Report to Congress on Advancing Historically Black Colleges and Universities
By the Subcommittee on Advancing Historically Black Colleges and Universities of the Advisory Committee of the National Science Foundation Directorate for Education and Human Resources

I. Executive Summary

The Senate requested that the National Science Foundation (NSF) convene a high-level panel, comprised mostly of leaders of Historically Black Colleges and Universities (HBCUs) with strong graduate programs, to devise a comprehensive strategy to accelerate significant competitive opportunities for HBCUs in NSF's Research and Related Activities (R&RA) directorates. In response, NSF charged a Subcommittee of its Advisory Committee for the Directorate for Education and Human Resources (EHR), led by Dr. Tuajuanda Jordan, president of St. Mary's College of Maryland, with researching and reporting on the issue.

The Subcommittee concluded that there are currently three categories of HBCUs in relation to NSF: those that have been successful in obtaining funding from both the R&RA and EHR directorates; those that are in transition to more research-active status, but currently receive the bulk of their funding from EHR, especially the Historically Black Colleges and Universities – Undergraduate Program (HBCU-UP); and those that only rarely, if at all, apply for NSF funding. The subcommittee analyzed the issues surrounding each of the three groups and developed recommendations for increasing their success at NSF, including, as requested by the Senate, measurable milestones.

Key Recommendations for HBCUs:

1. HBCUs will work with NSF to obtain technical assistance and advice in preparing submissions for the Faculty Early Career Development Program (CAREER) or other single-investigator awards in the R&RA directorates. Institutional submissions should increase to 25% of each new faculty cohort within the next five years.
2. HBCUs will do an assessment to determine internal impediments faced by their faculty that prevent significant numbers from submitting R&RA proposals. As part of their proposals to the HBCU-UP Research Initiation Awards (RIA) program, the HBCU will be required to identify the impediments and submit a proposal to address the internal challenges. HBCU-UP RIA should mandate this information as part of the application submission process as well as institute the requirement that applicants include a 10-year plan for transitioning faculty from that funding mechanism to submissions to the R&RA directorates.
3. To the extent possible, HBCUs will provide resources (human and financial) to junior faculty as they establish their research agendas. The amount of funding dedicated to start-up resources for junior faculty should increase to the 50th percentile of that provided by the average research-active HBCU within five years of the release of this report.
4. HBCUs should work with NSF to identify centers near HBCUs that could involve the HBCUs in their education and outreach activities. All NSF centers and large facilities (e.g., Engineering Research Centers, Science and Technology Centers, Materials Research Science and Engineering Centers, LIGO, astronomy) have required education and outreach components. These activities provide opportunities for both faculty and students at all levels to become involved in cutting edge research.
5. Beginning in FY2017, all HBCUs applying for grants in EHR programs should include as part of the application process 10-year development plans to 1) prepare their faculty to become more research-active and 2) build a research-support infrastructure within their institution.

Key Recommendations for NSF:

1. NSF will further analyze the issues related to multi-institution versus single investigator awards and explore ways in which to encourage more HBCU applicants for single investigator awards, including CAREER awards. An internal review and report by NSF will be conducted.
2. NSF will explore additional mechanisms through which program staff can interact with faculty at HBCUs who are starting research careers. NSF will ensure that outreach to HBCUs through in-person sessions, webinars, etc. continues, especially in the R&RA directorates. Successful programs will be studied and replicated, if feasible.
3. Beginning in FY2017, NSF should supply technical support to assist HBCUs in developing faculty and institutional research support programs.
4. NSF should identify other funding agencies with which to partner to help HBCUs develop a research culture. This should be advertised to HBCUs by FY2018.
5. NSF will explore ways to make programs that focus on broadening participation in both the R&RA and EHR directorates more widely known in the HBCU community. In addition, since 50 percent of HBCUs are in Experimental Program to Stimulate Competitive Research (EPSCoR) states, NSF will work to foster increased interactions between the NSF EPSCoR office and HBCUs. NSF will hold internal meetings among the R&RA directorates, successful programs such as HBCU-UP in EHR, and the NSF EPSCoR staff to explore options for better collaboration. These meetings will be held and a plan developed during FY 2016.

II. Introduction and Charge to the Subcommittee

In Senate Report 114-66, entitled *Department of Commerce and Justice, and Science and Related Agencies Appropriations Bill 2016*, the Senate included instructions to the National Science Foundation (NSF) to "convene a high-level panel to devise a comprehensive strategy to accelerate significant competitive opportunities for HBCUs that can continuously tap NSF's core research directorates rather than its education and human resources program base." The Senate went on to indicate that the report strategy should include "measurable milestones" and that the panel should be "comprised primarily of leaders from the Nation's HBCUs with an emphasis on those institutions with strong graduate programs that are successful at capturing Federal research funding."

In response, NSF convened a Subcommittee of the Advisory Committee for the Directorate for Education and Human Resources, chaired by Dr. Tuajuanda Jordan (President, St. Mary's College of Maryland). Other members of the Subcommittee include Drs. Sandra DeLoatch (Provost and Vice President for Academic Affairs, Norfolk State University), Wayne Frederick (President, Howard University), José Goity (Professor, Hampton University and Jefferson Lab), Keith Hargrove (Dean of the College of Engineering, Tennessee State University), Melissa Hines (Director, Cornell Center for Materials Research, Cornell University), Everette Joseph (Professor of Atmospheric Science and Director of the Atmospheric Sciences Research Center, University of Albany), Loretta Moore (Vice President of Research and Federal Relations, Jackson State University), Jagannathan Sankar (Distinguished University Professor and Director of the NSF Engineering Research Center for Revolutionizing Metallic Biomaterials, North Carolina A&T State University), and George C. Wright (President, Prairie View A&M University). Drs. Meldon Hollis (former Associate Director, White House Initiative on HBCUs) and Lee Todd (Former Chair, Advisory Committee for the National Science Foundation's Directorate for Education and Human Resources and President Emeritus, University of Kentucky) served as *ex officio* members of the Subcommittee.

The Subcommittee was charged by the NSF Director Dr. France Córdova, with researching and analyzing several key areas:

- What are optimal strategies that the HBCU community might undertake to increase the competitiveness of HBCUs and HBCU faculty with NSF R&RA [Research and Related Activities] directorates? What kind of institutional commitments and institutional change would be necessary to begin that shift? How can NSF be involved in achieving this change? Please include metrics that would define success. For example, are some HBCUs poised to move to Carnegie RU/VH and RU/H classification?
- Examine particular research programs within the R&RA directorates in which HBCU faculty have been most competitive and identify common characteristics across these programs that might be responsible for this success.
- There are many science and engineering faculty members in HBCUs who have been successful in obtaining NSF R&RA funding. Determine any factors that have been key to their success.
- Several HBCUs have been successful in obtaining funding through R&RA directorates, both directly and through partnerships with other institutions. Are there characteristic of these HBCUs or these partnerships that have made them more competitive for NSF R&RA funding?

To develop its response to the Senate's request, the Subcommittee held an initial meeting in Washington, DC on June 5, 2015, followed by research on the questions in the charge, a conference call on June 15, 2015 and a second face-to-face meeting on July 29, 2015. The report was vetted by leaders at a group of HBCUs not represented on the Subcommittee and approved by the Subcommittee before being submitted to NSF for forwarding to the Senate.

