Fiscal Year 2001 Annual Performance Report to the White House Initiative Office on Historically Black Colleges and Universities

National Aeronautics and Space Administration
Office of Equal Opportunity Programs
July 2002

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 2001ANNUAL PERFORMANCE REPORT TO THE WHITE HOUSE INITIATIVE OFFICE ON HISTORICALLY BLACK COLLEGES AND UNIVERSITIES

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)
FISCAL YEAR 2001 ANNUAL PERFORMANCE REPORT
TO THE WHITE HOUSE INITIATIVE OFFICE ON
HISTORICALLY BLACK COLLEGES AND UNIVERSITIES (HBCU)

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EXECUTIVE SUMMARY

The National Aeronautics and Space Administration (NASA) has a commitment to ensure that Historically Black Colleges and Universities (HBCU) broaden their participation in the Agency's research programs and its overall mission. The goals emphasized by NASA in FY 2001 for HBCU's were as follows:

- To facilitate research and development activities at HBCU's that contribute substantially to NASA's mission.
- To create systematic and sustainable change at HBCU's through partnerships and programs that enhance research and educational outcomes in NASA-related fields.
- To prepare faculty and students at HBCU's to successfully participate in the competitive research and educational processes of the NASA Strategic Enterprises.
- To partner with HBCU's to increase the number of students who are prepared to enter college and successfully pursue and complete undergraduate degrees in NASA-related fields.

This commitment is evidenced by the significant progress made toward the Agency's Fiscal Year (FY) 2001 Annual Plan to Assist HBCU's.

NASA's investment in HBCU's via the Office of Equal Opportunity Programs grew from its planned investment of $50.9 million for FY 2001 to an actual investment of $61.1 million, a 20-percent increase over the expected investment. The primary reason for the increased FY 2001 funding was more technical assistance and outreach to the HBCU community. Evidence of the Agency's funding commitment is seen in the research that was conducted through University Research Centers, Faculty Awards for Research and research-oriented Partnership Awards programs. Further evidence is the expanded participation of HBCU's in the Curriculum Improvement Partnership Award program. As a result of sustained NASA funding, HBCU's reported in FY 2001 that 586 refereed publications were published, 20 patents were awarded, and 21 African Americans received doctoral degrees in NASA-related scientific and technical areas. Additionally, 41 HBCU's were the recipients of 375 awards that reached more than 40,000 faculty, administrators, and students.

During FY 2001, HBCU's were recognized nationally for their outstanding accomplishments and increased their participation in NASA's Strategic Enterprise activities. For example, Morehouse School of Medicine's Space Medicine Life Sciences Research Center was recognized for its research to support routine space travel and enrich life on Earth. Cutting-edge research regarding human space flight is being conducted on the cardiovascular, skeletal, vascular, and retinal areas of the body. These studies will lead to the development of countermeasures for the cardiovascular changes and the bone loss experienced by astronauts during space flight. Concurrently, Prairie View A&M University's Center for Applied Radiation Research (CARR) is conducting valuable research for NASA on radiation tolerance of spacecrafts. The researchers at CARR are taking a systems approach to developing emerging technologies, both in materials and electronics, that will be able to withstand the long-term exposure to space radiation. As a result of sustained NASA funding, Prairie View A&M University has achieved outstanding program results and has been approved for a new Ph.D. program in Electrical Engineering.

NASA continues to value its partnership with HBCU's and the contributions made to this Nation's scientific priorities and the development of scientific and technical human resources.

SUMMARY OF AGENCY AWARDS TO HBCU's BY CATEGORY: FY 2001

1. Agency: National Aeronautics and Space Administration

2. Agency Representative: George E. Reese
Assistant Administrator for
Equal Opportunity Programs
(Signature)

3. Total Funds for Institutions of Higher Education (IHE): **$1,118,241,050**

DISCRETIONARY AWARDS (dollars in thousands)

CATEGORY	*AWARDS TO IHE's+*	*AWARDS TO HBCU's**	*AWARDS TO HBCU's AS % OF TOTAL AWARDS TO IHE's*
1. Research & Development	$942,506	$27,477	2.9%
2. Program Evaluation			
3. Training	$36,654	$15,060	41.1%
4. Facilities and Equipment	$15,150		
5. Fellowships, Internships, Traineeships, Recruitment, and Arrangements under the Intergovernmental Personnel Act (IPA)		$2,287	
6. Student Tuition Assistance, Scholarships, and Other Aid		$4,329	
7. Direct Institutional Subsidies			
8. Third-Party Awards		$7,904	
9. Private-Sector Involvement		$969	
10. Administrative Infrastructure			
11. Other	$123,931	$3,121	2.5%
TOTAL	**$1,118,241**	**$61,147**	**5.5%**

Sean O'Keefe
Administrator
(Signature)

+ IHE=Institutions of Higher Education
* HBCU's=Historically Black Colleges and Universities

TOTAL FY 2001 AWARDS TO HISTORICALLY BLACK COLLEGES AND UNIVERSITIES

	Institutions of Higher Education	*Historically Black Colleges And Universities*
DISCRETIONARY AWARDS:	$1,118,241,050	$61,147,533
LEGISLATED AWARDS:	$0	$0
TOTAL AWARD:	$1,118,241,050	$61,147,533

FY 2001 SUMMARY OF AGENCY AWARDS TO HBCU's BY INSTITUTION

STATE/INSTITUTION	R & D	PE	TRAINING	F&E	FELLOWS	STA	DIS	TPA	PSI	AI	OTHER	TOTAL
ALABAMA												
Alabama A&M University	$2,402,704		$100,000								$182,634	$2,585,338
Oakwood College			$100,000									$100,000
Trenholm State Technical College											$100,000	$100,000
Tuskegee University	$1,629,887										$86,000	$2,213,187
DELAWARE												
Delaware State University	$100,000											$100,000
DISTRICT OF COLUMBIA												
Howard University	$1,891,247		$497,300		$649,000						$73,700	$2,613,947
University of the District of Columbia											$295,047	$295,047
FLORIDA												
Bethune-Cookman College			$782,885									$782,885
Florida A&M University	$2,314,846		$454,265		$356,500	$1,260,000						$4,385,611
GEORGIA												
Albany State University											$75,000	$75,000
Clark Atlanta University	$1,953,625		$459,896									$2,413,521
Morehouse College	$72,811					$1,539,013						$1,611,824
Morehouse School of Medicine	$1,345,717											$1,345,717
Paine College											$100,000	$100,000
Savannah State University											$74,971	$74,971
Spelman College	$78,420		$1,707,081			$1,500,000						$3,285,501
LOUISIANA												
Southern University and A&M College – Baton Rouge	$236,818		$1,123,800									$1,360,618
Xavier University			$200,000								$150,000	$350,000
MARYLAND												
Bowie State University	$59,901		$2,000,800									$2,060,701
Morgan State University	$279,210		$1,950,000									$2,229,210

STATE/INSTITUTION	R & D	PE	TRAINING	F&E	FELLOWS	STA	DIS	TPA	PSI	AI	OTHER	TOTAL
University of Maryland at Eastern Shore	$27,623										$147,217	$174,840
MISSISSIPPI												
Jackson State University	$270,807										$199,600	$470,407
Mississippi Valley State University	$77,299										$297,774	$375,073
NORTH CAROLINA												
Elizabeth City State University	$211,777		$467,485									$679,262
Fayetteville State University											$100,000	$100,000
Johnson C. Smith University	$97,596											$97,596
North Carolina A&T State University	$2,194,870		$776,721		$323,500							$3,295,091
Shaw University			$99,364								$88,107	$187,471
Winston-Salem State University	$51,839											$51,839
OHIO												
Wilberforce University			$299,957									$299,957
PENNSYLVANIA												
Lincoln University			$30,000									$30,000
SOUTH CAROLINA												
South Carolina State University			$776,164									$776,164
Voorhees College			$139,980									$139,980
TENNESSEE												
Fisk University	$1,524,142											$1,524,142
Tennessee State University	$2,260,908		$557,721								$53,212	$2,871,841
TEXAS												
Jarvis Christian College											$100,000	$100,000
Prairie View A&M University	$2,295,293		$412,418									$2,707,711
Texas College											$998,000	$998,000
Texas Southern University	$436,998											$436,998
VIRGINIA												

STATE/INSTITUTION	R & D	PE	TRAINING	F&E	FELLOWS	STA	DIS	TPA	PSI	AI	OTHER	TOTAL
Hampton University	$4,409,302		$1,348,394		$907,871							$6,665,567
Norfolk State University	$818,401		$1,141,038		$50,000							$2,009,439
WEST VIRGINIA												
Bluefield State College			$100,000									$100,000
West Virginia State College	$70,000					$30,000						$100,000
OTHER HBCU AWARDS												
Aerospace Education Services Program (AESP)								$301,726				$301,726
American Society for Engineering Education								$50,000				$50,000
Experimental Program to Stimulate Competitive Research (EPSCOR)								$111,560				$111,560
Global Science & Technology, Inc./NASA Peer Review Services									$969,064			$969,064
Louisiana Research Consortium								$136,000				$136,000
Minority Access, Inc.								$950,000				$950,000
Mississippi Research Consortium								$74,934				$74,934
Mississippi Space Commerce Initiative								$300,845				$300,845
National Action Council for Minorities in Engineering (NACME)								$855,000				$855,000
National Association for Equal Opportunity in Higher Education (NAFEO)								$1,694,276				$1,694,276
National Space Grant College/Fellowship Program								$397,185				$397,185
Paragon Tech Inc./SEMAA								$903,000				$903,000
Summer High School Apprenticeship Research Program (SHARP)								$650,000				$650,000
Tennessee State University Diversified Career and Educational Services (DCES)								$100,000				$100,000
United Negro College Fund (UNCF)								$1,273,977				$1,273,977

STATE/INSTITUTION	R & D	PE	TRAINING	F&E	FELLOWS	STA	DIS	TPA	PSI	AI	OTHER	TOTAL
GRAND TOTAL	**$27,112,041**		**$15,425,269**		**$2,286,871**	**$4,329,013**		**$7,904,013**	**$969,064**		**$3,121,262**	**$61,147,533**

ABBREVIATIONS KEY	
R&D	Research & Development
PE	Program Evaluation
TRAINING	Training
F&E	Facilities and Equipment
FELLOWS	Fellowships, Internships, Traineeships, Recruitment, and Arrangements under the Intergovernmental Personnel Act (IPA's)
STA	Student Tuition Assistance, Scholarships, and Other Aid
DIS	Direct Institutional Subsidies
TPA	Third-Party Awards
PSI	Private-Sector Involvement
AI	Administrative Infrastructure
OTHER	Other Activities

SUMMARY OF FY 2001 AWARDS TO HBCU's BY NASA CENTER AND ENTERPRISE

NASA CENTER	AA	OEOP	HO	OAT	OES	OHRE	OBPR	OSF	OSMA	OSS	Third-Party Awards	GRAND TOTAL
ARC		$688,440		$1,072,182			$230,691	$100,000		$96,758		$2,188,071
DFRC		$340,053		$60,000								$400,053
GRC	$126,112	$2,359,694		$2,696,284		$21,850	$312,964			$147,963		$5,664,867
GSFC	$13,244	$8,151,711	$50,000	$149,899	$3,116,216	$368,346		$64,000	$300,000	$4,605,367		$16,818,783
JSC	$37,000	$613,468		$1,000,000			$729,658	$2,008,691				$4,388,817
KSC		$2,161,286					$123,609	$910,614				$3,195,509
LARC	$72,400	$2,448,066	$13,600	$3,932,821	$2,655,758	$60,326		$81,260	$5,200	$291,200		$9,560,631
MSFC	$49,997	$4,622,436		$64,719	$590,847	$22,000		$1,512,378		$1,606,804		$8,469,181
SSC		$674,744			$913,800						$511,779	$2,100,323
HQ		$6,795,317				$1,565,981					$7,392,234	$8,361,298
GRAND TOTAL	**$298,753**	**$28,855,215**	**$63,600**	**$8,975,905**	**$7,276,621**	**$2,038,503**	**$1,396,922**	**$4,676,943**	**$305,200**	**$6,748,092**	**$7,904,013**	**$61,147,533**

ARC	Ames Research Center
DFRC	Dryden Flight Research Center
GRC	Glenn Research Center
GSFC	Goddard Space Flight Center
JSC	Johnson Space Center
KSC	Kennedy Space Center
LaRC	Langley Research Center
MSFC	Marshall Space Flight Center
SSC	Stennis Space Center
HQ	Headquarters

AA	Associate Administrator
OEOP	Office of Equal Opportunity Programs
HO	Headquarters Operations
OAT	Office of Aerospace Technology
OES	Office of Earth Science
OHRE	Office of Human Resources and Education
OBPR	Office of Biological and Physical Research
OSF	Office of Space Flight
OSMA	Office of Safety and Mission Assurance
OSS	Office of Space Science

George E. Reese
Assistant Administrator for
Equal Opportunity Programs

AWARDS

BY

OBJECT

CATEGORY

AWARDS BY OBJECT CATEGORY

Research and Development

STATE	INSTITUTION	DESCRIPTION	AWARD
AL	Alabama A&M University	All Optical Micro Motors Based on Moving Grating in Photo Sensitive Media	$93,564
AL	Alabama A&M University	Center for Hydrology, Soil Climatology, and Remote Sensing (HSCARS)	$1,199,918
AL	Alabama A&M University	Computational Analysis of Ion Trajectory in Pulse Magnetic Flux Compression Reaction	$29,719
AL	Alabama A&M University	Computer Model of the TVC Electromechanical Actuator	$87,709
AL	Alabama A&M University	Development of Improved High Temperature Silicon Carbide Sensors	$99,568
AL	Alabama A&M University	Fabrication and Optical and Electrical Characterization of the Diffractive Holographic Optical Elemn	$22,000
AL	Alabama A&M University	Innovative Exploration of Semiorganic Nonlinear Optical Materials for Optical Processing Applications	$80,000
AL	Alabama A&M University	Mathematical Safety Analysis	$79,956
AL	Alabama A&M University	Microbial Viability and Biocide Efficiency Studies for the International Space Station	$81,916
AL	Alabama A&M University	Numerical Predication of Drag of Ajax Type Vehicles	$60,000
AL	Alabama A&M University	Hypersonic Non-Equilibrium Flows with Low Reynolds Effect	$99,775
AL	Alabama A&M University	Investigation of Structural Properties of Composite Smart Materials	$98,582
AL	Alabama A&M University	Space Science Education and the Sun-Earth Connection	$225,000
AL	Alabama A&M University	Student Launch Initiative	$49,997
AL	Alabama A&M University	Weakly Ionized Gas Characteristics and Effect on the Shock Wave Structure	$95,000
AL	Tuskegee University	Center for Food and Environmental Systems for the Human Exploration of Space (CFESH)	$1,225,000
AL	Tuskegee University	Durability Assessment of Airframe Composite Repair Patches	$60,000
AL	Tuskegee University	Evaluation of Fire Extinguishing Halon Compounds	$104,887
AL	Tuskegee University	Polymide Based Nanocomposites for Affordable Space Transport	$100,000
AL	Tuskegee University	Soy Research Pilot Study	$20,000
AL	Tuskegee University	Sputtering Erosion in the Ion Thruster	$20,000
AL	Tuskegee University	STARSAT 12000 Testing Tactics and Strategies	$100,000

