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Glenn's Strategic Partnerships With HBCUs and OMUs

M. David Kankam
Glenn Research Center, Cleveland, Ohio

May 2003

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National Aeronautics and
Space Administration

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Glenn's Strategic Partnerships with HBCUs and OMUs

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Summary

The identification by NASA senior management of the need to develop a strategy for increased contracting with the historically black colleges and universities (HBCUs) and other minority universities (OMUs) is aligned with Executive Order 12320 requesting that "The Secretary of Education to the extent permitted by Law, shall stimulate initiatives by private sector and other Institutions to strengthen HBCUs, including efforts to further improve their management, financial structure and research." These observations clearly suggest the necessity and desire to cultivate stronger partnerships with the minority universities. Both NASA and the universities can benefit from collaborating with each other. The benefits to the universities include a stronger industrial base via NASA partnerships with major technology-based companies, increased strength to compete for technology research opportunities, enhanced research capability, and broader experience base. The expected gains for NASA are increased contributed value of university research to support Agency missions and programs along with the provision of NASA program-related training for students who can be potential future recruits for the Agency.

Consistent with the cited need by the Executive Order and NASA senior management, this report documents synergistic links between Glenn Research Center's research and technology (R/T) programs and the capabilities of the faculty at HBCUs and OMUs. The links are derived from Glenn technologies pursued by the various directorates and program and project offices; they indicate a combination of existing collaborative R/T areas and potential new ones to pursue between Glenn and the universities. The report identifies the bulk of Glenn R/T programs and projects in which minority universities' participation is known. Contact information on key university personnel is provided, to enable expeditious search for faculty members or university research groups with the best match for collaborative opportunities at Glenn.

The report recommends a summer Faculty Fellowship at Glenn as a possible first step to cultivate first-time Glenn-faculty relationship towards program and project initiation. A follow-on interaction may take the form of a research grant, a NASA Research Announcement Award, or National Research Council Resident Research Associateship. The other recommendation is to strengthen ties between NASA, HBCUs, OMUs, and industry, with the view to improve the infrastructure and research capabilities at the universities. In conclusion, NASA resources embody cutting-edge and challenging research and technologies. The major aerospace companies have well-equipped Research and Development Facilities and are strong in high technology development and system design and integration. Universities are generally skilled in basic research and have relatively low overhead cost. NASA-HBCU/OMU-industry partnerships cannot only accelerate technology transfer and development at reduced cost, but also expedite the development of infrastructure at the universities. A possible outcome of this is the establishment of NASA mission-related graduate programs at the universities and a pool of potential student recruits with NASA-relevant research experience. Finally, the exposure gained by the universities, via partnerships with Glenn, can significantly improve the chance for joint Glenn-academe efforts to succeed in competition for NASA and external R/T awards.

Introduction

Historically black colleges and universities (HBCUs) and other minority universities (OMUs) represent a pool of research collaborators and partners whose capabilities have not been fully utilized. In his letter of June 27, 1994, then NASA Administrator Daniel Goldin identified the need to "develop a strategy for increased contracting with HBCUs and minority educational institutions (MEIs)," hereafter emphasized with regard to OMUs. More recently, Mr. Goldin's successor, Mr. Sean O'Keefe, has reinforced this need embodied in his newly created "The Education Enterprise (Code N)" focused primarily on education. This NASA senior management priority echoes Section 6 of United States Executive Order 12320 which states that "The Secretary of Education to the extent permitted by Law, shall stimulate initiatives by private sector and other Institutions to strengthen HBCUs, including efforts to further improve their management, financial structure and research." The stated quotations suggest the need and desire by the highest level in the U.S. Government and NASA senior management, to foster a closer alliance with the HBCUs and OMUs. Several mutual benefits can be derived from such a partnership.

The manpower potential within the universities can be leveraged towards NASA programs and missions. Also, the institutions can be positioned, subsequently, to more effectively pursue technology-based research opportunities within and outside of NASA. A strong NASA-HBCU-OMU partnership is expected to promote increased and mutually fruitful interactions between the universities and the major technology-based aerospace companies such as TRW, Inc., The Boeing Company, Hamilton Sundstrand, and Lockheed Martin Corporation, which historically have participated and continue to be engaged in government programs. Successful contracting roles in technical programs will propel the HBCUs and OMUs to a higher level of competitiveness with regard to NASA and other research awards and help them build stronger industrial partnerships. The added advantage is the weaning of the minority universities from near-sole dependency on NASA support, to competing for funding from other sources. Besides developing a broader experience base for faculty, a focused partnership with NASA and industry will enhance the development of research capabilities of the universities to make them better contributors to NASA programs, while providing NASA mission-related training for students who constitute potential future recruits for the Agency. These benefits highlight the importance of establishing strong NASA partnerships with the HBCUs and OMUs and suggest the need for increased interactions where necessary.