The report begins with a brief overview outlining the context of HBCUs and the diversity among them. It then analyzes three groups of HBCUs and their relationships with NSF, especially the Research and Related Activities (R&RA) directorates—HBCUs that have been consistently successful in obtaining R&RA funding, HBCUs that aspire to compete for R&RA funding, and HBCUs that may benefit from NSF programs but do not currently seek R&RA research funding. The period for the analyses was 2010-2014. Each section includes recommendations for both the HBCU community and NSF. The report ends with a conclusions section.

III. Historically Black Colleges and Universities (HBCUs) and their Relationship to NSF

HBCUs are a vital asset to the nation. There are 100 accredited HBCUs in the United States, ranging from small regional liberal arts colleges to large research-active universities with comprehensive graduate programs. HBCUs comprise about three percent of all institutions of higher education (IHEs). They include community colleges, four-year institutions, and graduate degree-granting institutions, both private and public. Fourteen HBCUs have accredited engineering programs. Twenty-one HBCUs offer the Ph.D. in at least one STEM discipline. According to the National Center for Education Statistics (NCES), of the 100 HBCU institutions in America today, 30 offer doctoral programs and 56 provide graduate degree programs at the Master's level (2013). At the undergraduate level, 85 of the HBCUs offer a bachelor's degree program and 25 of these schools offer associate degrees. There are twelve two- year institutions offering associate degrees (NCES, 2013).

Historically Black Colleges and Universities have awarded a large share of bachelor's degrees to African-American students in science, technology, engineering and mathematics (STEM), and between 2008 and 2012, nine of the top ten institutions where African-American STEM doctorate recipients studied as

undergraduates are HBCUs, as data by the National Center for Science and Engineering Statistics (NCSES) show (2015). In 2012, 8.5 percent of black undergraduates attended HBCUs; however, HBCUs awarded 16.7 percent of the bachelor's degrees and 17.8 percent of the science and engineering bachelor's degrees to black students that year, an illustration of the importance of HBCUs to the nation's STEM enterprise (NSF, 2015).

HBCUs vary in size, mission, and focus. Twenty-nine HBCUs enroll fewer than 1,000 students, with nine of these having an enrollment of fewer than 500 students. Forty-seven HBCUs enroll between 1,000 and 4,000 students; twenty-four HBCUs enroll over 4,000 students, with only two of these enrolling more than 10,000 students (NCES, 2013).

NSF has long supported HBCUs through both the EHR and R&RA directorates. Table 1 shows the number of HBCUs that have applied for and received NSF funding between 2010 and 2014, the period chosen by the Subcommittee for analysis. About 30 percent of HBCUs neither applied for nor received funding from the NSF during that period. The same is true for comparable non-minority-serving institutions across the U.S. Table 1 reveals that in any given year, between 10 and 20 percent of HBCUs receive funding only from the EHR Directorate where the HBCU-Undergraduate Program (HBCU-UP) is housed. HBCU-UP, in addition to providing support for STEM undergraduate education and research, also provides research support to faculty in all NSF funded disciplines via the Research Initiation Award and Broadening Participation Research tracks. HBCU-UP has funded 85 of the 100 HBCUs to date, including 7 of the 12 community colleges. Other EHR divisions and programs also fund HBCU projects, although HBCU-UP remains the primary source of support in the EHR directorate. At present, about 50 percent of HBCUs do not apply to the R&RA directorates for funding.

The Subcommittee report focuses primarily on two sets of institutions: 1) HBCUs that are successful in obtaining R&RA funding (see Section IV) and 2) HBCUs in transition with aspirations to compete for R&RA funding (see Section V). These transitional institutions often rely on EHR programs, especially those housed in the Division of Human Resource Development (HRD) such as HBCU-UP, to build capacity in STEM education. Additionally, the report includes recommendations regarding the approximately 30 HBCUs that do not as a rule apply for NSF funding.

Table 1 – Number of HBCUs Applying for and Receiving NSF Funding

	Applied for NSF Funding	Received at least 1 NSF Award	Applied for R&RA Funding	Received at least 1 R&RA Award
2010	67	39	55	30
2011	70	42	54	28
2012	70	41	50	21
2013	66	33	51	14
2014	67	45	48	24

Thirty-five percent of the proposals submitted to R&RA programs by HBCUs between 2010 and 2014 were submitted by five institutions: Howard University, Jackson State University, North Carolina A&T State University, Tennessee State University, and Tuskegee University. Three of these (North Carolina A&T State University, Tennessee State University, and Tuskegee University) are land grant universities founded in response to the second Morrill Act of 1890, which required states to establish a separate land grant college for Blacks if Blacks were being excluded from the existing land grant college. These

land grant schools continue to receive annual federal funding for their research, extension and outreach activities (Lee, 2013). Fourteen percent of the total proposals submitted by HBCUs to R&RA programs were submitted by North Carolina A&T State University. Howard University and Jackson State University, the two HBCUs classified as research universities by the Carnegie Classification, are highly successful in receiving NSF R&RA funding, but are not land grant universities. Howard University is a federally chartered university that receives an annual congressional appropriation administered by the U.S. Department of Education.

IV. *HBCUs that are Successful in Obtaining Funding from the R&RA Directorates*

The Senate language states that "NSF's primary research directorates have a far more anemic track record" in funding HBCUs than EHR and concludes that this is "a reality that the Committee believes must change if the Nation is to take advantage of the country's growing diversity to enhance America's economic competitiveness." The Subcommittee agrees that both HBCUs and NSF can do more to increase support to HBCUs, but it also applauds the considerable support that NSF, especially EHR, has historically provided to HBCUs (Table 2). In addition, it recognizes that the R&RA directorates are also providing considerable support and that HBCUs may be more successful in obtaining funding from them than is commonly perceived (Table 2).

Table 2: HBCU Funding Rate for Competitive Proposals, FY 2010-2014

	EHR				R&RA			
	Awards	Declines	Total	Funding Rate	Awards	Declines	Total	Funding Rate
2010	58	200	258	22%	67	345	412	16%
2011	59	216	275	21%	52	331	383	14%
2012	80	227	307	26%	49	293	342	14%
2013	51	210	261	20%	27	271	298	9%
2014	69	255	324	21%	45	262	307	15%

Table 3: IHE Funding Rate for Competitive Proposals, FY 2010-2014

	EHR				R&RA			
	Awards	Declines	Total	Funding Rate	Awards	Declines	Total	Funding Rate
2010	786	3,632	4,418	18%	10,698	34,444	45,142	24%
2011	708	3,329	4,037	18%	9,320	32,766	42,086	22%
2012	776	2,912	3,688	21%	9,552	30,282	39,834	24%
2013	704	3,236	3,940	18%	9,035	31,435	40,470	22%
2014	599	2,923	3,522	17%	9,319	30,642	39,961	23%

In order to study the competitiveness of HBCUs in the R&RA directorates, the Subcommittee assessed the state of HBCUs that competed for and received NSF funding between fiscal years 2010 and 2014. To analyze the competitiveness of the most research-active HBCUs, the Subcommittee initially focused on a

cohort of nine of these HBCUs with solid track records of NSF funding. In alphabetical order, these institutions were Alabama A&M University, Hampton University, Howard University, Jackson State University, North Carolina A&T University, Prairie View A&M University, Southern University and A&M College, Tennessee State University, and Tuskegee University.

