

**NSF ADVANCE Proposal**  
**University of Virginia**  
**November 2011**

Edited slightly for clarity.

## **INTRODUCTION**

Our proposal is built on the premise that ensuring the full participation of women faculty in science, technology, engineering and math (STEM) at all levels of the University of Virginia—in leadership roles, in interdisciplinary and global research and teaching ventures, and visibly, in the built and symbolic spaces that define us as an institution—will enhance the overall research and educational mission of the University. U.Va. ADVANCE will be a multifaceted endeavor touching many aspects of our University. It will require vision, pragmatic and effective programs and activities, attention to both quantitative data and qualitative experiences, and strategically distributed resources. It will need to encourage creative problem solving and address multifaceted cultural issues and competing priorities, for which there are no immediate solutions, but that will require the community as a whole to commit to open dialogue about how we can become a model of new educational strategies and a source of visionary, public-spirited leaders, both female and male, for the twenty-first century.

### **Institutional Background**

The University of Virginia, founded by Thomas Jefferson in 1819, is the flagship public university in the Commonwealth of Virginia. *US News and World Report* (USNWR) ranked U.Va. second among U.S. public universities (tied with UCLA) in its 2012 rankings (USNWR, 2011a), and 25<sup>th</sup> among all public and private universities (USNWR, 2011b). U.Va.'s overall graduation rate places it highest among top-ranked public institutions; it has also maintained the highest graduation rate for African American students of any state-chartered institution in the nation for nearly two decades (*Journal of Blacks in Higher Education*, 2011).

The School of Engineering and Applied Science (SEAS), established in 1836, is the oldest university school of engineering in the US. SEAS offers the following majors: aerospace engineering, biomedical engineering, chemical engineering, civil engineering, computer engineering, computer science, electrical engineering, engineering science, environmental engineering, mechanical engineering, and systems and information engineering. U.Va.'s School of Arts and Sciences (A&S) is the largest of its 11 schools, with more than 10,000 undergraduate and 1,500 graduate students.

### **Strategic Planning and Faculty Diversity**

In 2007, the University of Virginia embarked on an intentional transformation process. The Commission on the Future of the University prioritized six initiatives to distinguish U.Va. and serve as a blueprint for its strategic plan. Among them were (a) the recruitment and retention of a more diverse faculty; (b) strong, university-wide emphasis on interdisciplinary collaborations; and (c) improved research capacity in the sciences and engineering. The commission outlined concrete recommendations for achieving these aims, and in the fall of 2008 those recommendations were adopted as University mandates for the next decade and beyond. By the time the strategic plan was broadly disseminated, the University had already begun to experience a hiring renaissance, with significant overall increases in the number of African American, Hispanic/Latino and Asian/Asian American faculty, and White women, faculty hired (Fraser and Hunt, 2011). Institutional studies of faculty age structure and enrollment growth forecasted that over the next 10 years, approximately 600 new faculty hires would be necessary, many of these in the sciences. The anticipated infusion of new talent was broadly endorsed as a golden opportunity not only to create “new and highly innovative programs at the intersection of traditional disciplines” but to increase the gender, racial, and ethnic diversity of the faculty at an accelerated pace.

The assumption of economic growth was due in part to an initially successful endowment campaign and a restructured agreement with the state to allow greater institutional autonomy. The renewed focus on inclusion and diversity stemmed from recommendations by an institution-wide diversity commission endorsed by the Board of Visitors and the former university president. Advocates for diversity expressed optimism that many more underrepresented minority (URM, which includes African American, American Indian, Asian, and Hispanic/Latino) scholars would join the University faculty. The convergence of these factors fostered the sense that everyone could benefit from infusions of new funding for faculty, interdisciplinary scholarship, and science and engineering research ventures. Furthermore, in faculty town hall meetings, talk about the strategic plan struck a good balance between maintaining traditional strengths and values (e.g., the humanities, teaching excellence, and Jeffersonian ideals) and undertaking bold initiatives.