This report identifies Glenn program- and project-related research and technologies in which faculty members at 34 HBCUs and OMUs have collaborated or are currently collaborating with Glenn. Included are synergistic links that relate Centerwide research and technologies to faculty expertise. The indicated links, NASA-funded research centers and their directors, other university research and institute directors, and listed points of contact can be used to expeditiously identify Glenn-university matches for collaborative efforts, with high probability for success. Additionally, summaries are provided on sample university research-derived products and their real and potential applications to NASA programs and missions to demonstrate the capabilities of, and value-added contributions by, the minority universities. The recommendations suggest means to cultivate and strengthen the universities.

Glenn's Synergistic Links With HBCUs and OMUs

A review of past and current research efforts within the HBCUs and OMUs reveals that many members of faculty have capabilities that can benefit Glenn technology programs. The aggregate synergistic links between Glenn technology programs and projects and minority university capabilities reveal the extent of collective, faculty experience.

The Glenn program- and project-related clusters of faculty expertise are depicted in figure 1. The mapping into table I(a) and (b) shows the individual university expertise linked to the Center technology programs and projects. Figure 2 depicts a histogram of total HBCUs and OMUs versus their capabilities

Figure 1.—Clusters of HBCUs and OMUs research areas. A/C is aircraft; CFD, computational fluid dynamics; EM, electromagnetic; MEMS, microelectromechanical systems; PMAD, power management and distribution; PV, photovoltaic; RBCC, rocket-based combined cycle; RFC, regenerative fuel cell; and VLSI, very large system integration.

TABLE I.—GLENN TECHNOLOGY PROGRAMS AND PROJECTS[a]
(a) Links to HBCU Capabilities

HBCUs	Technology Programs																																
	Material—polymers and composites	Thin films	MEMS, nanotechnology, micromotors	Carbon nanotubes	Sensors and gauges/optics	Dynamics and control-flight systems	Electronics/semiconductors/converters*	RF and microwave technologies	Data compression	Millimeter wave imaging	Combustion modeling, engine combustion and diagnostics	CFD/nozzle-inlet flows	Supersonic/hypersonic vehicles and flows	Space structures	Launch vehicles—TVC/EA/fault	Microgravity sciences—chaos, combustion particle melting	Biotechnology and bioengineering	Fuel and solar cells, renewable energy* RFC, energy storage	Satellite operations	Aircraft ice protection	High-performance and soft computing, and software engineering	Systems and control engineering	Intelligent controls	Thermal coatings/protective barrier	Power electronics/motor drives	Aerospace power system/PMAD	Electric, chemical and EM propulsion	Space environments (radiation*)	Plasma-hypersonic flows	Computational analysis-jet noise	Thermal management	High-temperature electronics	PV concentrators/TPVs
Hampton University (VA)	X				X						X	X															X	X					
Norfolk State University (VA)	X	X	X	X	X							X																X					X
Howard University (DC)	X						X									X					X		X	X	X	X		X					
N. Carolina A&T State Univ. (NC)	X				X	X	X	X				X		X			X						X		X		X	X					
Alabama A&M University (AL)	X	X	X	X	X		X						X		X								X			X			X				
So Univ. and A&M College BR (LA)	X	X			X					X													X								X		
Tennessee State University (TN)		X	X	X		X						X		X		X							X									
Fisk University (TN)	X	X	X	X		X	X											X								X					X		
Tuskegee University (AL)	X		X	X			X				X	X					X	X							X	X	X	X				X	
Florida A&M University (FL)	X	X	X	X									X		X	X				X	X					X						X	
Savannah State University (GA)																		X*															
Wilberforce University (OH)																		X															
Prairie View A&M Univ. (TX)	X	X	X				X*				X	X														X		X*	X		X		
Clark Atlanta University (GA)	X	X	X	X	X		X				X			X		X		X			X		X	X		X					X		
Bowie State University (MD)																			X									X*					
Morgan State University (MD)	X	X			X		X	X			X							X								X							
Elizabeth City State Univ. (NC)																X																	
Benedict College (SC)																X																	
Johnson C. Smith University (NC)										X																							
Spelman College (GA)	X										X																						
Morehouse College (GA)																X	X																
Alcorn State University (MS)	X																																
Grambling State University (LA)	X																																
Texas Southern University (TX)			X	X													X	X														X	
Bennett College (NC)																	X																

[a]Key: CFD is computational fluid dynamics; EA, electric actuation; EM, electromagnetic; MEMS, microelectromechanical systems; PMAD, power management and distribution; PV, photovoltaic; RF, radiofrequency; RFC, regenerative fuel cell; and TVC, thrust vector control.

TABLE I.—GLENN TECHNOLOGY PROGRAMS AND PROJECTS[b] (Concluded)
(b) Links to OMU Capabilities