The Subcommittee took the identification of an appropriate peer cohort for these nine institutions seriously, as the challenges to such matching are well known. The first matched cohort of nine peer institutions (most of them predominately white institutions (PWIs), but some minority-serving institutions) was chosen by NSF program officers on the basis of program size, scope, and geography. The Subcommittee expanded upon this initial pool by choosing an additional 18 matched institutions, two per chosen HBCU, using the current Carnegie Classification of Institutions of Higher Education.[1] Since few institutions have an exact match across all seven Carnegie Classification criteria, the panel focused on selection criteria that are most important to research competitiveness: Level, Control, Graduate Instructional Program, Enrollment Profile, and Basic.[2] When more than two matches were returned, institutions in similar geographical areas were given preference.

Five years of data (2010-14) were examined for the nine HBCUs and the 27-institution peer cohort (see appendix D). These data are summarized in Table 4. This comparison was found to be relatively insensitive to the methodology used to select the peer cohort, and similar results were obtained when comparisons were separately made to the NSF-chosen cohort of nine peer institutions or the 18 Carnegie-Classification-based peer cohort.

Table 4: Comparison of Proposals, Funding Rate, and Total Funds Received by Select Research-Active HBCUs to their Peer Cohort Institutions across NSF and by Program Type, FY 2010-2014

	All NSF Programs			EHR Programs Only			R&RA Programs Only					
Name	**Proposals**	**Fund Rate**	**Total Funds**	**Proposals**	**Fund Rate**	**Total Funds**	**Proposals**	**Fund Rate**	**Total Funds**	**% of Total from EHR**	**Avg. RRA Award**	**Avg EHR Award**
HBCU Avg.	**158**	**17.6%**	**$24 M**	**59**	**23.8%**	**$15 M**	**99**	**13.9%**	**$9 M**	**61.6%**	**$676 K**	**$1.06 M**
Peer Avg.	**178**	**15.9%**	**$11 M**	**20**	**15.4%**	**$3 M**	**158**	**16.0%**	**$8 M**	**26.7%**	**$326 K**	**$968 K**

Table 4 compares the average performance of 9 select, highly research-active HBCUs to the average performance of a 27-institution peer cohort. The data are institutional averages. For example, the average HBCU institution submitted 158 proposals over the period FY 2010–2014 and received a total of

[1] carnegieclassifications.iu.edu/lookup_listings/institution.php

[2] The Carnegie classification scheme is described at carnegieclassifications.iu.edu/descriptions/. The Level category is based on highest degree awarded, whereas the Control category differentiates between public and private institutions. Graduate Instructional Program categorizes graduate education, with a special focus on the mix of graduate programs across fields of study. Enrollment profile provides a broad view of the student according to the mix of students enrolled at the undergraduate and graduate/professional levels. The Basic Classification is an update of the traditional classification framework developed by the Carnegie Commission on Higher Education in 1970.

$24 M in NSF funding, while the average institution in the peer cohort submitted 178 proposals over the same period and received $11 M in NSF funding.

Conclusions

On the basis of this comparison, a number of conclusions regarding the HBCUs that have had the most success in obtaining funding from the R&RA directorates are apparent:

- **While it is true that HBCUs continue to receive the majority of their NSF funding from the EHR directorate, the selected HBCUs are arguably as competitive as their peers in obtaining R&RA funding as judged either by total funding or by funding rate.** While proposals from HBCUs were selected for funding by the R&RAs at a slightly lower rate than those from the peer cohort (14% vs. 16%, respectively), the HBCUs received, on average, slightly more funding from R&RA awards than their peers ($9.2 M vs. $8.0 M).

  These data show that the relatively high percentage of funding that the HBCUs received from the EHR directorate was not a reflection of an overall lack of competitiveness on the part of the HBCUs, but rather a reflection of NSF's considerable investment in expanding the diversity of the Nation's STEM pipeline through the EHR programs focused on building institutional and individual research capacity.

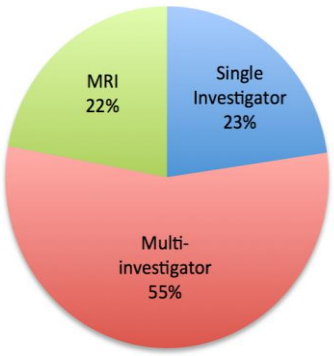
- **While HBCUs and their peers receive comparable amounts of R&RA funding, the nature of the awards to the two types of institutions is significantly different.** This difference is most dramatically seen in the average size of R&RA awards, with the average award to the HBCUs being more than twice as large as the average award to the peer cohort. Interestingly, a similar trend was not seen in awards from the EHR directorate, where the average grant size was found to be essentially identical between the two groups.

  The overall number of proposals submitted by the two groups was also found to be significantly different. Researchers at HBCUs submitted 40 percent fewer proposals to R&RA programs than those in the peer cohort.

- **The relatively large average size of awards to HBCUs from R&RA directorates reflects the relative importance of multi-investigator awards at HBCUs**.

  To gain further insight into the differences in Table 4, the Subcommittee examined all NSF awards to HBCUs in FY 2010–2014. Importantly, this analysis included additionally funded HBCUs, not just the nine representative HBCUs chosen for Table 4. As a result, data from 18 HBCUs were examined. In addition to the original nine HBCUs, awards to Clark Atlanta University, Delaware State University, Fisk University, Florida A&M University, Morgan State University, Norfolk State University, North Carolina Central University, Texas Southern University, and Virginia State University were included.

Fig. 1: All R&RA Research Awards to HBCUs, FY 2010–2014



As shown in Figure 1, research support from R&RA directorates fell into three categories: single investigator support (including the CAREER program[3] for junior faculty), multi-investigator support (including the PREM program[4]), and support for major research infrastructure (MRI program[5]). The large proportion of funding that is devoted to multi-investigator awards, including infrastructure awards, provides a natural explanation for the relatively large average R&RA grant size to HBCUs. While the large size of multi-investigator awards is typically viewed as a positive attribute, the relative lack of single investigator awards is concerning, as individual investigator awards are the foundation of NSF support — support upon which collaborative research typically builds.

Further evidence for the relative paucity of single investigator awards comes from a separate analysis of the CAREER program, a single-investigator program that funds prestigious awards to support junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education, and the integration of education and research. This is a highly competitive, cross-directorate R&RA program, and only 19 percent of applications to the program in FY 2010–2014 were successful. In contrast, CAREER proposals from HBCUs were far less successful than this average, with only 5 percent being funded. In an average year, fewer than two junior investigators from HBCUs received a CAREER award.

This statistic, while concerning, does not imply that junior faculty at HBCUs are entirely unsuccessful in obtaining NSF research support, as analysis of R&RA awards does not include Research Initiation Awards (RIAs), which are funded from the HBCU-UP program in the EHR directorate. RIAs are designed to provide support for junior faculty at HBCUs who are starting to build a research program, as well as for mid-career faculty who want to redirect and rebuild a research program or want to build a research program.

In parallel with its statistical analysis, the Subcommittee conducted informal discussions with a number of NSF program officers across a number of NSF directorates, asking them for their thoughts on the competitiveness of proposals from HBCUs within their respective directorates. The general consensus was that the problem was not a lack of competitiveness of proposals submitted by HBCUs *per se,* but rather an overall lack of proposals from HBCUs.