This sense of a boundless future and forward momentum stalled in 2009 with the dramatic reversals in the global economy. As a cost-saving measure, the University instituted a hiring slowdown in 2009, which prohibited departments from hiring even previously approved faculty lines. Salaries were not cut, but there were no raises for three years. There were no staff layoffs or firings, however, and retrenchment in academic programs was limited so as to sustain the highest quality undergraduate experience. The university also reserved additional central funds for faculty career and leadership development programs and interdisciplinary ventures between STEM disciplines, the humanities, and the professional schools (Medicine, Law, and the Graduate School of Business). Believing that the fiscal crisis made a robust array of faculty development resources even more critical, the University sought to nurture and support faculty in their professional growth and to sustain their sense of commitment to U.Va. As was the case for many public universities, however, the opportunity to launch a significant demographic transition among faculty would have to be deferred.

### **Convergence: New Leadership and Political Mandates**

There is now central leadership with a strong orientation to investment in STEM research who champion the faculty's importance to the overall excellence of the academic enterprise and the strategic importance of faculty diversity. They also bring a fresh perspective on the institution's established traditions and culture.

Against the backdrop of the economic downturn, the University underwent a dramatic transition in senior leadership: after a long period of male leadership at the central and school levels—and counter to the tradition of internally selected academic leaders—the University conducted national searches for deans in 8 of its 11 schools. Of those offered appointments, three were women, including the new dean of the School of Arts and Sciences: In 2008, Korean-born Meredith Jung-En Woo became the first female dean in the school's 187 year history. Two years later, Teresa Sullivan, former provost of the University of Michigan, became U.Va.'s first female president. In a recent public address, Sullivan highlighted the convergence of interdisciplinary scholarship, inclusion, and innovation: "In addition to being engines of innovation," she said, "universities [must] ... foster a tolerant culture that is open to new ideas and diverse perspectives."

President Sullivan recently named John Simon as U.Va.'s new Executive Vice President and Provost and charged him with two primary tasks: promoting interdisciplinary and innovative approaches to education and research, and fostering diversity among faculty, students, and staff. During his first month at U.Va. Simon created a new performance review document for deans that accounted for inclusion and equity metrics. The provost will undertake a full review of university promotion and tenure policies and procedures over the next two years. This review-and-oversight framework is a strong indication that U.Va. ADVANCE initiatives will be incorporated into institutional policies and procedures.

### **STEM Education as a State Priority**

In response to the governor's request to award 100,000 more degrees throughout the state over the next 15 years, the U.Va. Board of Visitors approved an increase of 1,400 in overall enrollment by

2014-2015, and specified that one third will be new STEM students. What this means is that a resurgence in faculty hiring—especially in STEM fields—is now mandatory. During the course of the ADVANCE initiatives at the University, approximately 100 new STEM hires are projected. Public universities like ours have experienced overall reduction in public funds, but will be expected to meet targeted enrollment goals. In light of these conflicting commitments of the broad need for increasing STEM capacity and fewer overall funds for higher education, one of our most critical priorities will be to keep the focus on STEM faculty diversity as we hire new faculty.

**Institutional Data**

Today at U.Va. 33.8% of all teaching and research faculty (both tenured/tenure track [TTT] and nontenure-track) are women. Our overall faculty sex-ratio is just over critical mass (if we use the 30% level suggested by Frehill and Jeser-Cannavale 2004). Promotion and tenure data for the last decade show no significant differences in promotion and retention rates between men and women.

In STEM fields<sup>1</sup> the underrepresentation of women is the starkest. Only 13.7% of the TTT faculty (and 11.9% of the nontenure-track faculty) in STEM is female —42 women (14 tenure-track, 28 tenured) spread across 15 departments (Table 1). The data documents the near invisibility—or absence, in the case of African American women scientists—of URM women in STEM at U.Va. There are only 8 URM women (6 Asian, 2 Latina) STEM teaching and research faculty; the university’s demographic progress in STEM has primarily accrued to White women. Departmental level data in Table 1 show that 6 departments (Physics, Chemistry, Biology and Mathematics in A&S and Civil and Environmental Engineering and Mechanical and Aerospace Engineering in SEAS) approach or exceed national statistics