OMUs	Technology Programs																															
	Materials-polymers and composites	**Thin films**	**MEMS, nanotechnology, micromotors**	**Carbon nanotubes**	**Sensors and gauges/optics**	**Dynamics and control-flight systems**	**Electronics/semiconductors/converters**	**RF and microwave technologies**	**Data compression**	**Millimeter wave imaging**	**Combustion modeling, engine combustion and diagnostics**	**CFD/nozzle-inlet flows**	**Supersonic/hypersonic vehicles and flows**	**Space structures**	**Launch vehicles-TVC/EA/fault**	**Microgravity sciences-chaos, combustion particle melting**	**Biotechnology and bioengineering**	**Fuel and solar cells, renewable energy RFC, energy storage**	**Satellite operations**	**Aircraft ice protection**	**High-Performance and soft computing, and software engineering**	**Systems and control engineering**	**Intelligent controls**	**Thermal coatings/protective barrier**	**Power electronics/motor drives**	**Aerospace power system/PMAD**	**Electric, chemical and EM propulsion**	**Space environments (radiation)**	**Plasma-hypersonic flows**	**Computational analysis-jet noise**	**Thermal management**	**High-temperature electronics**	**PV concentrators/TPVs**
University of Texas/El Paso (TX)		X																X															
U. of Puerto Rico-Mayaguez	X	X															X				X												
U. of Puerto Rico-Rio Piedras		X	X														X	X			X												
New Mexico State University (NM)																					X					X							
University of New Mexico (NM)	X								X													X		X						X	X		
California State University-LA													X	X																			
Florida International University	X	X	X		X						X	X	X			X	X					X			X						X		
City University of New York (NY)	X				X	X					X	X				X																	

[b]Key: CFD is computational fluid dynamics; EA, electric actuation; EM, electromagnetic; MEMS, microelectromechanical systems; PMAD, power management and distribution; PV, photovoltaic; RF, radiofrequency; RFC, regenerative fuel cell; and TVC, thrust vector control.

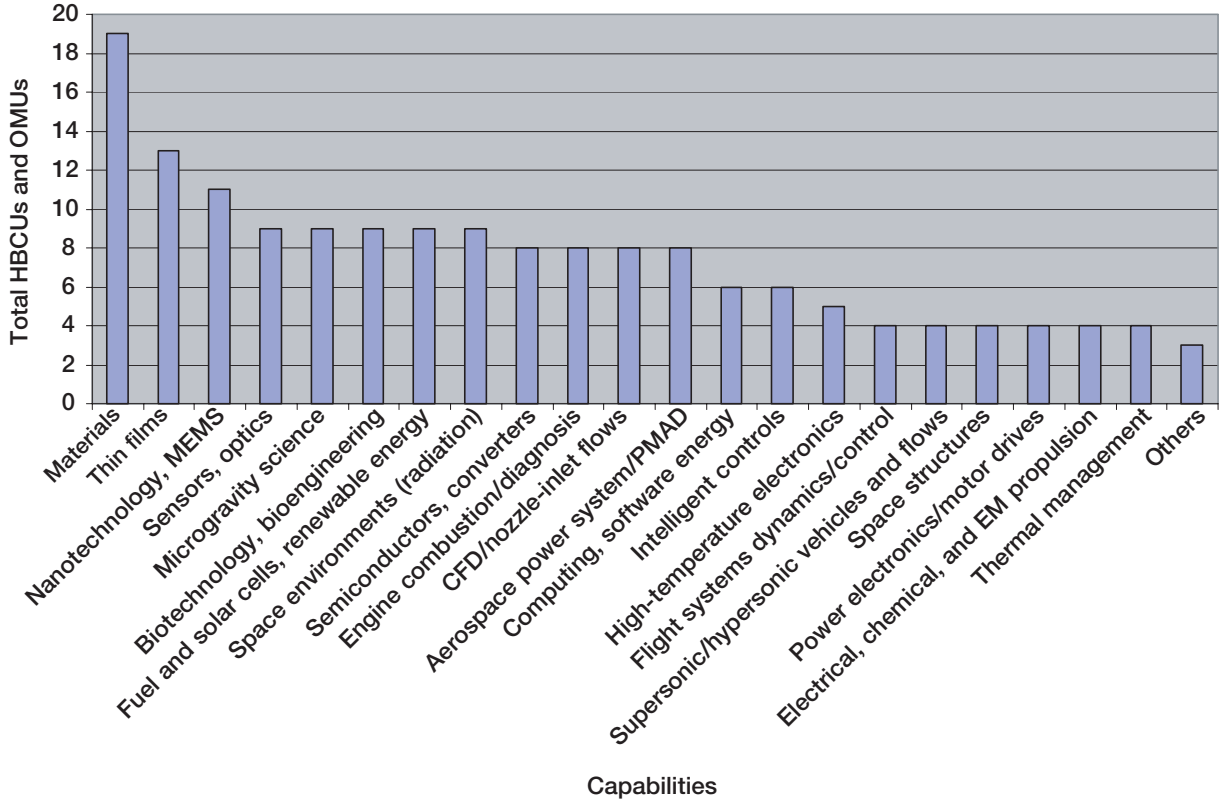


Figure 2.—Total HBCUs and OMUs versus Glenn technology program capabilities. CFD is computational fluid dynamics; EM, electromagnetic; MEMS, microelectromechanical systems; and PMAD, power management and distribution.

in Glenn technologies. The figure portrays the relative concentrations of the universities with expertise in a particular area. The Aeropropulsion Research Program Office and directorates across the Center are engaged in research related to the listed technology programs. The capabilities shown are based on a review of the universities' research involvement with NASA (refs. 1 and 2).