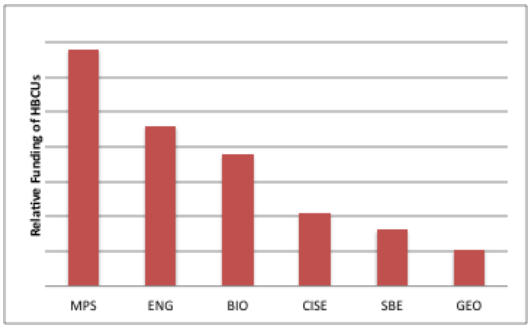
- **While R&RA funding for HBCUs varied significantly between NSF directorates over the five years studied, as shown in Figure 2, these differences were affected by the uneven distribution of large multi-investigator programs across the directorates.** For example, the relatively high rate of R&RA funding to HBCUs by the Mathematical and Physical Sciences (MPS) and Engineering directorates was influenced by the Partnerships in Research and Education in Materials (PREM) and Engineering Research Centers (ERC) programs, respectively. In addition, HBCUs are often partners in Science and Technology Centers (STCs); however, the distribution of these awards across the directorates fluctuates. Thus, while the panel cannot rule out substantive differences in HBCU funding among the various directorates, such differences would be difficult to ascertain from a five-year analysis.

[3] The Faculty Early Career Development (CAREER) Program is a Foundation-wide program for non-tenured assistant professors.

[4] PREM: Partnerships in Research and Education in Materials, a DMR program in MPS.

[5] The Major Research Instrumentation Program (MRI) serves to increase access to shared scientific and engineering instruments for research and research training.

Figure 2: Relative Funding to HBCUs by Directorate, FY 2010-2014, Normalized to each Directorate's FY 2012 Budget Exclusive of SBIR/STTR Funds.



Note: This graph does not include funding by the Office of the Director or EHR.

Metrics and recommendations for defining success of research-active HBCUs:

For HBCUs:

1. Using information from the NSF-funded survey described below, HBCUs will identify and prioritize factors that may contribute to the relatively low proposal submission rate, e.g., course loads, mentoring, professional development programming, etc., develop plans to address them and metrics to determine success.
2. HBCUs will work with NSF to obtain technical assistance and advice in preparing submissions for CAREER or other single-investigator awards in the R&RA directorates. Institutional submissions should increase to 25% of each new faculty cohort within the next five years.
3. HBCUs that have R&RA funding rates comparable to, or better than, their PWI peers should consider transition to moving to more research-focused Carnegie categories over the next 5 years.
4. HBCUs that have been successful in obtaining R&RA funding should be compelled to develop a set of promising practices and realistic timelines of implementing these practices that would be disseminated to other HBCUs via NSF. This should be required of all funded HBCUs beginning in FY2017.

For NSF:

1. In order to help NSF, the HBCU community, and Congress understand the current landscape of issues at HBCUs and design clear strategies for increasing HBCU competitiveness in the R&RA directorates, NSF will fund a comprehensive survey of HBCUs in order to gain additional information about factors that impact funding success. The Subcommittee and NSF staff will be consulted about the design and content of the survey.
2. NSF will further analyze the issues related to multi-institution versus single investigator awards and explore ways in which to encourage more HBCU applicants for single investigator awards, including CAREER awards. An internal review and report by NSF will be conducted. (See recommendation #2 for HBCUs.)
3. NSF will study the impact of the RIA program within HBCU-UP as it matures in order to understand its role in the success of junior faculty at HBCUs at obtaining funding from the R&RA directorates. NSF will prepare a preliminary report for the public. If an evaluation of the HBCU-UP program is underway or upcoming, it will include a thorough analysis of RIA.

4. Among HBCUs, there are institutions that are more competitive with respect to securing extramural research support than others. However, just as with all institutions, funding rates tend to fluctuate from year to year and additional information is needed to identify any significant trends in both funding rates and funding amounts for both HBCUs as a group and for individual institutions. NSF staff will analyze these data and provide a report.

V. *HBCUs in Transition: Preliminary Findings and Recommendations*

As discussed in the previous section, data provided by the NSF indicate that a small number of HBCUs (approximately 20 out of 100) received 72 percent of the funding from the NSF; these institutions have relatively strong programs in STEM disciplines. Some of them successfully partner with majority institutions to acquire funding (see appendix E). However, there are a number of HBCUs that define themselves as being in transition from a teaching-focused mission to a more research-focused mission. This transitional group of institutions shares some characteristics and issues with the institutions that are more successful in obtaining R&RA funding, but they also have unique challenges. The Subcommittee estimates that there are approximately twenty-five institutions in this transitional category that aspire to submit fundable proposals to the NSF R&RAs but may need some additional capacity in order to be successful.

To obtain information from HBCUs that may impact their pursuit of NSF funding, and to describe the climate in which they reside, the Subcommittee used discovery data obtained by a project funded by the National Science Foundation's Innovation Corps for Learning Program (Award #1519704). A multi-disciplinary team from Jackson State University interviewed 100 faculty, department chairs, deans, and other administrators to determine their interest in offering intensive writing retreats to enhance faculty research productivity. The investigations were designed to determine the likelihood of pursuing scalable sustainability and commercialization of the JSU ADVANCE Summer Writing Retreats, a component of JSU's ADVANCE Institutional Transformation project (Award #1008708). The lessons learned through the I-Corps Discovery Interview process revealed factors that appear to impact the level of support that institutions (especially those transitioning from primarily teaching focused to research focused) are able to provide to its faculty in terms of research development and career advancement. The group conducted interviews to understand key factors that impact faculty research productivity and those that support or hinder the acquisition and pursuit of research funding. Below are some of the observations from the discovery interviews that have informed the Subcommittee for Advancing HBCUs.

Conclusions

Based on the interviews conducted for the I-Corps-L project, the Subcommittee has reached the following preliminary conclusions:

- **Universities/Colleges in Transition:** Faculty and administrators at most HBCUs described their institutions as ones that were in a period of transition -- from teaching-focused into more research-focused institutions. Despite the transition, both faculty and administrators recognized that quite often the resources are not available to provide course releases and post-doctoral fellows, which are so crucial to successful research endeavors. Additionally, most of the Departments were not Ph.D. granting, and many only granted STEM degrees at the bachelor's level. Without graduate students it is difficult to build and sustain a successful research trajectory.

- **New/Junior Faculty Research Ambitions and Expectations:** New faculty at HBCUs in transition recognize that despite 4/4 teaching loads, advising duties, administrative assignments, and limited access to graduate level laboratory assistance and well-equipped laboratories, they are expected to maintain active research agendas--both in terms of publishing and securing external grants. The new hires—many of whom were trained at major research institutions—desire to build their scientific reputations in their chosen field, and they recognize that doing so means securing external funding to advance their research and buying out their time from teaching.

- **Gap in Research Mentorship:** The team learned that the institutions that see themselves as in a period of transition also find themselves in a position that demands attention to faculty development at multiple levels. Development and training are required both for faculty who have earned tenure but whose research and grantsmanship experiences are quite limited and for junior faculty (new hires) who often have more experience in cutting edge research techniques. In a traditional situation, senior faculty would be able to serve as research mentors for new hires to connect them to collaborative networks in the profession and to funding opportunities, but at many institutions the new faculty are more likely to establish research trajectories that lead to funding than their more senior colleagues.

- **Limited Budgets for Faculty Development:** Department chairs acknowledged the potential benefits of providing focused faculty development to increase writing productivity and improve grant development skills; however, they overwhelmingly indicated that they would not be comfortable investing $5,000 for one individual to attend a writing retreat unless the outcome of the retreat was a completed and very competitive grant proposal that was ready for immediate submission. They also indicated that a train-the-trainer approach to grant development would be ideal. Because it would not be financially feasible to send all faculty to a retreat, they would want an added outcome of attendance to be a detailed plan for sharing their grant writing knowledge with their colleagues. From the chair perspective, supporting faculty to attend a grant writing retreat would be using travel funds (typically allocated for professional conferences) and merging it with funds from other sources across campus. (NOTE: Faculty and chairs at some institutions indicated that the cost would not be a problem because they have separate funds allocated for travel and faculty development. Interestingly faculty in law schools and business schools indicated that they would not have a problem spending from their individual or personal funds to pay for a grant development service. Faculty in these disciplines however often have salaries that are significantly higher than those earned by faculty at many HBCUs.)