STATE	INSTITUTION	DESCRIPTION	AWARD
DC	Howard University	A Search for Porphyrins & Metalloporphyrins in the Murchison Meteorite Using Maldi-T of Mass Spectrophotometry	$60,778
DC	Howard University	Center for the Study of Terrestrial and Extraterrestrial Atmospheres (CSTEA)	$1,222,784
DC	Howard University	Contribution of Flap-Side Edge Vortex Bursting to Airframe Noise	$63,415
DC	Howard University	Detection, Diagnosis, Location and Recommendation of Remedial Actions for Corona/Soft Faults	$57,517
DC	Howard University	Experimental Verification of Electric Drive Technologies Based on Artificial Intelligence Tools	$76,000
DC	Howard University	Hierarchical Algorithms and Their Embedded Computational Realization in Reconfigurable H/W	$234,354
DC	Howard University	Nanocomposite-Based Compact Thermomagnetic Cryocoolers	$126,399
DC	Howard University	Technology Assessment and Reliability Characterization of III-V Semiconductor Modfet Device	$50,000
DE	Delaware State University	Center for Excellence in Mathematics, Science, and Technology	$100,000
FL	Florida A&M University	A Cooperative Research Program in Aeronautical Information Science Technologies	$349,927
FL	Florida A&M University	Active Control of Boundary-Layer Separation and Flow Distortion in Adverse Pressure Gradient Flows	$80,981
FL	Florida A&M University	Center for Nonlinear and Nonequilibrium Aerosciences (CeNNAS)	$1,200,000
FL	Florida A&M University	Collision Processes in Astrophysical Plasmas	$175,427
FL	Florida A&M University	Electrochemical Capacitors and Hybrid Power Sources for Space Applications	$99,849
FL	Florida A&M University	Electrostatic Charging, Precipitation, Adhesion, and Dissipation in the Martian Atmosphere	$93,577
FL	Florida A&M University	Evolutionary Algorithms	$48,208
FL	Florida A&M University	Investigation of the Electronic Properties of Distorted Carbon Nanotubes	$89,433
FL	Florida A&M University	Robust Fault Detection and Isolation for NASA Launch Vehicles	$80,129
FL	Florida A&M University	Wireless Spread-Spectrum Intercommunication System	$97,315
GA	Clark Atlanta University	Commercial Process Development for Polyimide Foams	$75,000
GA	Clark Atlanta University	Developing Novel Fluorescent Materials with Near Infrared Emission By Using M-Pheylene	$20,000
GA	Clark Atlanta University	Development of Thermally Stable and Highly Fluorescent IR Dyes	$20,000
GA	Clark Atlanta University	High Performance Polymers and Composites Center	$1,649,525

STATE	INSTITUTION	DESCRIPTION	AWARD
GA	Clark Atlanta University	Liquid Fuels: Pyrolytic Degradation and Fire Spread Behavior as Influenced by Buoyancy	$132,964
GA	Clark Atlanta University	Resin Transfer Molding and Vacuum Assisted Resin Transfer Molding Program	$56,136
GA	Morehouse College	Using the NASA Rotating Bioreactor to Study Role of Nitric Oxide in Breast-Induced Angiogenesis	$72,811
GA	Morehouse School of Medicine	Bone and Calcium Metabolism in Dahl Salt Sensitive and Salt Resistant Rats with Unloaded Hindlimbs	$37,901
GA	Morehouse School of Medicine	Chondrocyte Differentiation and Maturation in Hypergravity	$191,606
GA	Morehouse School of Medicine	Gravitational Effects on Nutrient Diffusion Through Cartilage Matrix	$30,000
GA	Morehouse School of Medicine	Joint Research on Space-Related Biological Issues	$150,000
GA	Morehouse School of Medicine	Minority University Space Medicine Center	$904,658
GA	Morehouse School of Medicine	Tissue Engineering of Human Retina in NASA Bioreactor for Transplant	$31,552
GA	Spelman College	Development of a Novel Multi-Component Probe for Combustion and Propulsion Diagnostics	$78,420
LA	Southern University A&M College-Baton Rouge	Fiberglass Instrument Development	$99,510
LA	Southern University A&M College-Baton Rouge	Integrated Approach to Reasoning Under Multiple Perspectives	$88,670
LA	Southern University A&M College-Baton Rouge	Structural Materials Failure Analysis Database	$48,638
MD	Bowie State University	Continued Support of EOS-IDS Urban Impacts on Global Productivity	$59,901
MD	Morgan State University	Developing an SSPA Utilizing Wide Band Gap Semiconductor Material	$13,244
MD	Morgan State University	Examine Samples of Carbon Carbonados	$3,000
MD	Morgan State University	Image Registration and Fusion for Future Formation Flying Systems	$18,000
MD	Morgan State University	Investigation of the Magnetic and Electronic Proper Ties of Metal and Metal Oxide Films and Multilayer	$100,000
MD	Morgan State University	Polymerization of Advanced Thermosets in Microgravity to Develop Ultra Low Polymers	$99,966
MD	Morgan State University	Sige ADC for Digital Microwave Radiometry	$40,000
MD	Morgan State University	Space Technology 5 Project. Application of Production Design Considerations to Nano-Satellites	$5,000
MD	University of Maryland-Eastern Shore	Research Participation in Airborne Oceanographic Lidar on Long Range Missions	$27,623
MS	Jackson State University	Intelligent Interface to the Numerical Simulators (IINS) of the Aerospace Transportation Engines	$35,815

STATE	INSTITUTION	DESCRIPTION	AWARD
MS	Jackson State University	Network Visualization in Three-Dimensions (NetViz)	$35,000
MS	Jackson State University	Satellite Analysis of Gulf Coast Atmosphere Moisture and Tropospheric Aerosols	$99,992
MS	Jackson State University	Studies of Ocean-Atmospheric Interactions and Associated Tropical Cyclones/Hurricanes	$100,000
MS	Mississippi Valley State University	Response of Soybean Leaf and Canopy Spectral Reflectance to Chelate Assisted Lead/ Jutpextractopm	$77,299
NC	Elizabeth City State University	A Pilot Computer Aided Design and Manufacturing Curriculum that Promotes Engineering	$75,001
NC	Elizabeth City State University	Air Traffic Analysis	$35,000
NC	Elizabeth City State University	Mathematics of the Great Dismal Swamp	$101,776
NC	Johnson C. Smith University	The Development of a Passive Millimeter Wave Imaging System with Super-Resolution	$97,596
NC	North Carolina A&T State University	8cm and 30cm Carbon-Carbon Grids, Using Innovative Manufacturing Process	$40,000
NC	North Carolina A&T State University	Advanced Cross Enterprise Technology	$539,870
NC	North Carolina A&T State University	Carbon Fiber Reinforced Ceramic Composites for Propulsion Application	$5,000
NC	North Carolina A&T State University	Development and Evaluation of Fault-Tolerant Flight Control Systems	$100,000
NC	North Carolina A&T State University	Examining the Pilot and Controller Performance Data When in a Free Flight With Weather Phenomenon	$130,000
NC	North Carolina A&T State University	Self-Timed Synchronous Digital System Design	$100,000
NC	North Carolina A&T State University	Structural Health Monitoring of Aerospace Vehicles	$80,000
NC	North Carolina A&T State University	The Center for Aerospace Research: A NASA Center of Excellence	$1,200,000
NC	Winston-Salem State University	Generic Divide and Conquer Internet-Based	$51,839
TN	Fisk University	Center for Photonic Materials and Devices	$1,200,000
TN	Fisk University	Characterization of Crystalline Perfection of Binary and Ternary Wide Gap Semiconductors	$79,824
TN	Fisk University	Optical Trapping and Manipulation of Nanocrystals Created in a Laser Abation Plume	$96,355
TN	Fisk University	Size Graded Quantum Dot Solar Energy Cells for Space Power Technology	$147,963
TN	Tennessee State University	Embodiment of Intelligent Behaviors on Mobile Robots	$132,567
TN	Tennessee State University	Quality of Service Comparisons Between Satellite, Microwave, and T1 Communications	$100,000
TN	Tennessee State University	The NASA Engineering and Science Collaborative	$762,940

STATE	INSTITUTION	DESCRIPTION	AWARD
TN	Tennessee State University	Center for Automated Space Science	$1,265,401
TX	Prairie View A&M University	Advanced Fuel Injector Optimization for RBCC Engine Concept	$100,000
TX	Prairie View A&M University	Center for Applied Radiation Research	$1,199,999
TX	Prairie View A&M University	Establishment of a Solar Observatory and Studies on the Solar Atmosphere	$100,000
TX	Prairie View A&M University	Improvement of the Solar Observation Facilities at Prairie View Solar Observatory	$35,500
TX	Prairie View A&M University	Mitigation of High Altitude and Low Earth Orbit Radiation Effects on Microelectronics Via Shielding	$100,000
TX	Prairie View A&M University	Radiation Exposure Effects and Shielding Analysis of Carbon Nanotube Materials	$37,000
TX	Prairie View A&M University	Research to Significantly Enhance Composites Survivability at 550 Degrees Fahrenheit in Oxidative Environment	$136,102
TX	Prairie View A&M University	Software Engineering Initiative	$526,692
TX	Prairie View A&M University	Use of Electromigration to Immobilize Metal Ions	$60,000
TX	Texas Southern University	Development of Natural Language Understanding Grammars for Intelligent Monitoring	$14,998
TX	Texas Southern University	High Pressure Laboratory	$300,000
TX	Texas Southern University	Mold Development in Hydroponics	$72,000
TX	Texas Southern University	Silicon Uptake in Hydroponics by Graminaceous Crop Plants	$50,000
VA	Hampton University	Advanced Methods for Aircraft Engine Thrust and Noise Benefits: Nozzle-Inlet Flow Analysis	$100,000
VA	Hampton University	Advanced Undergraduate Research Using Optical Radiation in the Atmosphere (Aurora 2001)	$75,000
VA	Hampton University	Analysis of Antioxidant and Phosphoinositol Signal Transduction Pathway (S) in Plants After Exposure	$55,000
VA	Hampton University	Analysis of Student Nitric Oxide Explorer Solar X-Ray Photometer Measurements	$35,000
VA	Hampton University	Applied CFD Research & Training	$100,000
VA	Hampton University	Concept Study for the "Aeronomy of Ice in the Mesosphere" (AIM) Mission	$347,116
VA	Hampton University	Corrugated and Composed Nozzles Application for Thrust and Jet Noise Benefits Via UEET Program	$125,000
VA	Hampton University	Development and Comparison of Global Aerosol, Water Vapor, and Ozone Climatologies Using Sage II	$63,000
VA	Hampton University	Dynamical Interpretation of Aerosol Influences on Dobson Spectrophotometer	$11,640
VA	Hampton University	Evaluation of the Effect of Water Vapor on the Performance of NASA's NMRO Catalyst for Carbon	$74,869

STATE	INSTITUTION	DESCRIPTION	AWARD
VA	Hampton University	Numerical Simulation of One- and Two-Phase Flows in Propulsion Systems	$100,000
VA	Hampton University	Optical Electronic Bragg Reflection Sensor System with Hydrodynamic Flow Applications	$95,000
VA	Hampton University	Picasso-CENA International Science Advisory Panel, Science Activities, Algorithm Implementation and OU	$799,421
VA	Hampton University	Principal Investigator Services to Support SAGE II and III, SABER, HALOE, LITE and LIDAR Programs	$222,672
VA	Hampton University	Research Center for Optical Physics	$1,218,999
VA	Hampton University	Standards of Climatology and Long-Term Changes of Chemical Tracers in the Middle Atmosphere Using UARS Data and HALOE	$44,492
VA	Hampton University	Statistical Methods for Rapid Aerothermal Analysis and Design Technology	$80,000
VA	Hampton University	Student Field Testing of the Hampton University Compact Ozone LIDAR System Certification	$75,000
VA	Hampton University	Studies of Polar Mesopheric Clouds from Observations by the Student Nitric Oxide Explorer	$77,307
VA	Hampton University	Study of Contrails and Atmospheric Radiation Measurements (ARM) Data Project Development	$115,057
VA	Hampton University	Theoretical and Observational Determination of Global and Regional Radiation Budget, Forcing and Feedback Top-of-Atmosphere	$463,052
VA	Hampton University	Top-of-Atmosphere Albedo Estimation from Polder Multi-Angle Measurements: Evaluation of Water	$52,279
VA	Hampton University	Top-of-Atmosphere Clear-Sky Broadband Radiative Flux and Direct Aerosol Radiative Forcing	$57,548
VA	Hampton University	UV Induced Densification and Ablation During the Formation of Bragg Gratings In Ge-Doped Si02 Preformation	$21,850
VA	Norfolk State University	Design and Performance Tests of Ultra-Compact Calorimeters for High Energy Astrophysics	$80,075
VA	Norfolk State University	Development of Novel Composite and Random Material for Nonlinear Optics and Lasers	$420,000
VA	Norfolk State University	Nonselective Room Temperature Microbolometers Based on CMB Thin Films	$73,412
VA	Norfolk State University	Norfolk State University Research Experience in Earth Science	$75,608
VA	Norfolk State University	Scenario Based Learning: Inquiry for a Digital Earth	$77,461
VA	Norfolk State University	Variational Method in Design Optimization	$91,845
WV	West Virginia State College	Application of NASA's Remote Sensing Satellites to Environmental Research and Earth Science Education	$70,000

STATE	INSTITUTION	DESCRIPTION	AWARD
RESEARCH AND DEVELOPMENT TOTAL			***$27,112,041***

AWARDS BY OBJECT CATEGORY

Program Evaluation

Uniform Outcomes

In order to monitor the progress of NASA HBCU programs, each grant recipient was required to submit a Uniform Outcomes Report as part of their annual performance report. The Uniform Outcomes Report consists of both numerical outcomes data and a narrative summary of project accomplishments covering Academic Year (AY) 2000-2001 and the summer of 2000. The data were collected electronically via the World Wide Web. This single annual collection of data is used to provide the information necessary for annual Minority University Research and Education Division (MURED) reports, required White House reports, budget submissions and justifications, and responses to congressional inquiries and comparative assessments of programs and projects.