**Table 1: Number and Percentage of Women in STEM by Department**

Department	Number of Women	Women as a % of Total	% Women in Top 50 depts. <sup>2</sup>
Biomedical Engineering	0	0.0%	
Astronomy	1	7.1%	15.8
Physics	3	8.8%	9.1
Computer Science	2	9.1%	13.2
Chemical Engineering	1	10.0%	12.6
Materials Sciences & Engineering	2	10.5%	
Economics	3	10.7%	16.3
Chemistry	3	13.0%	13.7
Electrical & Computer Engineering	3	13.6%	9.5
Systems and Information Engineering	2	14.3%	
Mechanical and Aerospace Engineering	3	16.7%	8.8
Mathematics	4	16.7%	12.9
Environmental Sciences	4	18.2%	
Biology	6	19.4%	24.4
Civil & Environment Engineering	3	25.0%	13.0

<sup>1</sup> Specifically, the following fields: Astronomy, Biology (& two associated centers), Biomedical Engineering (only in the engineering school), Chemical Engineering, Chemistry, Civil and Environment Engineering, Computer Science, Economics, Electrical and Computer Engineering, Environmental Sciences, Materials Science and Engineering, Mathematics, Mechanical and Aerospace Engineering, Physics, Statistics, and Systems and Information Engineering.

PLEASE NOTE: the National Science Foundation does not grant funding for departments in medical schools. All figures used in this proposal were developed using the specific departments indicated above. We hope that the efforts of the U.Va. ADVANCE program will have a broad, positive impact on all faculty.

<sup>2</sup> Nelson 2007

Statistics	2	28.6%	
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for percent of women on the faculty. Sex-ratio analysis show 10 departments between 0-17% which fall into Kanter’s definition of “female tokens”; 4 in the above 18% range or the “female minority” category and none with a balanced sex ratio (36-64%) (Rosser and Chameau 2007). Another way to describe the faculty is by the rank structure: 92% of professorial rank STEM faculty are men compared to 8% women; at the associate rank, 80% are men and 20% women and at the assistant professor level, 76% are men and 24% women.

How do women experience these structural inequalities? In focus groups that involved more than half of the total STEM women faculty at U.Va., common themes emerged: a) being isolated; b) having “time allocation mismatches” (Winslow 2010; Sheridan et.al. 2006) between research and teaching; even with an equal teaching load with men, women say they spend less time than preferred on research; c) facing an “old-guard attitude” that implies they should feel “lucky to have a position at U.Va.”; d) lacking recognition in home departments and e) observing that men had many more privileges (even when they were not as professionally successful). In summary, these data suggest that women in STEM viewed departments or schools as places of male privilege. These themes also surfaced in survey data (COACHE 2010a; COACHE 2010b; U.Va. Faculty Senate 2007). Furthermore, White women remarked on the absence of URM colleagues in their departments. Among the positive statements: women said they were able to be professionally successful, enjoyed their students, loved their science, found opportunities to advocate for change and admired chairs who created an inclusive, supportive departments.

U.Va. STEM women’s negative experiences of departmental culture and their perceptions of unfairness mirror the reports from previous ADVANCE Institutional Transformation (IT) projects as well as the findings from a recent study which found that women faculty in academic science and engineering gave lower ratings than men on departmental fairness and inclusion measures (Fox 2010). Women are resilient and they may find ways to manage the negative social environments; however, there is a cost to that strategy: it is apparent that even in departments with higher numbers of women, the calculus of change demands a cultural shift to transform the everyday assumptions of male privilege. Success will depend on engaging STEM men to achieve the experience of what organizational theorist and U.Va. professor Martin Davidson describes as “inclusion in the collective” (Davidson 1999; 2011).