- **Support for Retention of a Diverse Faculty:** Deans also saw the benefit of using retreats to help ensure the retention and advancement of diverse faculty (especially women in STEM) through mentorship and detailed grant development training. The deans indicated that their offices do have funds for activities such as this, but they preferred bringing trainers to campus in order to reach a larger group of faculty. Faculty members, however, overwhelmingly indicated that they would benefit most from dedicated time and space for writing and brainstorming that is uninterrupted by the demands of being on campus.

- **Need to Develop Resources at the Institutional Level to Support Grantsmanship:** The VPs for Research who were interviewed recognized the importance of support and accountability in grant development. Interviewees from PWIs and those from most HBCUs indicated very different access to support for proposal development. The institutions that are most successful

in securing external grant funding are those with grant writers and grant development officers on staff who identify solicitations and work closely with faculty to develop responses to the solicitations from the beginning until the end of the process. At most, faculty at HBCUs have access to annual grant writing workshops (one or two days) hosted by external consultants who do not provide follow-up interactions. Most HBCUs interviewed did not have resources for grant writers within their Sponsored Programs Unit or Research Office.

- **Gap in Engagement with Funding Agencies:** In terms of grant development needs, it was found that in addition to the basic elements of proposal development, new faculty need support in understanding how to engage with program officers and how to build professional networks within an agency. The team learned that at one major research institution, a part of the new faculty development program includes taking faculty members to Washington to meet the program officers of the agencies that are related to their fields of study. Another component is connecting faculty to elected officials who are on major committees related to their research/discipline. These types of personal interactions are often very powerful in understanding agency procedures and priorities.

- **Gap in Knowledge and/or Potential Bias among Reviewers and Agency Staff Relative to the Depth of HBCU Talent and Resources**: An unexpected lesson learned during the interviews was that faculty from HBCUs—especially those that have not typically been known for their research productivity—may experience less funding success because reviewers might not be as familiar with the institutions' resources. Whereas some schools have scholars who are very well-known in the field, an institution in a period of transition needs to do much more in order to build a case for its ability to carry out a major research project—physical infrastructure, cyber-infrastructure, human resources, etc.

Metrics and recommendations for HBCUs in transition and aspirant institutions:

For HBCUs:

1. HBCUs will continue to strengthen Research & Sponsored Program Offices to help with grant writing and research development support.
2. HBCUs will do an assessment to determine internal impediments faced by their faculty that prevent significant numbers from submitting R&RA proposals. As part of their proposals to the HBCU-UP Research Initiation Awards program, the HBCU will be required to identify the impediments and submit a proposal to address the internal challenges. HBCU-UP RIA should mandate this information as part of the application submission process as well as institute the requirement that applicants include a 10-year plan for transitioning faculty from that funding mechanism to R&RA submissions.
3. To the extent possible, HBCUs will provide resources (human and financial) to junior faculty as they establish their research agendas. The amount of funding dedicated to start-up resources for junior faculty must increase to the 50th percentile of that provided by the average successful HBCU within five years of the release of this report.
4. HBCUs will identify and encourage faculty members to serve as reviewers and rotators at the National Science Foundation in their areas of research.
5. HBUCs will seek out collaborations and partnerships with other HBCUs as well as non-HBCUs through 1) mentor-mentee-like partnerships between research intensive institutions and selected HBCUs and 2) mentor-mentee-like partnerships of HBCUs that have been successful in obtaining NSF R&RA funding with transitional HBCUs. The subcommittee recommends that *all*

HBCUs in the transitional category should seek, at the very least, a collaborative mentorship with another institution that has been successful in obtaining NSF funding.

6. HBCUs will ensure that traditionally underrepresented faculty members in STEM are serving as PIs on multi-institution grants.
7. HBCUs will strongly encourage faculty members to submit not only to programs in the EHR directorate but also to programs in the R&RA directorates. They will work with the R&RA directorates to encourage more submissions from HBCUs and increase the number of submissions from transitional HBCUs.

For NSF**:**

1. Approximately 30 percent of all funded proposals to HBCUs come through the HBCU-UP program. The Subcommittee strongly recommends that funding for this program not be decreased, but at a minimum maintained or increased. The majority of the HBCUs do not currently have the capacity (as described above) to obtain significant R&RA funding. It is therefore critical that NSF maintain funding to the HBCU-UP program as they build institutional capacity for research. The committee estimates that it takes up to 20 years for an institution to achieve the capacity to become competitive in the R&RAs. Sustained external funding sources are key to this type of transition.
2. NSF will continue to educate panels and program staff (in both EHR and the R&RA directorates) about issues such as implicit bias.
3. NSF will explore additional mechanisms through which program staff can interact with faculty at HBCUs who are starting research careers. NSF will ensure that outreach to HBCUs through in-person sessions, webinars, etc. continues, especially in the R&RA directorates. Successful programs will be studied and replicated, if feasible.
4. NSF will explore ways to make programs that focus on broadening participation in both the R&RAs and EHR more widely known in the HBCU community. In addition, since 50 percent of HBCUs are in EPSCoR states, NSF will work to foster increased interactions between the NSF EPSCoR office and HBCUs. NSF will hold internal meetings among the R&RA directorates, successful programs such as HBCU-UP in EHR, and the NSF EPSCoR staff to explore options for better collaboration. These meetings will be held and a plan developed during fiscal year 2016.
5. NSF will make available to all HBCUs a list of successful institutions with which to form a collaborative mentorship. As a means to this end, NSF should require all funded institutions to serve as a mentor to another institution as part of its broadening participation initiative.
6. NSF will require collaborative mentors for HBCUs to help their HBCU develop the plan and infrastructure required to transition HBCU UP RIA faculty to "mainstream" R&RA funding mechanisms.
7. Within five years of the release of this report, the NSF will provide assistance in helping HBCUs identify mechanisms to diversify their revenue streams so that the HBCUs are able to increase start-up packages for junior faculty.

VI: Other HBCUs: Observations and Recommendations

Many HBCUs, especially community colleges and baccalaureate institutions, have missions that may not lead them to seek research funding from NSF's R&RA directorates. However, they may have strong STEM programs that could, and do, benefit from partnerships with more research-active HBCUs and primarily white institutions (PWIs); these partnerships aid both faculty and students by providing research experiences and access to resources such as equipment and expertise. In addition, these institutions can benefit from NSF programs that focus on broadening participation developing the STEM

pipeline for underrepresented minorities (e.g., the Louis Stokes Alliances for Minority Participation – LSAMP), supporting a specific sector such as community colleges (e.g., the Advanced Technological Education program), and providing research experiences for undergraduates. The participation of non-research-active institutions in such NSF-funded programs benefits both the individuals and institutions involved while also helping to develop the diverse workforce necessary to enhance America's economic competitiveness. These institutions, in particular, should use the funding mechanisms provided by HBCU-UP to strengthen STEM education and research programs. The National Academy of Sciences report *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads* (2010) states that providing resources through HBCU-UP to strengthen the institutional STEM infrastructure at HBCUs has resulted in producing students who enter STEM graduate programs and the workforce at a greater rate than institutions of higher education nationally.