The numerical data measure program performance against metrics that apply to all NASA MURED projects. These metrics reduce the collection of data to the minimal amounts possible, emphasize outcome over process, and are applicable to any project. They are aggregable both horizontally and longitudinally, and they allow adjustable benchmarking standards to be applied. For research projects, including University Research Centers (URC), Institutional Research Awards (IRA), and Faculty Awards for Research (FAR), the metrics track two basic areas--student outcomes (degrees awarded and post-degree plans), and research outcomes (refereed publications, leveraged funding, patents, and commercial products). Vital process information, such as numbers of faculty and students supported and the gross categories in which funds are spent, is also collected. For education projects, the Uniform Outcomes Report not only continues to collect data on numbers and demographics of students supported, but primarily focuses on measurable improvements in student performance. Short-term metrics track increases in test scores and increases in enrollment in mathematics and science preparatory courses for students in NASA programs. Long-term metrics track the rate for which K-12 students in NASA programs enter college and obtain advanced degrees.

The narratives on each project provide information on accomplishments that are relative to that project, and are therefore not necessarily captured in the Uniform Outcomes data. These narratives serve as input for the annual Minority University Research and Education Program (MUREP) Hispanic-Serving Institutions (HSI) and Tribal Colleges and Universities (TCU) Performance Reports, Research and Technology Performance Report, Education and Training Performance Report, as well as this HBCU Performance Report and other such reports, as required.

Site Visits

Independent peer reviewers conducted onsite reviews of MURED grants at many HBCU's during the year. The purposes of the visits were to ascertain the projects'

accomplishments to date, to identify any potential barriers to achieving project objectives, to determine whether collaboration between the institution and NASA is sufficient to achieve maximum benefits for the university and for NASA, and to allow NASA personnel an opportunity to review the financial management of the grant, focusing on processes such as costing. The results of the reviews showed that practically all grantees were operating efficiently and were effectively achieving the objectives of their projects. As a result of the emphasis on the issue of grant costing over the past few years, the Agency has noted significant improvements in the rates of costing the grants by the institutions.

University Research Centers (URC)

During FY 2001, NASA contracted with the United Negro College Fund Special Programs Corporation (UNCFSPC) to conduct an evaluation of the first seven URC's established at HBCU's. These first seven HBCU's are known as "Group I." An important part of the URC's was the establishment of Technical Review Committees (TRC) to work with and provide advice and support to each URC in the accomplishment of its objectives. UNCFSPC subcontracted with Joffre T. Whisenton and Associates, Inc., and appointed a Program Review Panel of knowledgeable professionals to objectively evaluate these seven URC's. UNCFSPC requested that the effectiveness of NASA's strategy for building research capacity and infrastructure in NASA-related technologies at HBCU's be assessed and required that a report with recommendations be made to NASA.

The Program Review Panel gathered data about each of the Group I URC's through extensive document reviews; through site visits to each URC where presentations by selected key faculty, students, and university administrators were heard, and facilities and laboratories were observed; and through previous and current written and oral reports of the TRC's and their Chairs. The report presented the Program Review Panel's assessment findings as well as its recommendations.

AWARDS BY OBJECT CATEGORY

Training

STATE	INSTITUTION	DESCRIPTION	AWARD
AL	Oakwood College	Minority Student Development Program in Science and Engineering	$100,000
AL	Tuskegee University	NASA Spaceflight and Life Sciences Training Program (SLSTP) Academic Partner Alliance (NSAPA)	$497,300
FL	Bethune-Cookman College	NASA/Florida Minority Institution Entrepreneurial Partnership	$300,000
FL	Bethune-Cookman College	Operation of the Center for Space Education	$482,885
FL	Florida A&M University	Discover II SBI/NASA Internships	$204,265
FL	Florida A&M University	Linkages 2001 Project	$250,000
GA	Clark Atlanta University	Integration of Research and Education in the Area of Earth Systems Science	$440,032
GA	Clark Atlanta University	Transfer Inspiring Careers In Engineering, Mathematics and Science (ICEMS) from Morehouse College to Clark Atlanta University	$19,864
GA	Spelman College	Model Institutions for Excellence (MIE)	$1,707,081
LA	Southern University A&M College- Baton Rouge	Partnerships in Astronomy and Astrophysics Education and Research at Southern University	$210,000
LA	Southern University A&M College- Baton Rouge	Program to Increase Pursuit of Education and Learning in Engineering and Sciences	$913,800
LA	Xavier University	Teacher and Curriculum Enhancement Program	$200,000
MD	Bowie State University	A Fast Track Plan Toward Teacher Certification for the Public School System of Prince George's County	$200,000
MD	Bowie State University	Bowie Seeks to Integrate the Wire Mission into Its BSOCC Program to Provide Opportunities to Students	$64,000
MD	Bowie State University	Model Institutions for Excellence (MIE)	$1,529,000
MD	Bowie State University	To Manage A 2001 Summer Institute in Engineering and Computer Applications Program	$207,800
MD	Morgan State University	A Proposal for NASA-Related Capacity-Building and Outreach at Morgan State University	$1,600,000
MD	Morgan State University	NRTS Continuation/MUSPIN NRTS Program	$350,000
NC	Elizabeth City State University	Regional Network Resources and Training Site (NRTS) at ECSU	$372,694
NC	Elizabeth City State University	You be the Scientist with Satellite Imagery in EZ/EC Communities	$94,791
NC	North Carolina A&T State University	Access to Space Through Research and Education	$75,000
NC	North Carolina A&T State University	Integration of NASA Research in Undergraduate Education in Mathematics, Science, Engineering and Technology	$701,721
NC	Shaw University	Scientists Plus Allies Contributing to Education (SPACE)	$99,364
OH	Wilberforce University	Student Outreach With Renewable Energy Technology (SORET) Consortium	$299,957

STATE	INSTITUTION	DESCRIPTION	AWARD
PA	Lincoln University-Pennsylvania	Lincoln's Advanced Science and Engineering Reinforcement (LASER) Program	$30,000
SC	South Carolina State University	Enhancement of the Space Science Research Program at South Carolina State University	$227,000
SC	South Carolina State University	Share with a Pair of Peers (SWAPOP II)	$199,164
SC	South Carolina State University	The Center for NASA Research and Technology CNRT / MUSPIN NRTS Program	$350,000
SC	Voorhees College	Earth Science Education and Research Initiative	$139,980
TN	Tennessee State University	A Partnership Between the Tennessee State University Center of Excellence and the New Mexico Supercomputing Challenge	$100,000
TN	Tennessee State University	NASA/TSU Minority Universities Information Network for Research and Education/MUSPIN NRTS Program	$365,321
TN	Tennessee State University	TSU Research Projects for Increasing the Pool of Minority Engineers	$92,400
TX	Prairie View A&M University	NASA Southwest Regional Network Resources and Training Site/MUSPIN NRTS Program	$412,418
VA	Hampton University	A Space Science Curriculum at Hampton University: Development of a Minor, Faculty Enhancement	$244,997
VA	Hampton University	Center for LIDAR and Atmospheric Sciences Students	$500,000
VA	Hampton University	Development of an Astrobiology Education Curriculum at Hampton University	$103,000
VA	Hampton University	Hampton University College of Continuing Education Aeroscience Center	$300,000
VA	Hampton University	Program for Improving Success in Science, Engineering, and Mathematics (PRISEM)	$85,487
VA	Hampton University	Proposal for Membership to the Aerosol Radiative Forcing Science Team	$14,910
VA	Hampton University	The American Indian Educational Opportunities 2001 Program	$100,000
VA	Norfolk State University	2001 Preservice Teacher Conference	$150,029
VA	Norfolk State University	2001 Preservice Teacher Institute	$225,000
VA	Norfolk State University	A NASA-HBCU Partnership To Enhance Minority Education and Research Participation in the Space Science	$203,891
VA	Norfolk State University	Bringing Education and Science Together for Systemic Training and Empowerment of Preservice Teachers	$199,832
VA	Norfolk State University	Mission-Leveraged Education: NSU-NASA Innovative Undergraduate Model Millennium a NASA PAIR Project	$297,940
VA	Norfolk State University	Summer Workshop Program for Emerging Educators	$20,346
VA	Norfolk State University	Technical Education Outreach Materials Science and Technology Based on NASA's Materials Research	$44,000
WV	Bluefield State College	Emerging Leaders Institute	$100,000
TRAINING TOTAL			***$15,425,269***

AWARDS BY OBJECT CATEGORY

Facilities and Equipment

There were no grants funded specifically for Facilities and Equipment at HBCU's during FY 2001.

AWARDS BY OBJECT CATEGORY

Fellowships, Internships, Traineeships, Recruitment, and Arrangements under the Intergovernmental Personnel Act (IPA)

STATE	INSTITUTION	DESCRIPTION	AWARD
DC	Howard University	Goddard Space Flight Center/Howard University Fellowship in Atmospheric Science (GOHFAS)	$295,000
DC	Howard University	Support of the 2001 ASEE-NASA Summer Faculty Fellowship Program (Aeronautics & Space Research)	$354,000
FL	Florida A&M University	A Graduate Fellowship Component to Augment Program Image	$356,500
NC	North Carolina A&T State University	Ronald E. McNair Graduate Research Fellowship Program	$323,500
VA	Hampton University	Langley Aeroscience Research Summer Scholars (LARSS) Program	$907,871
VA	Norfolk State University	The Chrome Honors Program	$50,000
FELLOWSHIP TOTAL			***$2,286,871***

AWARDS BY OBJECT CATEGORY

Student Tuition Assistance, Scholarships, and Other Aid

STATE	INSTITUTION	DESCRIPTION	AWARD
FL	Florida A&M University	Minority Access to Graduate Engineering Program	$1,260,000
GA	Morehouse College	Strategic Preparedness Advancing Careers In Engineering/Sciences (SPACE)	$1,539,013
GA	Spelman College	Women in Sciences and Engineering Scholars Program	$1,500,000
WV	West Virginia State College	NASA Science and Technology Scholar Program	$30,000
STUDENT TUITION TOTAL			***$4,329,013***

AWARDS BY OBJECT CATEGORY

Direct Institutional Subsidies

There were no grants funded specifically for Direct Institutional Subsidies at HBCU's during FY 2001.

AWARDS BY OBJECT CATEGORY

Third-Party Awards

American Society for Engineering Education (ASEE)	
Helen T. Carr Fellowship	$50,000
National Association for Equal Opportunity in Higher Education (NAFEO)	
Louis Stokes Professional Leadership Program	$887,884
NASA Summer Internship Program	$111,600
NAFEO/NASA Research Academy	$694,792
Minority Access, Inc.	$950,000
Paragon Tech, Inc. – Science, Engineering, Mathematics and Aerospace Academy (SEMAA)	$903,000
United Negro College Fund Special Programs, Inc	
Harriett G. Jenkins Predoctoral Fellowship Program	$648,033
Curriculum Improvement Partnership Awards (CIPA)	$625,944
Mississippi Research Consortium	$74,934
Louisiana Research Consortium	$136,000
Mississippi Space Commerce Initiative	$300,845
National Space Grant College/Fellowship Program	$397,185
Summer High School Apprenticeship Research Program (SHARP) PLUS	$650,000
NASA Opportunities for Visionary Academics (NOVA)	$105,510
Aerospace Education Services Program (AESP)	$301,726
Experimental Program to Stimulate Competitive Research (EPSCOR)	$111,560
National Action Council for Minorities in Engineering (NACME)	$855,000
Tennessee State University Diversified Career and Educational Services (DCES)	$100,000
THIRD-PARTY TOTAL	***$7,904,013***

AWARDS BY OBJECT CATEGORY

Private-Sector Involvement

ORGANIZATION	DESCRIPTION	AWARD
Global Science & Technology, Inc.	NASA Peer Review Services	$969,064
PRIVATE-SECTOR TOTAL		***$969,064***

NASA's MURED is supported by NASA Peer Review Services (NPRS), a consolidated contract, of which Global Science & Technology, Inc. is the prime contractor. NPRS' functions include the development and enhancement of an internet-based electronic management system to support solicitation development, peer review and selection, post-award evaluation, and grants/cooperative agreements management with HBCU's and OMU's. Additionally, NPRS provides technical assistance to HBCU's and ensures that HBCU's are familiar with and capable of accessing the NASA HBCU programs online via the electronic management system to receive announcements of opportunity and to submit proposals, evaluations, and postaward management processes.

AWARDS BY OBJECT CATEGORY

Administrative Infrastructure

There were no grants funded specifically for Administrative Infrastructure at HBCU's during FY 2001.

AWARDS BY OBJECT CATEGORY

Other Activities

STATE	INSTITUTION	DESCRIPTION	AWARD
AL	Alabama A&M University	High School/High-Tech Career Development Program in Mathematics, Science Engineering, and Technology	$106,361
AL	Alabama A&M University	Enhancement of Students in Science, Engineering, and Mathematics	$76,273
AL	Trenholm State Technical College	NASA High School Science Enrichment Program (HSSEP)	$100,000
AL	Tuskegee University	Tuskegee University Gateway Achievement Program	$86,000
DC	Howard University	Public Service Intern Program	$73,700
DC	University of the District of Columbia	Retaining High Potential Junior and Senior High School Students	$295,047
GA	Albany State University	Albany State University High School/High Tech	$75,000
GA	Paine College	Pre-College Enrichment Program in Mathematics Science, Engineering and Technology	$100,000
GA	Savannah State University	High School/High Tech: Program a Partnership of SSU with the Georgia Committee on Employment of People	$74,971
LA	Xavier University	SOAR 2 Summer Bridge Program	$150,000
MD	University of Maryland-Eastern Shore	Pre-College Activities for Enhancing Minority Participation in Engineering	$97,217
MD	University of Maryland-Eastern Shore	Mathematics, Engineering, Science Enrichment Pre-College Program	$50,000
MS	Jackson State University	MASTAP Project: A Model for Improving the Pre-Service Training of Middle School Math Teachers	$199,600
MS	Mississippi Valley State University	Improving Teachers and Students Achievement in Mathematics and Science	$197,853
MS	Mississippi Valley State University	Mississippi Valley State University PACE Program	$99,921
NC	Fayetteville State University	Mathematics/Science Education Center Pre-College Program	$100,000
NC	Shaw University	Shaw University MSET Pre-College Experience	$88,107
TN	Tennessee State University	College Bound to Graduate School Program	$53,212
TX	Jarvis Christian College	PACE/MSET Summer Camp for Training and Mentoring	$100,000
TX	Texas College	Texas College Center for Excellence in Mathematics, Science and Technology, and a Technology Place for Kids	$998,000
OTHER ACTIVITIES TOTAL			***$3,121,262***

AWARDS

AND

EXEMPLARY

PROJECTS

- **Institutional Science, Engineering and Technology (ISET)**
  - University Research Center Program (URC)
  - Institutional Research Awards (IRA)
- **Principal Investigators (PI)**
  - Faculty Awards for Research (FAR)
  - NASA Administrator's Fellowship Program (NAFP)
  - Louis Stokes Leadership Program
- **Mathematics, Science, and Engineering (MSE)**
  - Mathematics, Science, and Technology Awards for Teacher and Curriculum Enhancement Program (MASTAP)
  - Precollege Awards For Excellence In Mathematics, Science, Engineering, and Technology (PACE/MSET)
  - Model Institutions of Excellence (MIE)
- **Partnerships**
  - Partnership Awards for the Integration of Research (PAIR)
  - Network Resources and Training Sites (NRTS)

AWARDS AND EXEMPLARY PROJECTS

- **Institutional Science, Engineering and Technology (ISET)**
- **Principal Investigators (PI)**
- **Mathematics, Science, and Engineering (MSE)**
- **Partnerships**

NASA employs a comprehensive and complementary array of strategies to achieve its established goals for minority institutions (MI). The successful deployment of these strategies has resulted in the establishment of four different programmatic award categories that apply equally to the HBCU and OMU Programs. These programmatic initiatives are carried out in close collaboration with NASA Strategic Enterprises and Centers/JPL. The Strategic Enterprises and Centers/JPL support minority university programs through direct funding, use of their facilities, and commitment of their personnel to serve on Technical Review Committees (TRC) and assist in other facets of program implementation. **Institutional Science, Engineering and Technology (ISET)** Awards combine the University Research Centers (URC) and Institutional Research Awards (IRA) under one award category. The ISET awards receive technical guidance and annual on-site reviews by TRC's. The awards for **Principal Investigators (PI)**, **Mathematics, Science, and Engineering (MSE)**, and **Partnerships** are managed predominately by personnel at the NASA Centers/JPL. As a result of the involvement of the Strategic Enterprises and NASA Centers/JPL in the MUREP, numerous students and PI's from MI's are knowledgeable about and make significant contributions to the aeronautics and space community.

