional goals of the RCBEH are to provide support for the development of underrepresented minority researchers (undergraduate to tenure track faculty) in their scholastic endeavors and competitiveness in winning mainstream research funding and support (internships, scholarship, fellowship, post-doctoral appointment and professorships). The following program outcomes are expected to be achieved: increased peer-reviewed publications, increase the number of research proposals submitted and funded, increase the number of minority undergraduate students pursuing graduate studies in space related sciences, and provide a foundation for continued professional development of TSU researchers.

PROGRAM ACCOMPLISHMENTS

Center Achievements: Oct 2006 - Sept 2007
Project I: Identification of Major Space Genes
Significance Achievement:

- A cohort of 32 gene candidates has been identified as potential space genes and key components in the regulatory network of cells. The gene expression profiles of the 162 putative gravity sensitive genes were statistically significant (P less than or equal to 0.05) showing at least 1.5 fold up- or down-regulation and were categorized into eighteen functional groups. Using the Venn diagram (Figure 1) the 162 significant genes across the five time series of in vitro simulated microgravity exposures to human skin AG and HEK001 cells, 32 genes were identified as showing a significant expression patterns in all five time points.

Project II: Utilization of Antimicrobial Natural Products for the Management of Microorganisms in Spacecrafts

- A powerful antifungal compound was isolated and identified from rose petals extract. The bioautograpgy is shown in Figure 2. Purified compound was subjected to spectroscopy techniques consisting of infrared (IR), ultraviolet (UV), mass (MS) and nuclear magnetic resonance (NMR) spectroscopy.

Project III: Studies with alpha-Tocopherol on Simulated Microgravity induced Oxidative Stress

- Results: in vivo studies of mouse model in the antiothrostatic tail suspension AOS simulated microgravity test showed an increased AP-1 DNA binding activity in all brain regions tested. In all regions brain there is an increase in the intensive of band showing the AP-1 protein in the microgravity environment. Using electromobility shift assay and specific antibodies we were able to demonstrate increased AP-1 DNA binding activity can be blocked by pretreatment with alpha-tocopherol. Figure 3 shows electromobility shift assays of four region of the brain. The following lane pattern was repeated in each assay: Lane 1 - Control, Lane 2 Control with alpha-tocopherol, Lane 3 - microgravity treated model with no alpha-tocopherol and Lane 4 -microgravity treated model also treaded with alpha-tocopherol. This clearly suggests that alpha-tocopherol can be effectively used as a countermeasure during space travel.

Project V: Effect of Radiation and Simulated Microgravity on Genomic Stability

Four hour-time points in triplicate and the data are shown here in Figure 4. The findings of this data are:

- MSH2 gene showed down regulation at all time points. MLH1 had down regulation occurred at 4, 24 and 72 time points with a significant changes occurring at 24 and 72 hours PMS6 expression varied as increases occurred at 4 hours and significantly at 24 hours. However, expression returned to normal at 48 and 72 hours. D12676 had decreases occurred at 4 hours and significantly at 24 hours. However, expression return to normal at 48 hours and reversed (increased) significantly at 72 hours.

STUDENT ACCOMPLISHMENTS

Student Participants

The RCBEH was very successful in training students from historically underrepresented populations in NASA related filed. During the academic year, both graduate and undergraduate students were involved in center's training program. Students were recruited by all of the principal investigators and the core analytical facilities laboratory. Eleven (11) students were recruited for summer 2007. These interns represented three (3) universities. Six of the summer 2007 interns were placed at NASA Johnson Space Center.

Graduates: Seven (7) undergraduate students who participated in the research training program received B.S. in May 2007; four (4) graduate students received M.S. and one (1) a Ph.D. degree.

Publications and Presentations: Graduate and undergraduate students made a total of twenty-three presentations at regional or national meetings this year.

Outreach: The RCBEH has made significant strides in the area of student outreach. As a result we were able to recruit students from three universities to participate in the summer 2007 program.

Activities in the NASA-related Research Community

- The NASA URC Summer Internship Program recruited 11 undergraduates this summer. These interns represented three universities. Interns were assigned to work with URC Principal Investigators, the Core Facilities Laboratory, the Bio Molecular Group at the University of Houston and six interns were placed at Johnson Space Center and two at the UH. The summer internship cumulated in a Research Symposium and Closing Ceremony at the Hilton NASA-Clear Lake on August 2, 2007. Guest speaker was Astronaut Robert Satcher.

The NASA URC Summer Interns participated in a tour of the Johnson Space Center, June 21, 2007.

PICTURES (5 images)