Metrics and recommendations for other HBCUs

For HBCUs:

1. HBCUs should work with NSF to identify centers near HBCUs that could involve the HBCUs in their education and outreach activities. All NSF centers and large facilities (e.g., Engineering Research Centers, Science and Technology Centers, Materials Research Science and Engineering Centers, Physics Frontier Centers, Centers of Research Excellence in Science and Technology. Laser Interferometer Gravitational Wave-Observatory (LIGO), Arecibo Observatory and others) have required education and outreach components. These activities provide opportunities for both faculty and students at all levels to become involved in cutting edge research.
2. Beginning in FY2017, HBCUs that are transitioning to becoming more research-active and are applying to EHR programs to support that effort should include as part of the application process 10-year development plans to 1) prepare their faculty to become more research-active and 2) build a research-support infrastructure within their institution.

Recommendations for NSF:

1. NSF will continue to fund HBCU-UP and other EHR programs that support HBCUs.
2. NSF will expand outreach activities to the non-research HBCUs.
3. Beginning in FY2017, NSF will supply technical support to assist HBCUs in developing faculty and institutional research support programs.
4. More than 50 institutions do not traditionally submit research-based proposals for NSF opportunities. Encourage HBCU non-applicants to consider more joint proposals with the successful HBCUs in a mentor-protégé partnership.

VII: Feedback from Selected HBCUs

Nine colleges and universities were selected to review the draft report and provide comments. The nine were selected with a deliberate intent to provide a cross section of institutions across the spectrum of NSF funding history (traditionally high funding, aspiring, and little or no funding), and to achieve geographical dispersion. The institutions invited to comment on the report were Claflin University, Coppin State University, Fisk University, Southern University and A&M College, Spelman College, Talladega College, Texas College, University of the Virgin Islands, and Virginia State University. Claflin University, Coppin State University, and Southern University and A&M College responded. The comments and recommendations received generally aligned with the Subcommittee's findings and recommendations.

VIII: Conclusions

The Subcommittee was charged by the Director of NSF, Dr. France Córdova, with researching and analyzing several key areas:

- What are optimal strategies that the HBCU community might undertake to increase the competitiveness of HBCUs and HBCU faculty with NSF R&RA [Research and Related Activities] directorates? What kind of institutional commitments and institutional change would be necessary to begin that shift? How can NSF be involved in achieving this change? Please include metrics that would define success. For example, are some HBCUs poised to move to Carnegie RU/VH and RU/H classification?
- Examine particular research programs within the R&RA directorates in which HBCU faculty have been most competitive and identify common characteristics across these programs that might be responsible for this success.
- There are many science and engineering faculty members in HBCUs who have been successful in obtaining NSF R&RA funding. Determine any factors that have been key to their success.
- Several HBCUs have been successful in obtaining funding through R&RA directorates, both directly and through partnerships with other institutions. Are there characteristic of these HBCUs or these partnerships that have made them more competitive for NSF R&RA funding?

The Subcommittee believes that it has been largely successful in responding to these questions within a relatively short time span. However, as is indicated in this report, there is considerable work to be done before definitive answers are available. The Subcommittee's thorough data analysis of funding propensities provides a solid foundation upon which to build deeper analyses. However, the Subcommittee did not have enough time to truly assess the traits and characteristics of the faculties and cultures at institutions that consistently garner NSF R&RA funding. To completely address the charge, this level of assessment must be completed. Questions to be addressed include, but are not limited to, the following. Why don't HBCUs submit more single-investigator awards? What can be done at both the NSF and at HBCUs to mitigate the challenges associated with submitting proposals? The Subcommittee strongly recommends that NSF fund a study of the current challenges and opportunities at HBCUs so that both the Foundation and the HBCU community will have a clearer sense of the range of the issues facing HBCUs that hope to become more competitive for R&RA funding. While many of the recommendations and milestones included in this report can be undertaken before the survey is completed and analyzed, the information to be gleaned from the survey will be invaluable in developing substantive policies and practices at both HBCUs and NSF. The data indicate that the number of HBCU submissions to some EHR programs is low. The Subcommittee strongly recommends that the NSF determines why this is the case and develop methods to address the identified obstacles

Acknowledgements

The Subcommittee would like to thank the Senate for posing the questions and to the NSF for responding so quickly to their request for information. We appreciate the HBCUs who agreed to vet the report and to those who provided suggestions. We acknowledge the JSU I-Corps Team consisting of Loretta A. Moore, Vice President for Research and Federal Relations (Principal Investigator), Deidre L. Wheaton, Assistant Professor of Interdisciplinary Studies (Entrepreneurial Lead), and Ramin C. Maysami, Dean of the College of Business (Mentor) for allowing us to include their HBCU survey findings about factors needed to better support faculty who desire to be more research active.

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The Subcommittee undertook the effort to generate this report independently. The opinions, findings, and conclusions or recommendations expressed in this report are those of the Subcommittee and do not necessarily reflect the views of the Advisory Committee to the Education and Human Resources Directorate or the National Science Foundation.

Appendix A: List of Acronyms

A&M	Agricultural & Mechanical
A&T	Agricultural & Technical
APLU	Association of Public and Land-grant Universities
ATE	Advanced Technological Education
CAREER	Faculty Early Career Development Program
DGE	Division of Graduate Education
DRL	Division of Research on Learning in Formal and Informal Settings
DMR	Division of Materials Research
EHR	Education and Human Resources
ERC	Engineering Research Centers
HBCU	Historically Black College or University
HBCU-UP	HBCU – Undergraduate Program
HRD	Human Resources Development
I-Corps L	I-Corps for Learning
IHE	Institution of Higher Education
LSAMP	Louis Stokes Alliances for Minority Participation
MPS	Mathematical and Physical Sciences
MRI	Major Research Instrumentation
NCES	National Center for Education Statistics
NCSES	National Center for Science and Engineering Statistics
NSF	National Science Foundation
PREM	Partnerships in Research and Education in Materials
PWI	Predominantly White Institution
R&RA	Research and Related Activities
REU	Research Experiences for Undergraduates
RIA	Research Initiation Award
RU/VH	Research University Very High Research Activity
RU/H	Research University High Research Activity
SBIR	Small Business Innovation research
STTR	Small Business Technology Transfer Research
STC	Science and Technology Center
STEM	Science, Technology, Engineering and Mathematics

Appendix B: HBCU Subcommittee Biographies

Chair

Tuajuanda Jordan
President, St. Mary's College of Maryland

Tuajuanda C. Jordan is the seventh president of St. Mary's College of Maryland. Prior to St. Mary's College, Jordan served as dean of the College of Arts and Sciences and professor of chemistry at Lewis & Clark College in Portland, OR. From 2005 to 2011, Jordan was the director of the Science Education Alliance (SEA) of the Howard Hughes Medical Institute.

Subcommittee Members

Sandra DeLoatch
Provost and Vice President for Academic Affairs, Norfolk State University

Dr. Sandra Deloatch was the founder of the university's Computer Science Program and the first Computer Science Department Chairperson. Over her 30 year career she has worked as a Chair and Dean and worked to improve undergraduate and graduate education. She has developed and implemented NSF HBCU-UP and ADVANCE awards.

Wayne Frederick
President, Howard University

Dr. Frederick began his academic career as Associate Director of the Cancer Center at University of Connecticut, where he also served on the Department of Surgery faculty. In June 2014, Congress recognized him for his contributions in addressing health disparities among African-Americans and historically underrepresented groups. Dr. Frederick's research and examination of the unconscious bias in academic medicine has been presented to national and international audiences.