The URC's and IRA's (Research) have been grouped into one award category, ISET Awards. This adjustment was made to better reflect the emphasis on strengthening the institution's research capability and achieving outcomes that enhance the institution. The IRA's for the Network Resources and Training Sites (NRTS) have been moved to Partnership Awards to better reflect the awards of this group's contributions to NASA's educational technology goals. Outreach to MI's will continue to be made in collaboration with the Strategic Enterprises and Centers/JPL to ensure that MI's are knowledgeable of and responsive to the Agency's Strategic Plan. OEOP will continue to set specific program goals that lead to measurable program outcomes that are consistent with the Agency's investment in MI's. These award categories are listed below.

<u>ISET AWARDS</u>

- URC
- IRA

URC

ISET Awards include the URC's and the IRA's. The URC Awards are collaborative programs conducted in cooperation with the Strategic Enterprises. These awards are designed to achieve a broad-based, competitive aerospace research capability among

the Nation's MI's that will foster new aerospace science and technology concepts; expand the Nation's base for aerospace research and development; develop mechanisms for increased participation by faculty and students in mainstream research; and increase the productivity of students (who are U.S. citizens and who have historically been underrepresented) with advanced degrees in NASA-related fields.

Together, the 11 HBCU Research Centers achieved the following outcomes in Academic Year (AY) 2000-2001 and the summer of 2001:

- 157 faculty members, research associates, and postdoctoral researchers conducted NASA-related research at URCs.
- 410 disadvantaged/underrepresented students participated in URC research.
- 129 degrees were awarded to disadvantaged/underrepresented students, including 79 bachelors degrees, 46 masters degrees, and 4 doctoral degrees.
- 270 refereed papers and/or book chapters were published or accepted for publication. There were 118 student authors or coauthors of these papers/chapters.
- 443 technical presentations were given, including 70 by students.
- $20.1 million was leveraged in new research funds from sources outside the NASA MUREP.
- 2 patents were awarded.
- 5 commercial products were under development.

Minority University Research Centers include the following HBCU's: Alabama A&M University, Clark Atlanta University, Fisk University, Florida A&M University, Hampton University, Howard University, Morehouse School of Medicine, North Carolina A&T State University, Prairie View A&M University, Tennessee State University, and Tuskegee University.

IRA

IRA's improve academic, scientific and technology, infrastructure and broaden the NASA-related science and technology base at MI's. The first IRA (Research) award was made in FY 1994 and was limited to only OMU's. The most recent competitively selected IRA awards were made in FY 2000 to both OMU's and an HBCU. These awards provide OMU's and HBCU's with an opportunity to provide a quality learning and research environment in NASA-related areas. As a result of participating in this program, OMU's and HBCU's contribute directly to NASA research and human resources requirements; support the development of the institution's NASA-related research capabilities; and increase the number and percentage of underrepresented minorities who are U.S. citizens with advanced degrees in NASA-related fields.

During FY 2001, only one HBCU was an IRA recipient, Norfolk State University.

AN EXEMPLARY UNIVERSITY RESEARCH CENTER

Tuskegee University
Center for Food and Environmental Systems for Human Exploration of Space

Since 1985, Tuskegee University, through its Center for Food and Environmental Systems for Human Exploration of Space (CFESH), has been engaged in research that addresses NASA's mission to achieve long-duration human space exploration. The research focuses mainly on two areas of NASA's Strategic Plan, which are defined as the Human Exploration and Development of Space Enterprise (HEDS) and the Space Technology Enterprise (STE). The strategic focus of the Center is the development of bioregenerative food production, food processing, and waste management for long-duration human planetary missions. Tuskegee University, through CFESH, is the leading institution for cultivar development and yield optimization of sweet potatoes and peanuts in controlled environments. In addition to the development of bioregenerative food production systems, integral to the Center's purpose is the training of undergraduate and graduate minority scientists and engineers to increase and diversify the professional pool in these disciplines. Outreach activities in developing space science and engineering interests, especially among K-12 minorities, are also emphasized. Currently, the Center supports 25 students (8 graduates and 17 undergraduates) majoring in agricultural and environmental sciences, biology, chemistry, mechanical, electrical, chemical/aerospace science engineering, or food and nutritional sciences. The work is organized under four interdisciplinary research teams of life sciences and engineering faculty and students charged with developing the horticultural protocols and systems and control technologies needed for advanced life support. The overall objective of the project is to provide tested information and technologies applicable to bioregenerative food production to enable humans to live and work safely for long durations in space. This year's research objectives were jointly agreed on by the CFESH team and the Technical Review Panel.

Research Accomplishments

The Crop Production and Environmental Systems research showed that elevated carbon dioxide concentrations can enhance seed yield of peanuts at high levels of relative humidity; growing peanut plants under low light levels similar to that found on Mars reduced seed yields, harvest index (ratio of edible to inedible plant parts), and delayed flowering.

The Germplasm Development and Improvement Group successfully completed its quarantine program that was put in place for the control of the sweet potato weevil found in the University fields in 1998. Two sweet potato accessions (J6/66 and TU-82-155) with high dry matter and sensory scores are being prepared for germplasm release for both field and hydroponics (water culture). In the area of biotechnology, research activity on transgenic sweet potatoes and peanuts continued.

The Food Technology and Utilization Working Group has developed a prototype extruded ready-to-eat breakfast cereal from sweet potatoes and completed work on the formula for a sweet potato biscuit mix.

The Waste Management and Resource Recycling Group evaluated the effectiveness of single and mixed culture bacterial treatments in releasing nutrients from inedible sweet potato biomass obtained from a large-scale test at Johnson Space Center. The single culture bacterial treatment was more effective in releasing all the major plant nutrients (nitrogen, phosphorous, magnesium, calcium) except potassium, 14 days after incubation. Another significant finding is that a lower concentration of sodium was recovered, and this has implications, particularly when the effluent is recycled to new plants to promote growth. This would reduce the sodium content of the next generation of storage roots.

Relevance to NASA Strategic Enterprises

The information gained on peanut response under high carbon dioxide levels and humidity as well as to low levels of light intensity are important to HEDS in developing an optimum protocol for production of this crop so valuable for its oil and protein contents. The completion of baking mix using sweet potato flour is an important contribution to the breads component of Advanced Life Support menus.

Benefits to Society

This work benefits the average citizen by expanding the variety of ways to utilize the sweet potato, not only for increased nutrition, but also for its potential health benefits such as reduced blood pressure and lower cholesterol levels. Information gained from extended shelf-life studies with sweet potatoes and the associated microbial changes with time will add valued inputs and increase our understanding of food safety issues. The finding that the quality of the flour, protein and amino acid contents obtained from sweet potato storage roots altered by an artificial storage protein gene were not positively affected has nutrition implications for not only US citizens but worldwide.

Student Achievements

A graduate student and an undergraduate student won awards at the Sigma Xi 28th Annual Student Research Symposium in March 2001. The undergraduate student also received a citation and monetary award at the First Annual Undergraduate Student Conference held at Tuskegee University in February 2001. Three students have been accepted into Ph.D. programs at Iowa State University, University of Nebraska, and University of Michigan. Another student completed his graduate program in Food and Nutritional Sciences and is pursuing a Doctor of Veterinary Medicine at Tuskegee University. Two undergraduate students from the Environmental Science program are pursuing MD and MS degrees at Wake Forest and Iowa State Universities, respectively. Two students served as interns at Johnson Space Center, and one student served as an intern at Kennedy Space Center. Ten local high school students interned with six CFESH scientists during the summer of 2000. The students' research focus areas included Food Science and Sensory Evaluation, Food Safety, Computer Applications, Plant, Soil, Animal and Environmental Sciences and Biotechnology.

AN EXEMPLARY INSTITUTIONAL RESEARCH AWARD (IRA)

Norfolk State University

Development of Novel Composite and Random Materials for Nonlinear Optics and Lasers

The research is focused on the development of unique random and composite laser sources and nonlinear optical materials. In this research effort, experimenters use the mixtures of pulverized and scattering solid-state laser materials with fractal metallic aggregates to improve the efficiency and reduce the threshold of random lasers via localization of the electromagnetic field. Researchers also develop and characterize composite sintered active optical media (inorganic dielectrics, optically clear ceramics) with embedded metallic and ceramic aggregates for application in NASA's nonlinear optical devices and lasers.

Significant Research Accomplishments

Sample research accomplishments include the following:

Threshold and Slope Efficiency of Nd0.5La0.5Al3(BO3)4 Ceramic Random Laser: Effect of the Pumped Spot Size

Researchers have experimentally found that in a random laser based on Nd0.5La0.5Al3(BO3)4 scattering ceramic, the threshold pumping density decreases and the output slope efficiency increases with the increase of the diameter of the pumped spot. The experimental behavior is explained in terms of random photon's walk in an amplifying medium.

Effect of Fractal Ag Aggregate on Spectroscopic Properties of Rhodamine 6G Laser Dye

Fractal aggregates of silver nanoparticles can strongly influence basic spectroscopic properties of Rhodamine 6G dye, in particular, create a new emission band. Further studies, which potentially can revolutionize the whole laser technology, are to be done in solid-state composite materials.

Near-Field Optical Study of Selective Photomodification of Fractal Aggregates

It was shown theoretically and confirmed experimentally, that with sufficient laser intensity, the fields created in the hot spots can be so high that they cause local structural modification of the aggregate either by fusing some of the constituent particles or locally fragmenting the aggregate. This, in turn, modifies the hot-spot pattern, and other optical properties of the aggregate, such as its absorption spectrum. The electron micrographs taken before and after irradiation show, in agreement with our theory, that the structure of the colloidal fractal cluster remains globally unchanged; however, a few particles within domains the size of the hot spots (a few nanometers) change their size, shape, and local arrangement. Near-field images of small-particle aggregates before and after photomodification show that the local changes in the near-field optical responses can be much stronger than changes in the average far-field optical response. A developed theoretical model of photomodification is in good agreement with experimental observations.

Relevance to a Specific NASA Strategic Enterprise

According to a researcher at the NASA LaRC, the research "... presents a roadmap for developing novel, robust, composite and random order materials for NASA non-linear optics and materials. These optics and materials will offer new photonic light sources for applications in NASA's Earth Science and Space Science Enterprises remote sensing of atmospheres. They will provide a wide range of wavelengths for probing the content and density of a large number of atmospheric species. And, because of their robust nature, they are ideal for deployment to harsh environments with minimal mechanical and thermal engineering concerns. The proposed materials can also support the Human Exploration and Development of Space Enterprise by providing sensor technology for detection of harmful gases and also, by enhancing optical communication capabilities. The Aeronautics Enterprise will be interested in developing these materials for application in non-invasive monitoring of structural and material properties."

Benefits to Society

The developed novel and nonlinear optical materials can find applications in various commercial laser systems, high-brightness display screens, airport security, etc.

Significant Student Achievements

Using 1st-year project money, Norfolk State University's IRA supported more than 10 graduate and 10 undergraduate research students through stipends and research assistantships. All of the students except two are members of an underrepresented minority group. The grant paid travel expenses for one student who attended the Annual Meeting of the Optical Society of America in Long Beach, California. Students supported by the grant coauthored 4 publications in peer-reviewed journals, 2 publications in the proceedings of the professional societies, 4 publications in technical digests, and 8 conference presentations.

PRINCIPAL INVESTIGATORS (PI) AWARDS

- Faculty Awards for Research (FAR)
- NASA Administrator's Fellowship Program (NAFP)
- Louis Stokes Leadership Program

PI Awards are designed to increase the participation of faculty and other professionals in conducting NASA research, research training and/or administration. Faculty and other professionals can apply to three different programs.

Faculty Awards for Research (FAR)
The Faculty Awards for Research (FAR) provide new faculty, and those who have limited NASA experience, the opportunity to integrate the research and education

components of their careers with the unique mission requirements of a specific NASA Center/JPL. The FAR program provides merit selection of proposals from outstanding and promising science, engineering, and technology (SET)-tenured and tenure-track faculty who are capable of contributing to the Agency's research and education objectives. This award provides faculty members with research support and exposure to the NASA peer review process to enable them to demonstrate creativity, productivity, and future promise in the transition to achieving competitive awards in the Agency's mainstream research processes.

During its 11th year, the FAR program funded approximately 60 research projects at 23 HBCU's. The data that follow were obtained from the projects that were funded and reported during FY 2001 and summarize the activities of these FAR projects during AY 2000-01 and the summer 2001 reporting period.

During this period, 66 professional-level investigators were involved in research projects including 50 faculty members, 15 research associates, and 1 postdoctoral fellow. A total of 160 students including 113 undergraduates, 40 graduate students, and 7 doctoral students participated in these research activities. Their research accomplishments were documented in 47 refereed papers or book chapters that were published during this period including 22 students who were authors or co-authors of these publications. Additionally, of the 14 that were accepted but not yet published, 11 were authored or coauthored by students.

Eighty-two students obtained degrees during the reporting period, including 55 bachelor degrees, 24 master degrees, and 3 doctoral degrees. Twenty-one of the graduates were employed in NASA-related fields, including 14 bachelor degree graduates, and 7 master degree graduates. Seventeen of the 55 bachelor degree graduates planned to pursue graduate degrees, while 10 of the 24 masters degree graduates planned to pursue doctoral degrees.