It is evident from figure 2 that a number of the universities have multiple capabilities in various Glenn programs. Nineteen such universities out of a total of thirty-three have faculty with expertise in materials. Thirteen universities have capability in thin films, and eleven in nanotechnology, followed by five groups each with nine universities whose faculty members are experienced in sensors and optics, microgravity science, biotechnology and bioengineering, fuel and solar cells and renewable energy, and space environments (including radiation). Also, four sets of eight universities have faculty knowledgeable in electronic semiconductors and converters, engine combustion and diagnosis, computational fluid dynamics including nozzle-inlet flows, and aerospace power systems inclusive of power management and distribution. For the remaining universities, faculty members in two groups of six institutions are versed in computing and software engineering and intelligent controls, and those in a group of five other institutions are knowledgeable in high-temperature electronics. There are six sets of four universities where the members of faculty have experience in dynamics and control of flight systems, supersonic and hypersonic vehicles and flows, space structures, power electronics and motor drives, onboard propulsion, and thermal management. Finally, only one to three institutions demonstrate capability in radiofrequency and microwave technologies, data compression, launch vehicles, aircraft ice protection, systems and control engineering, thermal coating and protection, plasma hypersonic flows, computational analysis of jet noise, and photovoltaic (PV) concentrators and thermophotovoltaics.

An examination of table I(a) and (b) shows that, based on information contained in the open literature, 14 universities appear to have minimal research involvement in Glenn-type technologies. The universities are Savannah State University (GA), Wilberforce University (OH), Bowie State University (MD), Elizabeth City State University (NC), Benedict College (SC), Johnson C. Smith University (NC), Spelman College (GA), Morehouse College (GA), Alcorn State University (MS), Grambling State University (LA), Bennett College (NC), University of Texas at El Paso (TX), New Mexico State University (NM), and California State University (CA). These universities can benefit from a broader interaction with Glenn. The next section shows examples of specific accomplishments from such interactions and serves to highlight the potential and actual applications of the research outcomes.

Accomplishments of Selected Universities

Research-based accomplishments of three of the universities listed in table I(a) are highlighted in figures 3 to 5 to demonstrate the valuable contributions by the universities to NASA missions and programs. These figures present specific accomplishments of three of the HBCUs in partnership with Glenn Research Center: Clark Atlanta, Hampton, and Johnson C. Smith Universities. The specific project objectives, applications, and collaborators are presented. Personnel at the NASA Center for High Performance Polymers and Composites (HiPPAC) at Clark Atlanta University perform research in polymeric materials, with focus on structural materials, electronic and photonic materials, and nanotechnology. The work is in support of the NASA Aerospace Technology (Code R) Enterprise. The other objective, as shown in figure 3, is to increase the participation, by minority students, in science and engineering. Potential uses of the technology include airframe and propulsion components for advanced

Composite testing

Advanced processing

Objectives:

- Perform research in polymeric materials in support of NASA programs and missions
  - ✓ Structural materials
  - ✓ Electronic and photonic materials
  - ✓ Nanotechnology
- Increase minority participation in sciences and engineering

Partners and customers:

- Glenn Research Center, Langley Research Center, and Marshall Space Flight Center
- NASA HQ: Code R
- Air Force Office of Scientific Research
- Department of Energy—Ames Research Center
- Lockheed Martin Corporation
- Laser Photonics, Inc.

Points of contact:

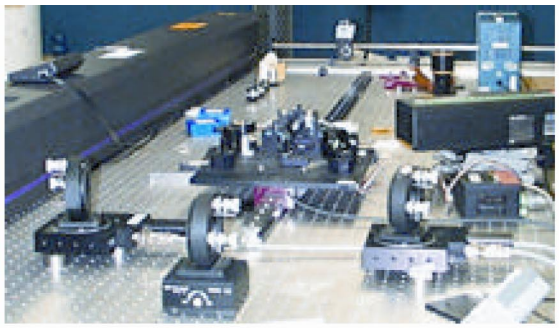
Technical monitor: Dr. Michael Meador, Glenn, 216–433–9518

Director: Dr. Eric Mintz, Clark Atlanta University, 404–880–6886

Applications:

- Airframe and propulsion components for advanced aircraft and space transportation systems
- Optical communications and computing
- Sensors and actuators
- Co-recipient of NASA 2001 Turning Goals Into Reality Award for resin transfer molded (RTM) processable polymers

Figure 3.—NASA Center for High Performance Polymers and Composites (HiPPAC) at Clark Atlanta University.