José Goity
Interim Physics Department Chair, Professor,
Hampton University and Jefferson Lab

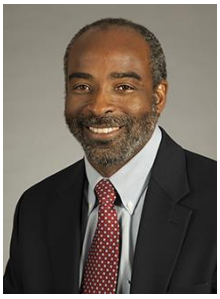
Dr. Goity is a theoretical Particle Physicist. He received his Ph.D. from the University of Munich in 1985 and became an Assistant Professor in Physics at Hampton University and CEBAF staff scientist in 1993. Dr. Goity served in the Jefferson Lab Users Group Board of Directors (appointed from June 2013 to June 2015). He is the author of 88 publications on theoretical particle physics.

Keith Hargrove
Dean of the College of Engineering, Tennessee State University

Dr. Hargrove formerly served as a Department Chair at Morgan State University, and Associate Professor of Mechanical Engineering at Tuskegee University. He has worked at General Electric, Boeing, GM, and three national research laboratories (Oak Ridge, Battelle, and NIST). He is actively engaged in K12 education, has research interests in advanced manufacturing, and a member of the Society of Manufacturing Engineers, Tennessee Society of Professional Engineers, and ASEE.

Melissa Hines
Director, Cornell Center for Materials Research, Cornell University

Dr. Hines is the Director of the Cornell Center for Materials Research, a NSF-funded Materials Research Science and Engineering Center (MRSEC) and previously served as the Director for the Nanoscale Control of Surface and Interfaces IGERT. Hines has received many awards and honors including the NSF CAREER Award and the Arthur Adamson Award for Surface Chemistry. She is currently active on the Charles E. Kaufman Foundation Scientific Advisory Board and has multiple publications.



Everette Joseph
Professor of Atmospheric Science, University of Albany

Dr. Joseph is the Director of the Atmospheric Sciences Research Center at the University of Albany. From 2008-2013, he served as director of the Howard University Program in Atmospheric Sciences (HUPAS), Washington, D.C. HUPAS significantly increased the number of minority Ph.D. graduates in the atmospheric sciences nationally over the past 10 years. He presently serves on the Board of Trustees of the University Corporation for Atmospheric Research.

Loretta Moore
Vice President of Research and Federal Relations, Jackson State University

Loretta A. Moore serves as Vice President for Research and Federal Relations and Professor of Computer Science at Jackson State University (JSU). She has led many NSF EHR grants focusing on enhancing STEM curriculum and building research experiences at the undergraduate level. She previously chaired the Department of Computer Science at Jackson State.

Jagannathan Sankar
Distinguished University Professor, North Carolina A&T State University

Dr. Sankar is Director of the NSF –ERC for Revolutionizing Metallic Biomaterials (RMB) and Center for Advanced Materials and Smart Structures (CAMSS). ERC-RMB conducts transformational and revolutionary biodegradable implant technologies and CAMSS encompasses various advanced materials, nanoscience and nanoengineering centers. In addition to numerous awards and recognitions, Sankar has given more than 25 Plenary/Keynote addresses in major meetings related to future directions in transformational materials/nano/bio research, education, innovation, economic impact and growth and next generation workforce development.

George C. Wright
President, Prairie View A&M University

Prior to joining the Prairie View A&M University family, Wright was Executive Vice-President for academic affairs and provost at the University of Texas at Arlington. In 1993, he joined the faculty at Duke University as vice provost for university programs and director of the Afro-American studies program at Duke University. From 1980 to 1993, he served as an assistant professor, associate professor, professor and vice provost at the University of Texas at Austin.

Ex Officio Members

Meldon Hollis
Associate Director, White House Initiative on HBCUs

Dr. Hollis background is in Political Science. Prior to the White House Initiative, he was at the Federal Emergency Management Agency (FEMA) where he had worked since September 2005. At FEMA, he served in various positions, including Coordinator for Intergovernmental Affairs in the External Affairs Division, Program Officer in the Individual Assistance Division and Program Officer in the Policy and Procedures Branch of the Public Assistance Division.

Lee Todd
Chair, Advisory Board for the National Science Foundation's
Directorate for Education and Human Resources Committee
President Emeritus, University of Kentucky

Dr. Todd was President of the University of Kentucky from 2001- 2011, after serving as senior vice president of IBM's Lotus Development Corp. Todd also co-founded the Kentucky Science and Technology Corporation in 1987, a not-for-profit organization focused on increasing university research capacity, developing science and technology education (K-12) programs, and encouraging an entrepreneurial economy in Kentucky. He served as Chairman of KSTC until 2001. He served as Chairman of the EPSCoR board for over 10 years.

Appendix C: Charge to: Advancing Historically Black Colleges and Universities Subcommittee of the Advisory Committee of the Directorate for Education and Human Resources

Historically Black Colleges and Universities (HBCUs) play a critical role in the nation's science, technology, engineering, and mathematics (STEM) research and education infrastructure and in the mission of the National Science Foundation (NSF). The achievements of faculty, students, administrators, and staff at HBCUs bring distinction to both the African-American community and the nation as a whole. As well as contributing directly to the nation's scientific research endeavors, HBCUs as institutions are positioned to provide meaningful research experiences to undergraduate and graduate students from groups underrepresented in STEM. Many HBCUs are particularly strong in terms of producing African American baccalaureate graduates in physics, engineering and computer science who go on to complete PhDs in those fields where the underrepresentation is even more pronounced.

The National Science Foundation (NSF) recognizes the importance of the HBCUs to the Nation's STEM enterprise, and has specific programs designed to build infrastructure and capacity at HBCUs. These NSF programs are located primarily within the Education and Human Resources Directorate. The majority of the NSF support for HBCUs is in the education and training category. However, the majority of scientific research support for most institutions (non-HBCUs) comes from the Research and Related Activities (R&RA) Directorates.

This subcommittee will consider the existing NSF funding landscape and provide recommendations for increasing the level of competitiveness of HBCUs, as institutions as well as for faculty members from HBCUs, within the NSF R&RA Directorates.

Charge: This subcommittee is charged to consider and provide responses to the following:

- What are optimal strategies that the HBCU community might undertake to increase the competitiveness of HBCUs and HBCU faculty within NSF R&RA directorates? What kind of institutional commitments and institutional change would be necessary to begin that shift? How can NSF be involved in achieving this change? Please include metrics that would define success. For example, are some HBCUs poised to move to Carnegie RU/VH and RU/H classifications?
- Examine particular research programs within the R&RA directorates in which HBCU faculty have been most competitive and identify common characteristics across these programs that might be responsible for this success.
- There are many science and engineering faculty members in HBCUs who have been successful in obtaining NSF R&RA funding. Determine any factors that have been key to their success.
- Several HBCUs have been successful in obtaining funding through R&RA directorates, both directly and through partnerships with other institutions. Are there characteristics of these HBCUs or these partnerships that have made them more competitive for NSF R&RA funding?

Background information: NSF staff are developing data and summary information to inform this discussion and to be available to the subcommittee. NSF data and information about the following are being assembled:

- Number of HBCU proposals submitted to and awards issued by NSF Directorate/Division by program for the past five years. This will include HBCU involvement in EPSCoR programs and large centers such as STCs and ERCs.
- Number of HBCU proposals submitted to NSF and awards issued by institution and institution type.
- Number of proposals submitted to and awards issued by NSF program from a comparison group of similar, non-HBCU institutions.
- Success of HBCU-UP and CREST HBCU awardee institutions in other R&RA programs.
- Number of HBCU-based reviewers and panelists by directorate /division/ program.
- Information on outreach efforts across the NSF Divisions aimed at or including HBCUs.
- Special NSF funding opportunities that are available to HBCUs, in particular those listed as programs focused on broadening participation.