NASA Administrator's Fellowship Program (NAFP)

The NASA Administrator's Fellowship Program (NAFP) provides opportunities for NASA career employees and the mathematics, science, engineering, and technology (MSET) faculty of minority-serving institutions to compete through peer review for placement in a formal professional development program. In addition to individualized professional development enhancement, NASA employees spend a year teaching or conducting research at a minority-serving institution while MSET faculty spends a year conducting research at a NASA Center.

Louis Stokes Leadership Program

The Louis Stokes Leadership Program provides competitive, peer review selection of faculty, educators and other scientific and technical personnel with an opportunity to participate in a 4-year professional leadership program designed to assist the HBCU's and OMU's in strengthening the delivery and management of NASA-sponsored scientific research and MSET educational and training programs. Participants will spend 2 years at a NASA Center/JPL and 2 years at an HBCU or OMU enhancing their knowledge and ability to lead the institutions in better responses to the Federal

Financial Assistance Management Improvement Act, Electronic Grants Initiatives, the Government Performance and Results Act, and achievement of better performance outcomes in conducting NASA-funded research and education programs.

AN EXEMPLARY FAR PROJECT

Howard University
The Development of a New Generation Trapped Radiation Database

Within the Earth's magnetosphere, the region surrounding the Earth affected by the Earth's magnetic field, the gross motions of energetic electrons, protons and other ions are largely determined by that magnetic field. This trapped radiation is unevenly distributed through the magnetosphere. In addition, the locations of regions of significant energetic particle populations are generally not static in time, being subject to external influences such as the Solar Wind (SW) and the Interplanetary Magnetic Field (IMF), which themselves vary with time. Understanding and predicting the location and intensity of such radiation as well as its time-evolution are among space physics' important challenges both from a practical as well as a theoretical perspective. During the last 30 years, the space physics community has generated several quantitative empirical models of trapped particle populations, in part to allow radiation dose predictions spacecraft may expect to encounter. Of these empirical models, the *de facto* standards, AE-8 and AP-8 developed by NASA, have been useful both to the scientific and the mission planning communities as a first generation effort. They are, however, dated by today's computing capabilities and outlook, and are correspondingly limited as modern scientific tools. Our objective is to prepare the way for a modern, flexible trapped radiation database by conducting the basic research needed to describe an effective new database paradigm, and to carry out preliminary steps in the implementation of such a database.

The AE-8 and AP-8 trapped radiation models are static, empirical models, created by averaging data collected from many different instruments over a 20-year time span, with large-scale spatial averaging. The spatial descriptions are magnetic field-model dependent, and, due to their method of construction, these trapped radiation models can neither be updated nor modified as new data sets become available or old ones are found to be suspect. Only time-based database searches are supported. Howard's approach, in contrast, allows the insertion or deletion of data sets with relatively little effort, maintains both the temporal and spatial resolution of individual data sets within the model, does not depend on any particular magnetic field model, and can be searched not only by time, but by magnetospheric-environmental features as well. Such search capabilities will in turn support the construction of condition-dependent empirical models, thus responding to an ever increasing need of both the mission planning and space physics research communities.

Howard uses an object-oriented database approach. Primary data sets are converted from their raw format to a standardized one, Common Data Format (CDF), developed at NASA. The database itself contains only meta-data characterizing the individual primary data sets and their intra-connections, including links to the primary CDF data

sets. One virtue of this approach is that primary data sets may be maintained at remote sites. For example, data sets that already belong to other databases may be used. Flexibility is inherent in object-oriented structures, so that retroactive modifications in the internal structure of the meta-data base are sometimes possible.

In addition to satellite-based instrument measurements of energetic particle fluxes within the confines of the Earth's magnetic field, the most important part of the primary data sets, other data needed for the new database design include ground-based measurements of responses of the magnetosphere to varying magnetospheric conditions, and satellite-based measurements of both the SW and IMF, both of which affect the distribution of particles within the magnetosphere. The relationships between these magnetospheric drivers and response parameters is not yet well understood. Much of the theoretical work deals with establishing characteristic time delays between sets of driver-related parameters and response parameters. Indeed, a full set of such relationships, along with driver and response parameter values, may be expected to characterize the *state* of the magnetosphere. Condition-dependent searches of the new database will be greatly facilitated once a full set of such magnetospheric states is determined. This is a large task which is far from finished. Faculty have designed and implemented new, nonlinear statistical methods to analyze certain time series associated with such problems, and have carried out an extensive cluster analysis of high-dimensional data to locate some of these states. In addition, the researchers have used several, more traditional time series tools such as Impulse Response Functions.

This database will provide an important ingredient in the creation of a new standard radiation belt model supported by both COSPAR and the IACG. It will be usable both by space physicists for theoretical analyses and the mission planning community for dosing evaluations. These increased capabilities will enhance the access and usage of space physics data and thus will promote research within the Office of Space Science (OSS) Sun-Earth Connection science theme.

The effects of extreme solar variations on communications capabilities and electrical grid stability are well established. The viability of some space missions has been compromised because spacecraft have unexpectedly encountered pockets of intense radiation, which, in turn, have adversely affected instrumentation on board. When fully implemented, this database will play an important role in providing both the mission planning and space physics communities greater predictive capabilities about the location, intensity, and evolution of trapped radiation.

Three undergraduates (two seniors in electrical engineering and a junior in computer science) and a graduate student in computer science worked on this research project.

MATHEMATICS AND SCIENCE EDUCATION (MSE) AWARDS

- Mathematics, Science, and Technology Awards for Teacher and Curriculum Enhancement Program (MASTAP)
- Precollege Awards For Excellence In Mathematics, Science, Engineering, and Technology (PACE/MSET)
- Model Institutions of Excellence (MIE)

MSE Awards build upon the institutions' outstanding ability to provide excellence in MSET training while increasing the participation and achievement of socially and economically disadvantaged and/or disabled students in MSET fields at all levels of education. Awards are made in the following three areas: undergraduate and graduate; teacher preparation and enhancement; and precollege activities.

MSE Awards contribute to the national education goals by integrating the contents from the NASA mission into the educational outreach projects at MI's. As a result, NASA contributes to the increase in the number and the strengthening of the skills, knowledge, and interest of students and teachers in mathematics-, science-, engineering-, and technology-based academic programs. To address NASA's future human resources requirements, new competitive peer review and merit selection awards were made in the following areas during FY 2001:

Undergraduate and Graduate Awards provide scholarships, fellowships, internships, and research opportunities in NASA-related fields, and other services to enhance retention and increase graduation rates.

Teacher Preparation and Enhancement Awards provide opportunities for MI's to develop diverse and exemplary research-based mathematics, science, technology and geography teacher education curricula that are integrated with content from NASA's mission. It is the Agency's desire that the results will contribute to the participating states' efforts to increase the numbers and percentage of state-certified mathematics, science, technology or geography teachers employed in hard-to-staff elementary, middle, and secondary schools not normally served by NASA.

Each **Mathematics, Science, and Technology Awards for Teacher and Curriculum Enhancement Program (MASTAP)** award recipient receives up to $200,000 per year for a maximum of 3 years based on performance and availability of funds under the program. During FY 2001, the MASTAP awardees were Alcorn State University, Bowie State University, Clark Atlanta University, Florida A&M University, Jackson State University, Mississippi Valley State University, Norfolk State University, South Carolina State University, and Xavier University of Louisiana.

Precollege Awards offer opportunities for MI's, in collaboration with NASA and local school districts, to provide informal educational opportunities that will enhance the numbers and percentage of students enrolled in mathematics and science college preparatory courses. As a result of participating in these awards, students will gain awareness of career opportunities in MSET fields, exposure to NASA's mission and scientific and technical personnel role models, and will enter college pursuing NASA-related career fields.

The primary purpose of the **Precollege Awards for Excellence (PACE)** is to encourage the implementation of innovative projects with collaborative strategies to ultimately increase the pool of talented scientists and researchers in Mathematics, Science, Engineering, and Technology (MSET) fields. PACE is designed to include any combination of outreach projects such as Saturday Academies, Summer Science Camps, In-School Mathematics and Science Academies, and After-School Enrichment

Programs. The program targets hard-to-staff public elementary, middle, and high schools, where 50 percent or more of the students are disadvantaged and have a large number and/or percentage of uncertified mathematics and science teachers. The following institutions were the FY 2001 PACE/MSET grant recipients.

Delaware State University	Lincoln University
Elizabeth City State University	Saint Augustine's College
Fayetteville State University	Shaw University
Hampton University	Trenholm State Technical College
Jarvis Christian College	Tuskegee University

Other exemplary MSE Awards include the ***Model Institutions of Excellence*** **(MIE)**. NASA, in collaboration with the National Science Foundation (NSF) and the Departments of Interior and Agriculture, award collaborative agreements of up to $2.5 million per year to each institution selected for the MIE Program. Each of the chosen MIE's has a track record of awarding Science, Education, and Mathematics (SEM) degrees; a strong commitment to SEM education and graduate research; and the potential for launching a major enhancement of their current efforts. The NASA-sponsored MIE's are Bowie State University and Spelman College.

AN EXEMPLARY MASTAP PROJECT

Xavier University of Louisiana

MASTAP-TCEP (Teacher Curriculum Enhancement Program) is designed to address the underrepresentation of minority mathematics, science, and technology teachers in middle and secondary schools with substantial enrollments of socially and economically disadvantaged students.

The goals of the project include:

- Increasing the number of minority, especially African American, certified mathematics and science teachers using a technology-based program.
- Enhancing the teacher preparation program in mathematics and science utilizing a technology-based curriculum.
- Completing an inquiry-based action research project.

Enrollment Data
The local school district is the New Orleans Public Schools (NOPS), which is made up of 90 percent African American students.

The inservice participants are middle school teachers teaching in hard-to-staff schools. The workshop was designed to facilitate the participation of inservice teachers, and to provide an opportunity for interaction between inservice and preservice teachers. A total of 13 teachers participated, with 4 receiving masters degrees and 1 receiving a certification.

The preservice participants are education and science undergraduate students. Students enroll in the IPSC 4010 Advanced Earth Science course. The course has been redesigned to serve as a GLOBE certification. A total of 14 students participated with 5 receiving bachelors degrees and 2 becoming state-certified. Two are teaching in the local school district, one in a hard-to-staff school.

Outcomes
Five area educators and staff were trained at the GLOBE Train-the-Trainer Workshops including one staff person from the Division of Education, one teacher, and one school librarian from the local school district.

A total of 21 GLOBE-certified teachers trained by Xavier University trainers represent 12 local schools.

A total of 17 Xavier preservice teachers and 1 Southern University of New Orleans preservice teacher have received GLOBE certification. Of the 18 trained preservice teachers, 10 have now graduated and received teaching positions.

Partnerships
The Chairs of the Division of Education and the Departments of Mathematics and Physics/Dual-Degree Engineering coordinate closely through the NASA MASTAP Grant to integrate mathematics and science education programs on campus.

The Xavier University GLOBE Partnership has maintained its connection with The Audubon Institute's Louisiana Nature Center, which has provided an instrument shelter site, a hydrology site, a land cover site, and a soil pit for use in the GLOBE Teacher Workshops.

A GLOBE teacher trainee from the spring 2000 workshop is now the Lead Instructional Technology Facilitator for Region I. Another spring 2000 GLOBE teacher trainee is now a Grant Writer in the Curriculum and Instruction/Professional Development Office of the New Orleans Public Schools.

The Secondary Science Specialist in the Curriculum and Instruction/Professional Development Office of the New Orleans Public Schools was the guest speaker at the Xavier University GLOBE Partnership banquet. She so liked the GLOBE program and the feedback she was receiving concerning it that she decided to attend a GLOBE Train-the-Trainer workshop. The connections with Region I and the New Orleans Public Schools will allow the GLOBE program to greatly expand in the New Orleans region in future years.

AN EXEMPLARY PACE/MSET PROJECT

Fayetteville State University (FSU)

The Mathematics and Science Education Network (MSEN) Pre-College Program came into existence at FSU in 1986. Studies of education in North Carolina revealed the serious underrepresentation of minorities and females in grades 6-12 mathematics and

science courses. With the support of the North Carolina General Assembly, the University of North Carolina (UNC) Mathematics and Science Education Network (MSEN) designed its Pre-College Program over 10 years ago. The program embodies the State's commitment shared with public schools, students, parents, teachers, and the private sector to academic excellence in education.

The MSEN Pre-College Program at Fayetteville State University, the sixth MSEN Pre-College site, was established through the efforts of the Director of the FSU Mathematics/Science Education Center. The National Science Foundation, the North Carolina General Assembly, the Department of Energy, and NASA have provided funding sources for the Program. The North Carolina General Assembly and NASA are providing current funding.

The MSEN Pre-College Program at FSU successfully completed the implementation of the Summer Scholars and Fall Saturday Academy.

Enrollment Criteria
The enrollment period is January through April of each year, and the requirements for enrollment are as follows:

- Must be a 6th-12th grade student, maintaining at least a C average with an interest in mathematics and/or science.
- Must have the potential to successfully master and complete enhanced coursework and not exemplify any disciplinary problems.
- Must complete an enrollment application.
- Students and parents must make a commitment to actively participate in the Pre-College Program via the Saturday Academy, Summer Scholars program, and parent activities.
- Must be recommended by the school principal, guidance counselor, or teacher if enrolled at a middle/junior high school providing the Academic Enrichment Class.
- Must adhere to the program's mandatory attendance requirements

List of Participating Schools

Reid Ross Classical School	Lewis Chapel Middle School
Seventy First Classical School	Hobbton High School
Westover Middle School	Luther Jerald Middle School
Douglas Byrd Middle School	J. B. Griffith Middle School
Lewis Chapel Middle School	Mac Williams Middle School
Anne Chestnutt Middle School	Cape Fear High School
Pine Forest High School	West Hoke Middle School
Albritton Middle School	South View High School
71st Classical Middle School	Dunn Middle School
E. E. Smith High School	New Hope Christian Academy
Spring Lake Middle School	Terry Sanford High School
Southview Middle School	Berean Baptist Academy

Pine Forest Middle School
Pine Forest High School
New Life Christian Academy

Westarea Middle School
Hope Mills Middle School
R. Max Abbot Middle School

Massey Hill Classical School
St. Ann Catholic School
Northwood Temple Academy

Summer Scholars Program
The Summer Scholars Program was held for 75 6th-10th grade students. The Project Prep Program was held on the campus of Fayetteville State University for 16 11th and 12th grade students. *The MSEN Pre-College Summer Research Program (PREP)* utilized the expertise of a professor with the FSU Department of Natural Sciences, who provided DNA Research for the PREP program. Two faculty members with the FSU Mathematics/Computer Science Department provided Mathematics Research and Technology research.