Bragg wavemeter prototype

Objectives:

- Fabricate fiber-optic interferometric sensors for high-temperature environments
- Designed and fabricated compact T and strain sensor
- Designed prototype for multiple sensor
- Developed readout for direct correlation of strain plume impingement and momentum transfer

Partners and customers:

- Dr. J.V. Lindesay, Collaborator, Stanford University
- Thirteen students at Hampton University
- Glenn Research Center
- NASA Headquarters: Aerospace Technology, Space Flight

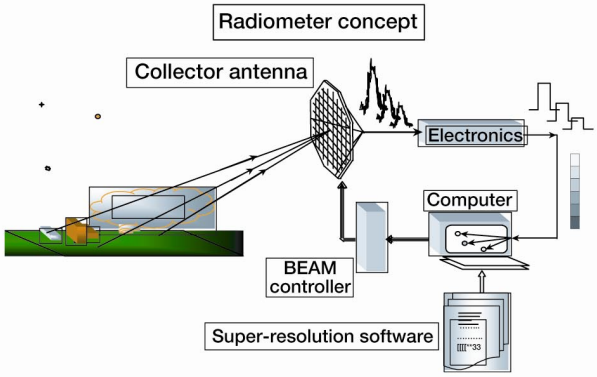
Points of contact:

Technical monitor: Eric Pencil, Glenn Research Center, 216–977–7463
Principal investigator: Dr. D.R. Lyons, Hampton University, 757–727–5923

Applications and patents:

- Sensor diagnostics in ion thrusters (risk reduction)
- Plume impacts on temperature cycling and high-cycle fatigue
- Spinoffs: biotechnology, environmental monitoring, and telecommunications
- Two patents, two technical papers

Figure 4.—Research accomplishments at Hampton University: Optical strain gauges for plume impingement studies.



Objectives:

- Apply radiometric sensors to alleviate atmospheric hazards to aviation
- Design and develop 94 GHz radiometer for real-time rapid image inversion processing and high-resolution images
- Building Glenn-designed radiometer system

Partners and customers:

- University of Reading, England
- University of Arizona, U.S.A.
- Five students at Johnson C. Smith University
- Glenn Research Center
- NASA Headquarters: Code E

Points of contact:

Technical monitor: Dr. Isaiah Blankson, Glenn Research Center, 216–433–6143
Principal investigator: Dr. Magdy Attia, Johnson C. Smith University, 704–378–1140

Applications and patents:

- Remote sensing: airport safety, all-weather vision, fused-sensor imaging, and weapon detection
- Diagnostics: medical and plasma
- General: insitu nondestructive testing, defense applications, and environmental
- Spinoffs: solutions for geological explorations, remote sensing of vegetation and soil conditions, and noninvasive brain volumetric mapping
- Four papers

Figure 5.—Research accomplishments at Johnson C. Smith University: passive millimeter wave imaging system.

aircraft and space transportation systems, optical communications and computing, and sensors and actuators. The researchers at the Center for HiPPAC were recipients of the NASA 2001 Turning Goals Into Reality Award, based on their development of resin transfer molded (RTM) processable polymers.

Figure 4 depicts research work by Hampton University on "Optical Strain Gauges for Plume Impingement Studies." Thirteen students have participated in the project. This work, in support of Code R and the Space Flight (Code M) Enterprise and funded by the NASA Partnership Award and Graduate Student Research Program Fellowship Award, seeks to fabricate fiber-optic interferometric sensors for high-temperature environments. Among the accomplishments is the development of a readout for direct correlation of strain plume impingement and momentum transfer. Application areas are sensor diagnostics to reduce risk in ion thrusters as well as determination of plume impacts on temperature cycling and high-cycle fatigue. The spinoff application areas are biotechnology, environmental monitoring, and telecommunications. The principal investigator at Hampton University and his collaborator at Stanford University have been awarded two patents based on their work.

Glenn collaborates with Johnson C. Smith University, NC, in research on the "Passive Millimeter Wave Imaging System." A radiometer concept is depicted in figure 5. One of the dual objectives of the project is to apply radiometric sensors to minimize atmospheric hazards to aviation. The other objective is to design and develop a 94-GHz radiometer for real-time rapid image inversion processing and high-resolution images. A Glenn-designed radiometer is currently under construction, to be completed in December 2002. The participants in the project are the University of Reading in England, the University of Arizona in Texas, and five students working under the principal investigator at the Johnson C. Smith University. NASA Headquarters Office of Equal Opportunity Programs (Code E) partially funds the project.

The imaging system has some key, potential applications. These include remote sensing for airport safety, all-weather vision, fused-sensor imaging and the detection of weapons. Other uses are in medical and plasma diagnostics, insitu destructive testing, and defense applications. The potential spinoffs embody solutions for geological explorations, remote sensing of vegetation and soil conditions, and noninvasive brain volumetric mapping. To date, the research has yielded four technical papers.

In addition to Partnership Awards, NASA Research Announcement awards, and other grants resulting in the links summarized in table I(a) and (b), the Agency sponsors competitively selected minority university research centers in specific NASA-related technology programs.

NASA-Funded University Research Centers

NASA has established and funded some key educational programs designed to strengthen research at and improve infrastructure within HBCUs and OMUs (ref. 3). Among these programs are the University Research Centers (URCs), the Institutional Research Awards (IRAs), Faculty Awards for Research (FAR), and the Partnership Awards for Innovative and Unique Education and Research. In particular, one of the goals for establishing the URCs is to "achieve a broad-based, mainstream, competitive aerospace research capability that will foster new aerospace science and technology concepts" (ref. 2), and to "develop infrastructures to help increase the production of socially disadvantaged and/or disabled students with advanced degrees in NASA-related fields" (ref. 4).