Timeline: The subcommittee is planning to conduct a one-hour teleconference on Friday, May 1st, 2:00 pm – 3:00 pm (EDT) to discuss the charge and introduce the members of the subcommittee. One or two in-person meetings at the National Science Foundation are planned at a later time between May and June 2015, with a final report due in August 2015.

Appendix D: List of HBCUs in Section IV and their Peer Institutions

HBCU Institution	Peer 1 Institution	Peer 2 Institution	Peer 3 Institution
Alabama A&M University (Huntsville, AL)	Arkansas State University - Main Campus (Jonesboro, AK)	Eastern Michigan University (Ypsilanti, MI)	University of West Alabama (Livingston, AL)
Hampton University (Hampton, VA)	Salve Regina University (Newport, RI)	Antioch University Seattle (Seattle, WA)	College of William & Mary (Williamsburg, VA)
Howard University (Washington, DC)	Loyola University Chicago (Chicago, IL)	St. Louis University-Main Campus (St. Louis, MO)	Georgetown University (Washington, DC)
Jackson State University (Jackson, MS)	University of New Orleans (New Orleans, LA)	Louisiana Tech University (Ruston, LA)	Mississippi State University (Starkville, MS)
North Carolina A&T St University (Greensboro, NC)	Morgan State University (Baltimore, MD)	Indiana State University (Terre Haute, IN)	University of Maryland – Baltimore County (Baltimore County, MD)
Prairie View A&M University (Prairie View, TX)	Montclair State University(Montclair, NJ)	Penn State University - Harrisburg (Middletown, PA)	University of Houston – Clear Lake (Houston, TX)
Southern University and A&M College (Baton Rouge, LA)	Texas State University – (San Marcos, TX)	Towson University (Towson, MD)	University of New Orleans (New Orleans, LA)
Tennessee State University (Nashville, TN)	Texas A&M University - Kingsville (Kingsville, TX)	East Tennessee State University (Johnson City, TN)	Tennessee Tech in Cookeville (Cookeville, TN)
Tuskegee University (Tuskegee, AL)	Louisiana College (Pineville, LA)	Wheeling Jesuit University (Wheeling, WV)	University of Richmond (Richmond, VA)

Appendix E: HBCUs partnering with Science & Technology Centers and Engineering Research Centers

Science & Technology Center partnering with an HBCU

- 4 out of 14 OR 28.6% partner with an HBCU. These are as follows with the HBCU in () and bolded:

I. A Center for Brains, Minds, and Machines: the Science and Technology Intelligence (**Howard**)
II. Center for Integrated Quantum Materials (**Howard**)
III. BEACON: An NSF Center for the Study of Evolution in Action (**NC A&T State U**)
IV. Center for Science of Information (**Howard**)

Engineering Research Centers partnering with an HBCU

- 4 out of 18 OR 22.2% partner with an HBCU. These ERCs are as follows with the HBCU in () and bolded:

I. ERC for Revolutionizing Metallic Biomaterials (**NC A&T State U**)
 NC A&T State U is the Lead Institution
II. ERC for Ultra-wide Area Resilient Electric Energy Transmission Networks (**Tuskegee U**)
III. ERC for Integrated Access Networks (**Tuskegee U**)
IV. ERC for Power Optimization for Electro-Thermal Systems (**Howard U**)

Appendix F: Additional Data Analysis

An analysis based on data provided by the NSF to this subcommittee [1] and data published in the National Center for Science and Engineering Statistics (NCSES) (December 2014) titled "Federal FY 2012 S&E Obligations to Academic and Nonprofit Institutions: Focus on Minority-Serving Institutions", provides several significant measures which compare the funding of HBCUs with other IHEs. The ones listed below are global comparisons, that is, compare all HBCUs with all IHEs. More specific measures, such as the comparison with peer institutions have been discussed elsewhere in this report. The global comparisons are deemed important, as they provide the rate of research activity per HBCU with respect to IHE, and also serve as a benchmark for individual HBCUs to compare with.
The comparisons are as follows:

Federal obligations (Reference: NCSES report) and NSF funding (NSF provided data)

a1) Federal funding HBCUs/Total=1.3% (source: average from 2009 to 2012 from data in NCSES report), i.e. 1.3% of total federal funding goes to HBCUs
a2) NSF funding HBCUs/Total=1.8% (source: average from 2010 to 2013 from data provided by NSF)
b1) Mean federal funding per institution: HBCU/IHE=15.5% (source: idem a1), i.e. on average HBCUs receive per institution 15.5% of what on average IEHs receive per institution.
b2) Mean NSF funding per institution: HBCU/IHE=22% (source: idem a2)
c1) NSF HBCU award numbers: EHR - 0.9 awards per HBCU per year (source: idem a2)
RRA - 0.8 awards per HBCU per year (source: idem a2)
c2) NSF IHE award numbers: EHR - 0.6 awards per IHE per year (source: idem a2)
RRA - 8 awards per IHE per year (source: idem a2)
d1) HBCUs submit to NSF 1% of all RRA proposals (source: idem a2)
d2) HBCUs submit to NSF 6 to 7 % of all EHR proposals (source: idem a2)
e1) HBCUs rate of success of submitted proposals: EHR: 22.2%, RRA: 13.2%
e2) IHE rate of success of submitted proposals: EHR:18.7%, RRA: 23%

The global comparison leads to the following conclusions:
a) The NSF funds HBCUs as compared with other institutions at a rate which is significantly higher than all the rest of the federal funding: 1.8% vs 1.3% (a1 and a2 above).
b) HBCUs are funded at a much smaller rate than IHEs. An average per institution shows that HBCUs receive 15.5% (Federal) vs 22% (NSF) of what IHE receive (b1 and b2 above). This can be considered as a measure of the average research activity per HBCU versus IHE. Presently that measure is at or below 20%.
c) The number of awards per HBCU per year made by the NSF are 0.9 in EHR and 0.8 in RRA (c1 above), while the same per IHE are 0.6 and 8 respectively (c2 above). The conclusion is that HBCUs are funded by EHR at a higher rate than IHEs (0.9 vs 0.6), and at a much smaller rate by RRA (0.8 vs 8). The latter is a rather dramatic difference, which has been discussed elsewhere in this report.
d) From d1) and d2) above, it is also deduced that HBCU proposals are in proportion submitted more to the EHR than the RRA directorates.
e) A measure of the success of proposals submitted to the NSF is the rate by which proposals succeed. From (e1 and e2 above) it is observed that in the EHR directorate HBCU proposals perform better than IHE proposals by an approximate ratio of 22 to 19, i.e. a slight difference that may be insignificant, while those proposals submitted to the RRA directorates are less successful with the corresponding ratio being 13 to 23.

[1] Data provided by NSF to this subcommittee:
Report on FY 2014 Funding to Minority Serving Institutions (Report to Congress).
Report to the National Science Board on the National Science Foundation's Merit Review Process Fiscal Year 2014.
Report on HBCU Funding Rate for Competitive Proposals, FY 2010-2014
Report on IHEs and HBCUs Award and Proposal Count by Directorate and Division1 (Competitive IHE proposals with decision made during the year) 2010 - 2014
Report on Select HBCUs and Comparable Institutions Funding by RRA and EHR 2010 – 2014

Appendix G: NSF Staff Support

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