Saturday Academy
The Fall Saturday Academy was held for 325 6th-12th grade students and the Spring Saturday Academy was held for 258 6th-12th grade students. Through funding from the NC General Assembly, NASA, and the UNC School of Engineering; the MSEN Pre-College Program presented its enrichment program in mathematics, science and technology. An afternoon tutorial program in mathematics and science for 4th-12th grade students was provided as a community outreach effort during the week for Cumberland County schools on the campus of FSU. This free-service tutorial program was implemented by the MSEN Pre-College Program at FSU and was held on Monday through Thursday evenings from 4:00-6:30 p.m. In addition to classroom activities, the MSEN Pre-College Program provided workshops for SAT Preparation, EOG Skills Building, Computer Science Enhanced Training, and mathematics/science tutorials.

At the conclusion of the Fall Saturday Academy, a special ceremony was held to acknowledge students for their academic achievements for the first grading period report card. Skits for the program were coordinated and presented by teachers and students.

Mathematics/Science Competition
The annual Mathematics/Science Education Network (MSEN) Day for the mathematics and science competition was held at North Carolina A&T State University in Greensboro, North Carolina. Eighty students from the FSU site and 20 parent volunteers participated in MSEN Day 2001.

AN EXEMPLARY MODEL INSTITUTION OF EXCELLENCE

Bowie State University

The Model Institutions for Excellence (MIE) initiative is a collaborative effort between the National Science Foundation (NSF) and NASA. The overall goal of Bowie State's Science, Engineering, and Mathematics Education (BSEME) reform program is to ensure that a higher number of students seek and complete advanced, quality education in science, engineering, and mathematics (SEM).

Bowie State's MIE initiative strategy is to validate and institutionalize a development model that encompasses the following educational reform components: Outreach, Retention, Educational Reform, Research, Linkages and Collaboration, Infrastructure and Human Resource Development, and Assessment and Self-Evaluation. Programs and activities within this model include, but are not limited to, the SEM Fellowship Program, the SEM colloquium, the SEM Summer Academy, the SEM Internship Program, the SEM Tutoring and Resource Center, the MIE Faculty Grants Program, and the Partnership Program.

The sixth year (2000-2001) of this long-term commitment represented a transition from Phase I to Phase II of the program with its emphasis on institutionalizing the MIE model campus-wide and expanding SEM student participation in some of the more successful elements of the MIE model. The number and diversity of summer internship opportunities were expanded and a summer residency program was introduced to Summer Academy students.

From the perspective of institutionalizing the MIE model on campus, a number of steps have been taken. The MIE-supported position of Computer System Administrator has been transferred to a state-supported position in the Department of Computer Science effective April 2001. The position of Data Management and Reporting Coordinator has been transferred to the Office of Institutional Research to which much of the data reporting requirements of the MIE program have been delegated. The Office of the Provost has launched a university-wide retention initiative where many of the successful MIE retention-related strategies are now being adopted. The SEM Academic Support Coordinator serves on the Retention Board appointed by the Provost. Additionally, a new science building is under construction. The 27,654 gross square feet facility, with its wireless networking capabilities, will house an expanded SEM Student Support Center, several engineering, computer, and research laboratories, and an expanded Bowie State University Satellite Operations Control Center (BSOCC) as well as the Department of Computer Science and the administrative offices of the MIE program. The new facility is expected to become operational in the summer of 2002.

Continuing assessment and self-evaluation results indicate significant progress toward achieving overall, long-term program goals and objectives--increased enrollment, improved retention rates, and expanding the number of SEM graduates who go on to graduate programs and related careers.

Enrollment Data
The overall enrollment of SEM undergraduate students at Bowie State University during this reporting period was 733, up 115 percent when compared with the number of students enrolled in the fall of 1995. The size of the SEM freshman class increased by 128 percent and all indications are that it will experience a dramatic growth in the fall of 2002. The number of SEM students graduating each year since 1995 has grown from 56 to 108, a 93-percent growth rate. Of these graduates, approximately 84 percent are African Americans, a figure that has elevated Bowie State to the topmost ranks nationally for its number of African Americans graduating with degrees in computer and information sciences.

The MIE program continues to impact its SEM students both directly and indirectly. The SEM Computing Facility, the SEM Colloquium program, site visits to research centers and graduate schools, paper presentations at conferences, and the annual SEM Showcase on campus provided ample opportunity for SEM majors to expand their horizons and career-related experiences. The MIE program also directly sponsored 71 SEM fellows (an increase from 53 the previous year) and 88 part-time assistants. A fellowship package includes $11,000 of financial support in the form of stipends and tuition assistance and part-time assistants receive approximately $2,000 per academic semester (graduate students are compensated at a higher rate). Fellows participated throughout the academic year in research projects, summer internships, conferences, workshops and other enrichment activities. Part-time assistants worked as lab monitors, tutors, peer mentors, BSOCC assistants, and office assistants.

Outcomes
The impact of the MIE initiative at Bowie State continues to be very positive with all of the goals of the program being met. SEM undergraduate enrollment (AY 2000-2001) has reached an all-time high of 733 students, an 11-percent increase over the previous academic year. This represents a 117-percent increase since launching the MIE initiative in 1995. The size of the SEM freshman class (i.e., new full-time and part-time students with 0-29 credits) grew to 217, an increase of 7 percent over the previous year. Much of the steady increase is due to improved visibility of the SEM domain at Bowie State and an expanded recruitment effort at the K-12 level and at the community college level. The MIE Outreach Coordinator has met with all of the Science Department Chairs from the Washington, DC Public Schools, spoke with the Prince George's County Public School Science Department Chairpersons at their annual meeting, and hosted on campus all of the Science, Engineering, and Mathematics Chairpersons from surrounding community colleges.

The rate of return of first-year students continues to improve, increasing from 52 percent for the year prior to the establishment of the MIE initiative, to 75 percent in the fall of 2000; while the rates of return of 2^{nd-}, 3^{rd-}, and 4^{th-}year students have also increased from 26 percent, 17 percent, and 12 percent to 62 percent, 55 percent and 38 percent respectively. The University credits this strong performance gain largely to the effectiveness of implementing a comprehensive educational reform model that is student-centered with emphasis on providing academic support services and engaging students in out-of-class, academically-based experiences. For example, SEM fellows made 41 presentations at various regional and national conferences. Twenty fellows

graduated during the academic year. Four fellows are pursuing graduate degrees either on a full-time or a part-time basis. Others have accepted employment offers from nationally recognized firms such as Lockheed Martin and Raytheon or government organizations such as NASA, the National Institute of Health, and St. Mary's Public School System. Additionally, 60 students worked as summer interns, an increase of 18 from last year, of which 48 were non-graduating fellows. Approximately 49 percent of the 2001 summer interns served at academic institutions; another 21 or 36 percent served at government agencies or government-funded laboratories; and the remaining 15 percent served in private industry. Thirty-six incoming freshmen participated in the 2001 SEM Summer Academy (SSA), which for the first time hosted all of the SSA students as residents on campus. The first-year retention rate of SSA students has reached an impressive 90 percent.

The SEM Tutoring and Resource Center, founded and supported by the MIE for all SEM-related academic programs, continues to serve the supplemental education needs of all SEM students. Over 2,000 tutoring sessions occurred during the academic year. Students enrolled in mathematics courses continue to be the heaviest users with computer science students following closely behind. Ninety percent of the students who indicated that they had taken advantage of the Center's services during the year reported a high level of satisfaction with the support they had received. The Center continues to operate satellite facilities in some of the student residence halls and helps sponsor study-marathons and group study sessions, especially around examination times.

The MIE initiative continued its cosponsorship of the Regional HBCU Summit on Student Retention in Ocean City, Maryland, which offered a number of workshops on retention strategies for many HBCU campuses. Several MIE staff members attended national professional society-sponsored training workshops and meetings as well as presented papers covering the MIE program's impact. Two staff retreats, also involving key Bowie State administrators, were held off-campus and focused on strategic planning, problem-solving, and team-building. Thirty SEM faculty and students participated in a 1-day workshop on "Undergraduate Research as a Training Tool."

The BSOCC, a spin-off program of the MIE initiative and sponsored by NASA's Goddard Space Flight Center, has successfully certified 50 SEM students as Command Controllers, Mission Planners, or Spacecraft Analysts since its establishment in 1997. In September 2000, Bowie State University received a special award from NASA that recognized the University's leadership in developing and managing BSOCC. Other outreach efforts included the Information Technology Outreach program which involved 8 computer science majors working collaboratively with Anne Arundel Public Schoolteachers, the publication of four quarterly newsletters on MIE programs circulated to more than 2,000 stakeholders, and an MIE Web page that covers all of the significant MIE events. The sponsorship of the annual SEM Showcase in April brought together corporate representatives, faculty and students to celebrate student achievements for the year. Area high school students provided posters covering their research projects; undergraduate Bowie State students displayed their research posters; and an annual alumni and friends reception was held as a way of recognizing student achievements.

Partnerships
The MIE initiative continues to develop new partnerships as well as build on existing ones. Much of the effort has been focused on either opening up internship opportunities or collaborating on projects by means of grants and contracts. Bowie State's partnership with NASA and the Goddard Space Flight Center is the most active. Additionally, the following listing represents potentially significant new partnerships developed during FY 2001:

- A newly established partnership with the National Institute of Standards and Technology resulted in four fellows participating in a summer research internship experience.
- The Wadsworth Research Center, a division of the New York State Department of Health, opened research experiences for two MIE fellows.

The faculty in the SEM domain continues to seek and secure grants to develop a viable infrastructure in support of a strong education and research agenda. Several new and continuation grants have been awarded during the year bringing the total annual value to $2.8 million for FY 2001.

PARTNERSHIP AWARDS

- Partnership Awards for the Integration of Research (PAIR)
- Networks and Research Training Sites (NRTS)

Partnership Awards include the Partnership Awards for Innovative and Unique Research and Education Projects (IUREP) and the **Partnership Awards for the Integration of Research (PAIR)** into MSET Undergraduate Education. These funds were also used to extend the **Networks and Research Training Sites (NRTS)** awards for 3 additional years. To better measure program outcomes, beginning in FY 2001, the Partnership Awards for IUREP (Research) were offered under the Principal Investigators Award category and the IUREP (Education) under the Mathematics and Science Education Awards category described above.

The PAIR awards provide opportunities for minority colleges and universities to build upon their NASA-sponsored research across disciplines by creating innovative approaches to the interdisciplinary study of mathematics, science, engineering, and technology.

Partnership Awards have been made in three categories--education, research, and a combination of education/research. This section summarizes the research and education/research Partnership Awards. Research awards are made to cover a wide spectrum of research that is of interest to NASA. Combination awards are made to projects that skillfully combine activities in both the research and education areas. During FY 2001, the following HBCU's were recipients of Partnership Awards:

Alabama A&M University
Albany State University
Bethune-Cookman College
Bowie State University
Clark Atlanta University
Edward Waters College
Elizabeth City State University
Fayetteville State University
Fisk University
Florida A&M University
Hampton University
Howard University
Johnson C. Smith University
Morgan State University
Morehouse School of Medicine
Norfolk State University
North Carolina A&T State University
Prairie View A&M University
Savannah State University
Southern University and A&M College
Spelman College
Tennessee State University
Texas Southern University
Tuskegee University
University of the District of Columbia
Wilberforce University

During FY 2001, the HBCU's that were recipients of the PAIR Award included Clark Atlanta University, Hampton University, Norfolk State University, North Carolina A&T State University, South Carolina State University, and Tuskegee University.

During FY 2001, five HBCU's received continued funding of their NRTS awards. Participating HBCU's included Elizabeth City State University, Morgan State University, Prairie View A&M University, South Carolina State University, and Tennessee State University.

AN EXEMPLARY PAIR PROJECT

North Carolina Agricultural and Technical (A&T) State University

The NASA PAIR program incorporates the NASA-sponsored research into the undergraduate environment at North Carolina A&T State University. This program is designed to significantly improve undergraduate education in the areas of mathematics, science, engineering, and technology (MSET) by directly benefiting from the experiences of NASA Centers, affiliated industrial partners, and academic institutions.

The three basic goals of the program are enhancing core courses in MSET curriculum, upgrading core-engineering laboratories to complement upgraded MSET curriculum, and conduct research training for undergraduates in MSET disciplines through a sophomore shadow program and through Research Experience for Undergraduates programs.

Since the inception of the program, nine courses have been modified to include NASA-related topics and research. These courses have impacted over 700 students in the first 2 years of the program. The Electrical Engineering Circuits Lab is completely equipped to include computer-controlled and data acquisition equipment. The Physics laboratory is upgraded to implement better sensory data acquisition to enhance students' understanding of course concepts.

Research training for students is conducted through four different programs: Apprentice program, Developers program, Sophomore Shadow program, and Independent Research program. These programs provide opportunities for 50 students per semester, with an average of 40 students participating each semester.

Each year, the NASA-Summer Undergraduate Research Experience (SURE) Program at North Carolina A&T State University recruits several talented pre-engineering candidates from 12 Southeastern institutions (majority-serving, HBCU's, Native American-serving and women-serving). Approximately 12–15 science, mathematics, and pre-engineering students are trained and instructed by faculty mentors on NASA-sponsored research projects during 8 weeks in the summer. Students are encouraged to pursue advanced technical careers by benefiting from professional development and mentoring activities.

Goals

1. To increase the participation of underrepresented minorities and women in MSET disciplines.
2. To foster the integration of NASA-sponsored research into undergraduate education and promote undergraduate research training.
3. To increase the quality of graduates through enhancement of core courses with research-based learning modules, use of research equipment or data, and the sophomore shadow program.
4. To promote the research preparedness of undergraduates by integrating discovery-based learning techniques throughout the MSET curricula.
5. To increase the number of students going to graduate school through year-round research training and the sophomore shadow program.
6. To increase collaboration among research and teaching faculty.
7. To increase student and faculty exposure to NASA research.
8. To develop an effective partnership program among North Carolina A&T State University, NASA Centers, industries, and community colleges.

Objectives

1. Enhance core-courses in the MSET curriculum though the development of portable learning modules, inspired by NASA-sponsored research.
2. Upgrade core-engineering laboratories to complement upgraded MSET curriculum and its appropriate teaching modules, and develop a new undergraduate laboratory for multidisciplinary dynamic systems and instrumentation.
3. Conduct research training for undergraduates in MSET disciplines through a sophomore shadow program with interaction among teaching and research faculty and through Research Experience for Undergraduate programs.

Enrollment Data

Ninety students enrolled in NASA PAIR during AY 2000-2001. Of these 90 students, there were 38 African-American males, 46 African-American females, 2 American Indian females, 2 White males, and 2 foreign national males. In addition, there were 17 African-Americans enrolled in the NASA SURE Program.