Appendix A lists the URCs that have been established to date. The Group 1 URCs, comprising the original seven universities established in 1992, have just completed their second and final 5-year tenure. This concludes their funding to date by NASA Minority University Research and Education Division (MURED) in Code E. The listing of Group 2 URCs represents the second set of seven universities established in 1995. This group is in their second 5-year funding cycle. The Group 3 URCs selected in 2002 have begun their first 5-year tenure. The directors of the URCs are valuable points-of-contact (POCs) for collaborative work.

University Research and Institute Directors

While there are 18 existing NASA URCs, there are a considerable number of HBCUs and OMUs with non-NASA-sponsored research centers and/or research institutes on their campuses. Some of these centers and institutes have multiple disciplines, some of which are closely aligned with NASA missions and technologies and, in particular, Glenn technologies. Some of the directors of such centers and institutes represent potential POCs for possible partnerships or collaborations. These centers, institutes, and the contact information for their directors are listed in table II(a) to (r) in appendix B. The directors of NASA URCs are also listed in this table, where applicable.

Points of Contact

The names listed in appendix C as POCs are a combination of the universities' vice-presidents (VPs) of the pertinent Office of Research and Sponsored Projects, directors of NASA-funded URCs, and other faculty members and administrative officials on the campuses. In the case of a known, conscientious, and dependable faculty member who is familiar with NASA programs and/or missions, his or her name is listed as the POC, to expedite identification of faculty with matching expertise to a NASA opportunity. If no such person is known, then the name of the VP of Research and Sponsored Project is given, provided such a VP office exists in the university administration. A dean is selected, where there is no VP, known faculty member, or pertinent NASA-funded or non-NASA-funded Research Center. A university without a research center or institute has its URC director as the POC. Other POCs are listed in URC Groups 1 to 3 (appendix A).

Concluding Remarks

Summary

This report summarizes synergistic links between NASA Glenn research- and technology-related programs and capabilities of the historically black colleges and universities (HBCUs) and other minority universities (OMUs). It identifies technology areas for potential collaborative and partnership efforts between the Universities and scientists and engineers at Glenn. Additionally, the report provides names and contact information for key personnel at the universities to enable an expeditious search for faculty or research groups with the best matching expertise for collaborative opportunities at Glenn. Nineteen of the thirty-three universities that are currently performing research for Glenn, or have done so in the past, have faculty with expertise in several or more areas of Glenn technology disciplines. Faculty members in the remaining 14 universities have had limited exposure to Glenn research and technology programs.

Recommendations

Strong partnerships between Glenn, HBCUs, and OMUs will serve as valuable vehicles for developing a broad-based expertise within the universities, to significantly improve their contributions to Glenn research and technology programs. Recommendations for stronger partnerships include the following:

1. Faculty members with limited exposure to Glenn research and technology programs will benefit from participating in Glenn summer Faculty Fellowship Program, to help them develop familiarity with

Glenn programs. Follow-on, competitive areas are NASA grants, NASA Research Announcement awards, and National Research Council Resident Research Associateships.

2. An effort must be made to strengthen the ties between NASA, the universities, and NASA's major aerospace and industrial partners such as Lockheed Martin Corporation; The Boeing Company; TRW, Inc.; and others to improve the infrastructure and research capabilities at the universities.

3. Because of expected, future improvements in faculty professional careers, the cited expertise in individual universities will undoubtedly broaden over time. Correspondingly, the summarized synergistic links will likely undergo some modifications. Hence, periodic review and update of the links are recommended.

Conclusions

The resources of NASA include cutting-edge and challenging research and technologies. The strength of the major aerospace industries lies in their high technology development, system design and integration, skilled and experienced personnel, research and development, facilities, and market awareness (ref. 5). Academic institutions are generally noted for their basic research skills and relatively low overhead cost, despite some university shortfalls in limited resources and facilities. Hence, partnering with the universities and industries can

1. Accelerate technology development at reduced cost, while promoting technology transfer
2. Accelerate infrastructure development at the universities, while encouraging the establishment of NASA mission-related graduate programs. This approach should, potentially, yield a high return-on-investment, such as NASA program-experienced graduate student recruits
3. Significantly improve the chance for success in joint Glenn-university efforts in competitive research awards from NASA and other agencies

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Appendix A
University Research Center (URC) Directors

GROUP 1
(Established in 1992: tenure expired in 2002)

Dr. Eric A. Mintz
High Performance Polymers and
Composites Research Center
Clark Atlanta University
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Appendix B
University Research and Institute Directors

Table II(a) to (r) provides the names and contact information of the directors of HBCU and OMU education centers or institutes either participating in or having potential to participate in research with Glenn.