Outcomes

Project Outcome	Actual Achievement
Modernize laboratories at North Carolina A&T State University	The Circuits and Physics II Laboratories were modernized.
Develop new laboratories	A new Dynamics System Laboratory is being developed. The instrumentation is already ordered and part of it is already received. The Laboratory is expected to be operational in 2002.
Enhance and develop the sophomore shadow programs	The Sophomore Shadow Program is created and students under this program were provided stipend to work with "shadow " or upperclass graduate students involved in NASA-sponsored research.
Develop and test laboratory and teaching modules	Two laboratories, MEEN 300 and PHYS 252, were modified to include teaching modules.
Reform and update core MSET courses	The following MSET courses were reformed: Chemical Engineering 220, Electrical Engineering 200, Mathematics 231, Mechanical Engineering 300, 335, 337, 560, and Physics 251.
To recruit eligible pre-engineering students	Eighty percent of eligible MSET majors have enrolled in engineering programs after completion of the SURE Program.

Partnership

In 1998, when the NASA PAIR program was established, North Carolina A&T State University also embarked upon a new program with the Jet Propulsion Laboratory entitled, Alliance for Learning and Vision for Underrepresented Americans (ALVA). This program provided Summer Engineering interns and a Calculus preparation course for seven of North Carolina A&T State University's incoming freshmen at JPL (five African Americans and two Native Americans). Also, North Carolina A&T State University is leveraging opportunities by bringing the NASA Undergraduate Student Awards for Research and Earth System Science Pathfinder program administered by NACME under the direction of the Education Co-Principal Investigator to enhance partnerships with other NASA Centers and universities.

In 1999, the ALVA program continued at JPL with three returning students and eight new prefreshmen. A new ALVA program was initiated with IBM in Research Triangle Park that included eight Native American students, three of whom attended the university that fall. A small portion of the NASA SURE funds was used to support two Native American students participating in a new ALVA program in Robeson County, North Carolina. The company in Robeson County, Porter Environmental Inc., is owned and operated by a Lumbee Native American woman dedicated to giving back to her

community. The partnership formed with this company is expanding among NASA, North Carolina A&T State University, and the Lumbee Community.

At the end of 1999, the ALVA program with Porter Environmental Inc. was discussed with Marshall Space Flight Center (MSFC) personnel. Subsequently, a proposal was submitted and funded by the MSFC for the year 2000 to support six students in the ALVA program with stipends and scholarships. This initiated efforts for an American Indian Science and Engineering Society (AISES) student chapter and other activities to enhance Native American outreach. As a result of this effort, the Native American population at North Carolina A&T State University has moved from one in 1998 to nine and growing in 2000.

Students supported in the Sophomore Shadow program have obtained research positions in the NASA CAR grant, as well as other research programs on and off campus.

AN EXEMPLARY NRTS PROJECT

Morgan State University

Morgan and its university partners are poised to broaden their participation in NASA educational programs and research opportunities. Recent NASA Opportunities for Visionary Academics (NOVA) awards at Central State University, the University of Maryland Eastern Shore (UMES), and Sojourner-Douglas College will build up the ability of Morgan State's partners to become more involved in several NASA Strategic Enterprises. The educational plans the NOVA awards represent are focused on advancing the literacy of preservice teachers and education excellence in science, mathematics and computer technology. These plans are to be implemented consistent with specific goals and objectives relevant to the NASA Space Science, Earth Science, and Human Exploration and Development of Space Strategic Enterprises. Involvement in these Enterprises will not only bring in more minority participation, but will also enhance the competitiveness of Morgan State's partners in other NASA opportunities.

The educational focus is extended to partners at the K-12 schools. Adventures in Supercomputing (AiS), the Pigeon Adventure, and EarthKAM are educational activities that will be sponsored to support scientific literacy and the use of computer technology among these partner schools.

The 3-year technical plan is based on the outcome of the Education Activity Metrics. It details specific education programs and activities and the measurable objectives, milestones and approaches to be met during the NRTS continuation period. These projects will involve preservice and inservice teachers and will provide opportunities for student learning, scholarships, and participation.

Student involvement of the NRTS continuation project is represented by scholarships and stipends that account for approximately a quarter of the budget each of the 3 project years. Approximately 100 students will be directly impacted by their participation in the project activities. Over 1,000 students will benefit from the instructional plans and

activities designed to advance their scientific literacy and inspire them to pursue science, mathematics, and computer technology fields.

The preparation of a highly skilled and scientifically literate faculty and student body for the 21st century is an institutional commitment. Morgan reinforces this in a 5-year plan that includes capital investments and expanded academic programs in science and mathematics education, engineering, computer technology, and bioenvironment science. The academic programs support Morgan's ability to fully participate in NASA-sponsored programs such as NRTS. In turn, university-in-kind contributions and partnerships with the National Science Foundation will help sustain the NRTS program beyond the continuation period.

The activities of the NRTS plan will be regularly broadcasted to various media outlets in the university and educational community. The evaluation of this plan will be conducted against the Education Activity Metrics.

The cost of the proposed activities will be leveraged to produce desired outcomes toward increasing the literacy of students and preservice teachers in science, mathematics and computer technology. The funding for these activities will help prepare the next generation of students to enter college and successfully pursue academic programs in these fields.

The Morgan NRTS and its partners are poised to take a more assertive role in the implementation of curriculum proposals, educational products and research ventures generated from NASA/Minority University-Space Interdisciplinary Network (MU-SPIN) opportunities to contribute more substantially to NASA's mission to "advance and communicate scientific knowledge and understanding of the Earth..."

Morgan's university partnership with Central State University, the University of Maryland Eastern Shore, and Sojourner-Douglas College is positioned to play a larger role in support of NASA/MURED goals to:

- Create systematic and sustainable change at HBCU's through partnerships and programs that enhance research and educational outcomes in NASA-related fields.

- Prepare faculty and students at HBCU's to successfully participate in the competitive research and educational processes of the NASA Strategic Enterprises.

- Partner with HBCU's to increase the number of students who are prepared to enter college and successfully pursue and complete the curriculum requirements for undergraduate degrees in NASA-related fields.

The ability of this partnership to contribute to the above goals will be built upon education plans based on NOVA. The education plans from partner institutions are all designed to create change and enhance the instructional experience for preservice teachers. The collaboration built into the plans between science and education faculty represents a prototype for reshaping traditional instructional methods that have been barriers to effective teaching and learning. These plans have been crafted to naturally

fit departmental objectives and institutional goals. Their educational spin-off will provide quality learning and research environments that prepare preservice teachers to create innovative pedagogical strategies for elementary and secondary school students.

The implementation of NOVA plans supports the following goals of the Morgan NRTS and the strategic position the University partnership brings to the stated NASA goals:

- Increased literacy of preservice teachers in science, mathematics, and computer technology.
- Support for innovative curriculum proposals.
- Development of unique educational products.
- Creation of partnership opportunities that support educational excellence.

At the K-12 grades, the pursuit of educational excellence is centered on the integration of mathematics and science found in a computational science program supported by NASA and known as Adventures in Supercomputing (AiS). The program is designed to use computer technology to facilitate learning and enhance the level of teacher and student technical and scientific knowledge. The goals at this educational level are to:

- Enhance the quality of science and mathematics instruction of preservice teachers at the K-12 grades.
- Promote computer and information technology, its use, and its applications in the classroom instruction of science and mathematics courses.
- Enlighten inquisitive minds and inspire the next generation of students to pursue science, mathematics, and computer technology fields.

The combined goals at both educational levels are made strategic by the following NASA Enterprises that complement and support how Morgan State has designed and will proceed to implement its instructional ventures and partnerships.

Space Science Enterprise
The Sun-Earth Connection and its Education Forum will form parts of a new science curriculum planned at Central State University. Tailored to the needs of preservice teachers, the new course will use inquiry-based techniques, laboratory activities, and Internet technology research. This course will represent a collaborative teaching approach between science and education faculty and is consistent with the objective of this Enterprise to enhance the quality of science, mathematics, and technology education at the precollege level.

Earth Science Enterprise
Central State University, Sojourner-Douglas College, and Morgan State University have plans to modify existing teacher education and elective science courses to introduce collaborative teaching environments between education and science faculty. The plans

are designed to better prepare preservice teachers, as recommended by the National Science Education Standards. These plans are consistent with the objective of this Enterprise to increase public understanding and involvement in the Earth System through formal and informal educational opportunities.

With Morgan's elementary school partners, the Earth Science products of NASA have been a stimulating source for science activities and projects. Echo the Bat and the Pigeon Adventure represent initiatives that have exciting curriculum appeal for teachers and students alike. Elementary and middle school partners are anticipating greater use and involvement in such resources as ways to link their minority student populations to NASA's educational resources. Morgan expects to foster the inauguration of The Pigeon Adventure project at one of its urban elementary schools. Preliminary testing of the lesson plans for this project is underway at this school.

Under the Earth Science Enterprise, Morgan will also institute a summer bioscience research academy for high school students involved with environmental research activities. Working with a high school partner, the academy would prepare scientifically minded students with the opportunity to assist local research scientists from the Center for Marine Biotechnology at the Baltimore Columbus Center.

Morgan intends to enhance the capacity of its middle school partners to participate in the EarthKAM project by facilitating cooperative partnerships with middle schools that are already participants in the project and its NRTS middle schools. This will enable its schools to model the experience and enhance the success of their participation in the EarthKAM project.

Office of Space Flight Enterprise

A NOVA-inspired curriculum aimed at helping preservice teachers develop techniques and course materials for improving the scientific knowledge of secondary students is planned at UMES. Using NASA data sets, the proposed course will explore the physiological limitations of human existence in a microgravity environment. It is the objective of this course to dispel inherent fears of preservice teachers to empirical and practical science, objectives consistent with that of this enterprise to expand scientific knowledge.

Other Education Products/Initiatives

Applicable to all the above NASA Enterprises will be the dissemination of a multimedia, multicultural learning tool known as *Al J. Bra.* This is an educational product developed to illustrate and demonstrate algebraic concepts in lessons and instructional material provided in both English and Spanish. It is designed to provide interactive, peer-to-peer tutoring within the context of an urban environment. It represents the research and development for an education product that has commercial market value besides the intended educational value to students and teachers.

The continuation of the Morgan/NRTS will assist the MU-SPIN mission to "Involve and prepare minority institutions and principal investigators to successfully participate in competitive research and education processes via computer networks," and "Develop training and education mechanisms to support, sustain and evolve the institutional

network infrastructure, thereby generating a better prepared pool of candidates to contribute to NASA's workforce diversity efforts."

NASA CENTER AND ENTERPRISE INVOLVEMENT

During FY 2001, the NASA Centers and Enterprises implemented numerous projects that helped to strengthen the infrastructure of HBCU's. These projects better equipped students and faculty to pursue studies and careers in NASA-related fields. The following summaries are synopses of the accomplishments of the NASA Centers and Enterprises for FY 2001 pursuant to Executive Order 12876. This Executive Order requires all Federal agencies to plan and report annually on how they increased the capacity of HBCU's to compete effectively for Federal funding.

Ames Research Center (ARC)

In FY 2001, ARC aggressively pursued partnerships with HBCU's in support of the development of human potential, coupled with strengthening the capacity of HBCU's to benefit from NASA's programs. ARC supported HBCU's with $1,193,949 in grants and cooperative agreements. This 25.2-percent increase of funds over FY 2000's $953,475 marked a renewed commitment to forge new partnerships and to seek out unique opportunities for HBCU's to participate in federal programs.

During FY 2001, ARC substantially increased funding to HBCU's in support of ARC's Astrobiology and Space Science efforts. The increased funding in this area ended a 10-year cycle of HBCU's not participating in this research area and demonstrated ARC's efforts to increase the participation of HBCU's in all aspects of its missions and goals.

During FY 2001, ARC established and accomplished the following objectives:

- Monthly presentations to the Ames Management Council (AMC) regarding performance versus plan to ensure compliance with projected research and development discretionary awards
- Increase the number of site visits by ARC program managers, scientists, and engineers with their counterparts at minority institutions.
- Expand outreach efforts to increase the number of internships offered to students attending HBCU's.
- Utilize NASA Quest, NASA Administrator's Fellowship Program, and IPA's to facilitate broader dissemination of ARC programs and partnership opportunities.

ARC continued to support the efforts of the National Association for Equal Opportunity in Higher Education (NAFEO) to become a partner in the NASA Research Park. This consortium of minority institutions participated in several technical assistance conferences that were held at ARC to assist the consortium in identifying potential areas of focused research and collaboration.

Dryden Flight Research Center (DFRC)

During FY 2001, DFRC continued to strengthen and expand its relationship with HBCU's through financial and technical support. DFRC has continued its efforts to comply with the White House Initiatives to advance the development of capabilities at HBCU's through science, engineering, and educational programs. DFRC is dedicated to continuing and expanding its partnerships with minority universities and colleges and to comply with the White House Initiative to advance the development of human potential at HBCU's through its science and engineering programs. DFRC recognizes the value offered by minority institutions.

During FY 2001, DFRC participated in an array of programs having impact on HBCU's, including PACE, FAR, Partnership Awards, NAFP, GEM Fellows, Graduate Student Research Program, High School/High Tech, and Louis Stokes Fellowship Program. Two students participated in the GEM program during FY 2001; one was an M.S. Computer Science student attending North Carolina A&T State University. During FY 2001, a DFRC employee was selected to participate in the NAFP and served as a visiting professor at Prairie View A&M University.

Glenn Research Center (GRC)

GRC strives to be recognized as a premiere R&D organization that utilizes and rewards the skills and talents of all people to the fullest extent possible. It is the Center's desire to be among the top R&D organizations in all applicable categories as determined by established measurement criteria. GRC's research partnerships with the Nation's HBCU's are integral parts of its strategy.

GRC awarded a total of $3.39 million in research grants, of which 79.6 percent or $2.7 million was awarded to HBCU's. In the area of fellowships, internships, and training, GRC awarded a total of $577,566 of which 94 percent or $542,736 was awarded to HBCU's.

Goddard Space Flight Center (GSFC)

During FY 2001, GSFC continued a more energetic outreach program to minority institutions, particularly those within its geographical region, through the following avenues:

- Travel of the Minority University Programs staff to the institutions was maintained, offering a physical presence on the university campuses in an effort to build new relationships or enhance existing relationships and explore mutual avenues for research and education collaborations.
- Minority University Programs staff participated in HBCU-sponsored technical conferences to foster the building of relationships with faculty and students.
- Opportunities were increased for Technical Monitors to make onsite visits to the universities with which they are affiliated.
- Efforts were made to include management level directorate personnel in the site visits and to attend minority university functions with the intent of exposing a

greater segment of the GSFC scientific and engineering community to the current and potential capabilities resident within minority institutions.

- GSFC continued reverse-site visits in which programmatic Principal Investigators (PI) are sponsored for a visit to the Center. The PI's are given an overall view of GSFC, NASA, and Headquarters staff as appropriate, as well as an opportunity to work with their Technical Monitors and others within the directorate. GSFC utilized these opportunities to introduce personnel to the programs and research capabilities of the minority institutions with which they are working.
- GSFC augmented the staff of Minority University Programs with the placement of a Louis Stokes Fellow. The Minority Programs Manager has been detailed to an engineering area, thus the Chief of Equal Opportunity is acting as such. As of last year, additional duties and responsibilities regarding Minority University Programs were assigned to the Equal Opportunity Programs Office Specialist at GSFC's Wallops Flight Facility. In addition, an excellent partnership arrangement with GSFC's contractor staff has served to energize GSFC's direction within the minority community.
- GSFC staff served as reviewers for Headquarters Programs peer review processes and site visits to HBCU's. Inclusion in these processes has afforded the opportunity to assist in the integration of research results into educational activities and to place GSFC science data and activities at HBCU's.

A total of $8,317,887 was awarded to HBCU's from GSFC during FY 2001. This amount represents an increase of $1,146,865 above the FY 2000 support level of $7,171,022.

Jet Propulsion Laboratory (JPL)

The primary mission of JPL is to explore the solar system with automated spacecraft. In addition, JPL undertakes other scientific, technological and education projects to meet national needs. JPL is fully committed to NASA's goals in support of HBCU's. During FY 2001, JPL continued to implement programs to achieve the goals of strengthening the capability of these institutions to provide quality education, and to conduct first-rate research activities for faculty and students. Moreover, JPL perceived a need to initiate a more proactive policy in its role as technical monitor, seeking out opportunities to more closely link funded programs to the technical divisions and to broaden education and public outreach efforts.

During FY 2001, there were significant contributions from HBCU programs that assisted JPL in the achievement of its goals and objectives with respect to minority initiatives. Programs such as Alliance and Vision for Underrepresented Americans (ALVA), For Inspiration and Recognition of Science and Technology (FIRST), LA's BEST, and the JPL Community College Consortium enabled JPL to continue forming partnerships with HBCU's. The ALVA program helps JPL identify bright and promising engineering students to develop a pipeline for future employees and assists with building a workforce that is representative of the Nation's diversity. Under the ALVA program, college-admitted minority students acquire summer jobs prior to their first year of college at a high technology or engineering organization. The FIRST Robotics Competition is a highly regarded national engineering contest that immerses high

school students in the exciting world of engineering. FIRST is dedicated to increasing interest in science, mathematics, and technology among youth of the United States. The LA's BEST program assists JPL in reaching underserved and underutilized communities and in developing an ongoing presence in the inner cities. Through various training activities and work experiences, enhanced by increased partnering with NASA/JPL education and public outreach programs, the faculty and students were provided with opportunities to further develop their research capabilities and to contribute to the accomplishment of the NASA mission.

During FY 2001, JPL awarded $284,421 to HBCU's.

Johnson Space Center (JSC)

In FY 2001, JSC continued to develop a successful and vital link with HBCU's. JSC aggressively seeks out new relationships with HBCU's and strengthens existing ones in promoting the development of competitive aerospace research capability in minority institutions of higher education.

During FY 2001, JSC accomplished significant measurable objectives in its goal to assist HBCU's and continued to emphasize the goal of inclusion of HBCU's in its programs. The Space Shuttle, International Space Station, and Space and Life Sciences Programs were required to identify their HBCU plans in their Program Operating Plan reviews. JSC provided support to 3 HBCU's in high-level peer reviewed projects. JSC continued to identify additional fund sources to increase selective support to participating HBCU's in space science and engineering initiatives at JSC.

JSC continued to provide assistance and to seek opportunities to strengthen technology and education outreach partnerships with existing HBCU's, as well as aggressively seek out new relationships with these institutions. JSC managers continue to support the Agency's goal and mission to assist HBCU's and, together with JSC's Director of Equal Opportunity Programs, the MURED Manager, and the Assistant Director for University Research and Affairs, continue to seek additional funding sources within their respective organizations. Clear and highly visible policies will permit and encourage the full participation of HBCU's in the JSC program.

The total FY 2001 HBCU funding was $1,416,342, which represents an 18-percent increase over FY 2000 funding of $1,198,206. JSC's MUREP funding includes FAR, URC's, PACE/MSET, PAIR into MSET Undergraduate Education, and unsolicited proposals.

Kennedy Space Center (KSC)

In FY 2001, KSC continued to serve as the home base for the Spaceflight and Life Sciences Training Program (SLSTP), which was awarded to Tuskegee University who is partnering with the New Jersey Specialized Center of Research and Training and Diné College to perform their functions. The 2001 SLSTP program provided a 6-week training program for 28 students selected from around the U.S. and the Canadian Space Agency funded 2 additional participants from Canada. The principle purpose of

the program is to use the exciting and unique resources of KSC to expose bright, diverse undergraduate students to the possible career paths available in NASA's Life Sciences and Engineering disciplines.

The grant awarded to Smith Research Corporation, a minority-owned company, in FY 2000, was continued during FY 2001 with the addition of a requirement to develop an HBCU/OMU Capabilities Document to identify areas of research that minority institutions are working on to assist in further developing research partnerships between NASA and the universities. Thirteen universities are included in the current document, which is being evaluated and utilized by the KSC Engineering and Technology directorate.

During FY 2001, the Operation of the Center for Space Education grant was re-bid and the new cooperative agreement was awarded to the incumbent Bethune-Cookman College. This agreement provides services to teachers in the State of Florida, offers NASA-sponsored programs for students and teachers in the Exploration Station located at the KSC Visitor's complex in the Center for Space Education, and provides support to the KSC Education Programs and University Research Division.

In FY 2001, a member of the KSC Education staff and graduate of Bethune-Cookman College, who is currently working toward a Ph.D., was selected to receive the James E. Webb Administrators Fellowship Program. Additionally during FY 2001, KSC received the first NASA/NAFEO Louis Stokes Professional Leadership Fellow from a minority institution, Florida A&M University.

One of KSC's African-American electrical engineers was selected and participated in the 2000-2001 Professional Development Program, working at NASA Headquarters in the Chief Scientist's office as a primary assignment. Colateral assignments included the NASA Education Office and GSFC in Integrated Mission Design and the Instrument Synthesis and Analysis Lab. The employee received his undergraduate degree from Howard University.

The total amount of awards to HBCU's for FY 2001 was $1,118,803.

Langley Research Center (LaRC)

LaRC initiatives to assist HBCU's during FY 2001 are in support of NASA's Strategic Enterprises in science and engineering programs. These initiatives are as follows: to facilitate research and development activities at minority institutions that contribute substantially to NASA's mission; to increase the number of HBCU students trained as interns and fellows through grants and cooperative education programs; to monitor the effectiveness of students and faculty participating in NASA internships and fellowships through grants, cooperative agreements, and contracts; to inform all HBCU and other university officials of procurement opportunities and requirements for NASA grants, cooperative agreements, and contracts on a regular basis; to utilize a variety of intervention mechanisms to inform HBCU administrators, students, and faculty of NASA outreach programs; and to exchange visitations between HBCU students and faculty

and LaRC scientists, engineers, and administrative professionals, and pursue collaboration opportunities that are beneficial to NASA and the institutions.

HBCU programs aided LaRC‘s achievement of its goals and objectives by permitting new and existing minority university collaborations and partnerships that provided mutually beneficial endeavors for university students, faculty and researchers. One such exemplary program is the Langley Aerospace Research Summer Scholars (LARSS) Program. The LARSS Program was established for the benefit of rising undergraduate juniors and seniors, and first-year graduate students who are pursuing degrees in aeronautical engineering or selected space disciplines of interest to LaRC. The LARSS Program is intended to encourage high-caliber college students to both pursue and earn graduate degrees and to enhance their interest in aerospace research by exposing them to the professional research resources and facilities at LaRC. The 2001 LARSS program was highly diversified with respect to participants’ background. Participants represented 59 universities including 12 HBCU’s. Of the 2001 LARSS participants, 74 were non-minority and 52 were self-reported minorities (19 African American, 4 Asian, 21 Hispanic, 5 Native American, and 3 Pacific Islander).

During FY 2001, LaRC provided $3,034,445 in funding to HBCU’s, a 17-percent increase from FY 2000.

Marshall Space Flight Center (MSFC)

The goals of MSFC for HBCU’s are to conduct vigorous research and education programs; increase overall funding as a percent of total awards to Institutions of Higher Education; and develop mechanisms to increase the number of minority students pursuing careers in science, mathematics, and engineering. These goals demonstrate MSFC's commitment to increasing the participation of minorities and women in science and engineering through HBCU research programs.

The method for measuring the success of MSFC’s Minority Programs initiative is to monitor the number of faculty and minority students participating in Center-funded research and education initiatives, the number of faculty and students conducting mainstream research, publications of research papers and concepts, and overall contract management in terms of the quality of research, schedule, and business management. The Center has in place a process whereby MSFC technical and business management experts work with HBCU’s to assure that established metrics are collected.

The Agency’s initiative to clearly define each Center’s roles and missions has allowed HBCU’s to easily target their research proposals to MSFC activities that are consistent with their own areas of expertise.

During FY 2001, a total of $5.6 million was awarded to HBCU’s. Also, during FY 2001, the MSFC Center Director agreed to serve on the Board of Directors of the Alabama A&M University Research Institute, and the Center was assigned a Louis Stokes Fellow whose primary function was to help strengthen the relationship between MSFC and minority institutions.

Stennis Space Center (SSC)

SSC established four goals in response to the White House Executive Order for HBCU's. Those goals and corresponding outcomes follow.

- To maintain minority university faculty participation in SSC onsite programs (such as the Summer Faculty Fellowship Program (SFFP) and the Resident Research Associate Program) at more than 10 percent; and to strive for HBCU faculty participation of at least 10 percent.

  Outcome: This goal was exceeded significantly. Of the 15 personnel participating in the SFFP, 7 (47 percent) were from minority universities and 6 (40 percent) were HBCU faculty. Of the 15 participants in SFFP, 9 (60 percent) were minorities, including 4 African-Americans, from either majority or minority institutions.

- To maintain funding of grants at minority universities and colleges at a level of 10 percent or more of all NASA/SSC grant expenditures, and to strive for 5-10 percent of that funding to go to HBCU's; and to steer minority institution grant activities to be more relevant to SSC missions.

  Outcome: This goal was exceeded. Approximately 15 percent of all NASA/SSC grants, delivery orders ("subcontracts" under a larger contract with a third-party) and contractor training support (from OEOP and non-OEOP funding sources minus congressional awards) go to minority institutions. HBCU's received 4.5 percent of all discretionary funding. This increase from 3.3 percent to 4.5 percent for HBCU's is in part due to Southern University at Baton Rouge taking the lead in the SFFP in FY 2001. HBCU members of the Mississippi Research Consortium also serve on the Mississippi Space Commerce Initiative Board coordinated by SSC.

- To maintain minority student participation in the SSC fellowship, internship, and traineeship programs at 10 percent or more; and to strive for 10 percent of the students to be from HBCU's.

  Outcome: This goal has been exceeded. Programs for undergraduate students at Spelman College (WISE), Morehouse School of Medicine (SPACE), and Florida A&M University (IMAGE) have been maintained with 6 HBCU participants. The PIPELINES program was a congressionally awarded program involving Southern University at Baton Rouge (an HBCU) and Iowa State University to support student educational and career development in science and engineering fields. SSC monitors this project, which is now in its third year, and also hosted a student. Of the summer student interns, over 70 percent are minorities; 46 percent of all the summer interns are from minority institutions; and 25 percent of all the summer student interns are from HBCU's. Of the Co-ops, 40 percent are minorities and 13 percent come from minority institutions, all of which are HBCU's. More than 25 percent of all graduate student-level fellowships/internships in programs such as the Graduate Student Researchers

Program, Harriett Jenkins Predoctoral Fellowship Program, and the Mississippi Space Commerce Initiative, sponsored by the Office of Space Flight through SSC, are held by minority students. Fifteen percent of all such fellowships are from minority institutions and 9 percent of all such fellowships are from HBCU's.

- To participate in outreach activities such as career fairs, mathematics/science fairs, Special Focus History month observances, mentoring programs, and speakers bureau at minority institutions within the SSC geographic area and minority institutions with projects and programs related to the SSC mission.

  Outcome: SSC employees visited each of the minority institutions with which SSC has an active project. Additional visits were made to acquaint other HBCU's with SSC NASA mission interests and desire to recruit students and/or faculty to participate in SSC programs and respond to NASA Research Announcements and Cooperative Agreement Notices. Civil servants and contractors also dedicated much time to mentoring the HBCU students and to collaborating with faculty when these individuals spent time onsite with programs at SSC. SSC civil servants also participated in and gave presentations at a number of minority-focused special emphasis conferences and workshops.

SSC provided $671,529 in funding to HBCU's in FY 2001.

OFFICE OF SMALL AND DISADVANTAGED BUSINESS UTILIZATION (OSDBU)

The Federal Acquisition Regulation authorizes NASA to recognize Historically Black Colleges and Universities (HBCU) and Other Minority Universities (OMU) as "Small Disadvantaged Businesses." Public Law 101-144 requires the NASA Administrator to ensure that at least 8 percent of prime and subcontract dollars be allocated to business opportunities with SDB's. To that end, OSDBU has developed a series of initiatives focused on increasing NASA's participation level of HBCU's and OMU's in the Agency's contracting opportunities. Listed below are examples of activities to reach out to HBCU's under these initiatives:

- Membership on NASA's Minority Business Resource Advisory Committee.
- Presenting University Capabilities at NASA Aeronautics and Science Forums.
- TADSBAT (Training and Development of Small Business in Advanced Technologies) training classes hosted at HBCU's.
- Developed directory of HBCU/MI Capabilities.
- Participants in Cooperative Agreement of International Space Station program performing Software Engineering Initiative.
- Participants in NASA Mentor-Protégé program.
- Participants in Cooperative agreement on Integrated Facility Solutions and Management Options for NASA facilities.
- NASA's University Research Centers (URC) presented their capabilities at NASA's Prime Contractor's Roundtable.
- URC's exhibited their technologies at NASA's national conferences.
- Partnership to develop a modeling management concept for HBCU/MI activities.

In February 2001, NASA established a goal for inclusion of HBCU's in NASA's prime and subcontracting programs. This goal was set at 1 percent of the total contracting dollars to be accomplished by the end of FY 2002. Based upon the most recent data on contract expenditures (FY 2000), the new goal equates to $105 million. To facilitate achievement of this goal, a Headquarters Working Group was formed to thoroughly analyze all avenues to assure that the goal is met. The team concluded that four training classes would be necessary to cover the variety of opportunities that were available to do business with NASA. Two of the training classes are in place – Training and Development of Small Businesses in Advanced Technologies (TADSBAT) and How to Commercialize NASA Technology. Two additional training classes that need to be developed are How to Market/Win Small Business Innovative Research (SBIR)/Small Business Technology Transfer (STTR) and Principal Investigator training on Program/Project Management techniques.

FY 2001 accomplishments towards HBCU initiatives were approximately $62 million with $48 million in prime contracts and $14 million in subcontracts.