TABLE II.—RESEARCH AND INSTITUTE DIRECTORS

(a) Alabama A&M University[a]

Center or institute	Director	Telephone	E-mail address
Center of Excellence in Nonlinear Optics and Nonlinear Optical Materials	Dr. Alton Williams	256–958–8145	acwilliams@prodigy.net
Center for Hydrology, Soil, Climatology, and Remote Sensing	Dr. Tommy Coleman	256–851–5462	tcoleman@aamu.edu
Center for Entrepreneurship and Economic Development	Dr. Sylanus S. Ogburia	256–851–5685	sogubria@aamu.edu
Howard J. Foster Center for Irradiation of Materials	Dr. Daryush Ila	256–851–5866	ila@cim.aamu.edu
Center for Forestry and Ecology	Dr. George Brown	256–858–4193	aamgfb01@aamu.edu
Plant Science Center	Dr. Caula Beyl	256–858–4193	cbey@aamu.edu
Alabama A&M University Research Institute	Dr. Daryush Ila	256–851–5866	ila@cim.aamu.edu

[a]www.aamu.edu

TABLE II.—RESEARCH AND INSTITUTE DIRECTORS (Continued)

(b) Clark Atlanta University[b]

Center or institute	Director	Telephone	E-mail address
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Army Center for Research in Information Science (ACRIS)	Dr. Nazir Warsi	404–880–6944	nwaris@cau.edu
Center for Environmental Policy, Education and Research	Dr. Yaw Yeboah	404–880–6619	yyeboah@cau.edu
Center of Excellence in Microelectronics and Photonics	Dr. Michael Williams	404–880–6902	mwilliams@cau.edu
Center for Surface Chemistry and Catalysis	Dr. Mark Mitchell	404–880–6860	mmitchell@cau.edu
Center for Theoretical Studies of Physical Systems	Dr. Alfred Msezane	404–880–8964	amsezane@cau.edu
Earth System Science Program	Dr. Randal Mandock	404–880–8964	mandock@cau.edu
Environmental Analytical Services Laboratory	Dr. Conrad Ingram	404–880–6898	cingram@cau.edu
Geographic Information System Laboratory	Dr. Hezekiah Adeyemi	404–880–6928	hadeyemi@cau.edu
High Performance Computing Research Partnership Program	Dr. Shahrouz Aliabadi	404–880–6433	saliabadii@cau.edu
High Performance Polymers and Composites (HiPPAC) Center	Dr. Eric Mintz	404–880–6886	emintz@cau.edu
Laboratory for Advanced Signal and Image Processing	Dr. Romain Murenzi	404–880–8799	rmurenzi@cau.edu
Laboratory for Electro-Optical Materials	Dr. Xiu (James) Bu	404–880–6897	xbu@cau.edu
National Institutes of Health (NIH) Research Center in Minority Institutions	Dr. Juarine Stewart	404–880–6764	jstewart@cau.edu
Biomedical Research and Training Program	Dr. John Browne	404–880–6785	jbrowne@cau.edu
Web Technology Development and Training Center	Dr. Roy George	404–880–6953	rgeorge@cau.edu

(c) Fisk University[c]

Center or institute	Director	Telephone	E-mail address
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[b]www.cau.edu

[c]www.fisk.edu

TABLE II.—RESEARCH AND INSTITUTE DIRECTORS (Continued)

(d) Florida International University[d]

Center or institute	Director	Telephone	E-mail address
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Center for Labor Research and Studies	Dr. Guillermo Grenier	305–348–2371	grenierg@fiu.edu
Drinking Water Research Center	Dr. Berrin Tansel	305–348–2928	tansel@eng.fiu.edu
International Hurricane Center	Dr. Stephen Leatherman	305–348–1607	leatherm@fiu.edu
Latin American and Caribbean Center	Eduardo Gamarra	305–348–2894	gamarrae@fiu.edu
Lehman Center for Transportation Research	Dr. L. David Shen	305–348–3055	shen@eng.fiu.edu
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High Performance Database Research Center	Dr. Naphtali David Rishe	305–348–2025	rishen@cs.fiu.edu
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Future Aerospace Science and Technology Center in Cryolectronics (FAST)	Dr. Grover Larkins, Jr.	305–348–3498	larkins@eng.fiu.edu
Knowledge Management Laboratory	Dr. Irma Becerra-Fernandez	305–348–3476	becferi@fiu.edu
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(e) Florida A&M University[e]

Center or institute	Director	Telephone	E-mail address
Center for Nonlinear and Nonequilibrium Aeroscience	Dr. Joseph A. Johnson III	850–561–2473	johnsonj@cennas.nhmfl.gov
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[d]www.fiu.edu

[e]www.famu.edu

TABLE II.—RESEARCH AND INSTITUTE DIRECTORS (Continued)

(f) Hampton University[f]

Center or institute	Director	Telephone	E-mail address
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Center for Fusion Research and Training	Dr. A.R. Punjabi	757–727–5343	apunjabi@hamptonu.edu
Nuclear/High Energy Physics Center	Dr. Cynthia Keppel	757–727–5283	ckeppel@hamptonu.edu
Pathfinder Instruments for Cloud and Aerosol Spaceborne Center	Dr. Doyle Temple	757–727–6908	dtemple@hamptonu.edu
Research Center for Optical Physics	Dr. Doyle Temple	757–727–6908	dtemple@hamptonu.edu

(g) Howard University[g]

Center or institute	Director	Telephone	E-mail address
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Center for Research in Evaluating Software Technology (CREST)	Dr. Ronald Leach	202–806–6650	rjl@scs.howard.edu
Center for the Study of Terrestrial and Extraterrestrial Atmosphere (CSTEA)	Dr. Arthur N. Thorpe	202–806–5172	Thorpe@cstea.howard.edu
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[f]www.hamptonu.edu

[g]www.howard.edu

TABLE II.—RESEARCH AND INSTITUTE DIRECTORS (Continued)

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Center or institute	Director	Telephone	E-mail address
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[h]www.morgan.edu

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TABLE II.—RESEARCH AND INSTITUTE DIRECTORS (Continued)

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(l) North Carolina A&T State University[l]

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TABLE II.—RESEARCH AND INSTITUTE DIRECTORS (Continued)

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Center of Excellence in Urban Education	Dr. Audean Allman	713–313–1053	Allman_sa@tsu.edu
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Center for Transportation Training and Research	Dr. Carol Lewis	713–313–1841	Lewis_ca@tsu.edu
Environmental Science Institute	Dr. Joseph Jones	713–313–7233	Jones_jx@tsu.edu
Center on Aging for Horizons Intergenerational Wellness	Dr. Maxine Hammonds-Smith	713–313–7635	Hammondssmith_mm@tsu.edu
Center on Cardiovascular Disease	Dr. Adebayo Oyekan	713–313–7565	Oyekan_ao@tsu.edu

(r) Tuskegee University[r]

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Center for Innovative Manufacturing of High Performance Materials	Dr. S. Jeelani	334–727–8970	jeelanis@acd.tusk.edu
NASA Center for Food and Environmental System for Human Exploration of Space	Dr. Walter A. Hill	334–727–8157	hillwa@tusk.edu
The Tuskegee Center for Advanced Materials	Dr. S. Jeelani	334–727–8970	jeelanis@acd.tusk.edu

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Appendix C
Points of Contact at Universities

TABLE III.—POINTS-OF-CONTACT AT UNIVERSITIES

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Benedict College	Dr. Juanita S. Scott	803–253–5149	jscott@benedict.edu
Bennett College	Ms. Wanda Davis Assistant to President	336–517–2267	wddavis@nr.infi.net
Bowie State University	Dr. George E. Miller III	301–860–4000	gmiller@bowiestate.edu
California State University, Los Angeles	Lori A. Redfearn	562–951–4815	lredfearn@calstate
Clark Atlanta University Research Center for Science and Technology	Dr. Kofi Bota	404–880–6996	kbota@cau.edu
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Fisk University	Dr. E. Silberman	615–329–8620	esilber@dubois.fisk.edu
Florida A&M University	Dr. B. Samuels	850–561–2423	bennie.samuels@famu.edu
Florida International University	Dr. M. Ali Ebadian	305–348–3585	ebadian@hcet.fiu.edu
Grambling State University	Dr. Danny E. Hubbard	318–274–3720	hubbard@alpha0.gram.edu
Hampton University	Dr. Donald R. Lyons	757–727–5923	drdrlyons@netscape.net
Howard University	Dr. Arthur Paul	202–806–6469	asp@scs.howard.edu
Johnson C. Smith University	Dr. Magdy Attia	704–378–1140	mattia@jcsu.edu
Morehouse College	Dr. N. White	404–681–2800	nwhite@morehouse.edu
Morgan State University	Dr. S.W. Lee	443–885–3106	slee@eng.morgan.edu
New Mexico State University	Dr. Jay B. Jordan	505–646–2914	engrdean@nmsu.edu
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North Carolina A&T State University	Dr. Frederick Ferguson	336–334–7254	fferguso@ncat.edu
Prairie View A&M University	Dr. John O. Attia	936–857–3923	J_attia@pvamu.edu
Savannah State University	Dr. George N. Williams	912–356–2186	williamg@savstate.edu
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University of New Mexico	Dr. M.S. El-Genk	505–277–5442	mgenk@unm.edu
University of Puerto Rico	Dr. Manuel Gomez	787–834–7620	mgomez@upr.clu.edu
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References

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13. ABSTRACT ***(Maximum 200 words)***

NASA senior management has identified the need to develop a strategy for increased contracting with the historically black colleges and universities (HBCUs) and other minority universities (OMUs). The benefits to the institutions, by partnering with NASA, include developing their industrial base via NASA-industry partnerships, strong competitive advantage in technology-based research opportunities, and improved research capabilities. NASA gains increased contributed value to the Agency missions and programs as well as potential future recruits from technology-trained students who also constitute a pool for the nation's workforce. This report documents synergistic links between Glenn Research Center research and technology programs and faculty expertise at HBCUs and OMUs. The links are derived, based on Glenn technologies in the various directorates, program offices, and project offices. Such links readily identify universities with faculty members who are knowledgeable or have backgrounds in the listed technologies for possible collaboration. Recommendations are made to use the links as opportunities for Glenn and NASA, as well as industry collaborators, to cultivate stronger partnerships with the universities. It is concluded that Glenn and its partners and collaborators can expect to mutually benefit from leveraging NASA's cutting-edge and challenging research and technologies; industry's high technology development, research and development facilities, system design capabilities and market awareness; and academia's expertise in basic research and relatively low overhead cost. Reduced cost, accelerated technology development, technology transfer, and infrastructure development constitute some of the derived benefits.

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