### Hiring

Over the past decade, U.Va. has steadily increased both the number and percentage of women and underrepresented minorities in TTT faculty positions (Figure 1). Among our Association of American Universities (AAU) peers, we went from being in the 47<sup>th</sup> percentile in 2003 for the number of African

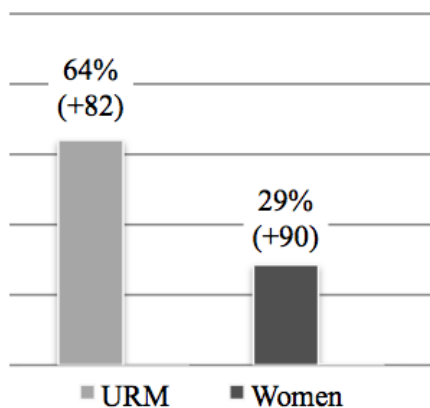


Figure 1: Percent Change, Full-Time Tenured and Tenure-Track Women U.Va. Faculty, and Underrepresented Minority (URM) Faculty, 2000-2010.

Americans to being in the 83<sup>rd</sup> percentile by 2009. This means that in 2003 fully 53% of our AAU peers had a larger percentage of African American Faculty. In 2009 only 17% of our AAU peers had a larger percentage of African American faculty. Among Asian Americans, Hispanic/Latinos and women, from 2003-2009 our percentile rank among our AAU peers went up slightly. This overall increase has been the result of intentional interventions by many stakeholders and organizational catalysts to improve recruitment and selection practices, working from within formal structures and at the margins (Fraser and Hunt 2011; Sturm 2007). Bridge funding for strategic hires and provision of dual career support have been key factors to the successful recruitment of faculty.

Why hasn’t U.Va. made more progress in hiring STEM women? We have only recently been able to effectively track data on applicant pools for open positions. According to recent

data from U.Va.'s Office of Equal Opportunity Programs (EOP), over the past year women applicants for STEM positions were underrepresented as compared to their male peers. For example, for positions at the assistant professor level in the biological and physical sciences, in which EOP estimated a female availability pool of 32%, only 20% of the applicants were women. Over the past ten years (FY00-FY10), 20% (25) of the TTT hires in STEM have been women, which suggests that increasing the number of female applicants in the pool is an area for improvement. This will be the focus of Initiative Three, described below—to increase the number of women and URM candidates applying for positions, to expand search and selection training and outreach to search committees and to provide a high quality experience for candidates throughout the search and campus visit process. Our goal is to increase the numbers of URM women and to provide role models for all our students by attracting and recruiting underrepresented minority women, especially African Americans, in STEM.

### Current Initiatives and Best Practices

Through the provost's office, the University invests about \$500,000 annually in career, leadership, and life-course development programs. Many of the individual and career development programs recommended as best practices by ADVANCE IT schools have been institutionalized. Some of these were developed in response to priorities identified during the strategic planning process and because of findings from the COACHE and U.Va. Faculty Senate surveys. There are policies and benefits in place in support of faculty work-life needs and flexible tenure schedules include time off the clock for parenting or other transitional emergencies, such as care for dependent family members. Funding for dual career positions is in the range of \$600,000 per year. While there is always room for more such programs,

**Table 2: Institutionalization and Sustainability**

Faculty Development/Mentoring	Institutional Policies, Practices and Programs	Research; Institutional data	Diversity Advocacy Groups or Academic Programs
<p>Leadership in Academic Matters, 12 weeks, 60 per cohort sessions (2x year) 7% URM and ~40% women;</p> <p>Department Chair Workshops (6 per year).</p>	<p>Dual Career Program, funds salaries; creates new positions or expedites spousal placement; raises program awareness among deans and chairs.</p>	<p>Exit surveys of departing faculty; Finalists Declination surveys for candidates who turn down offers; Search Committee Member Interviews.</p>	<p>Women's Leadership Council Diversity Council, chaired by co-PI; Report to Vice President and Chief Diversity Officer; elevated to presidential report.</p>
<p>Excellence and Diversity Fellowship, 1<sup>st</sup> &amp; 2<sup>nd</sup> year URM, 1<sup>st</sup> generation faculty</p> <p>Early Career Mentoring Initiative: Matching on Request;</p> <p>Post-tenure and Mid-career mentoring group for women;</p> <p>Workshops on negotiation, time management, conflict resolution; grant-writing.</p>	<p>Strategic Recruitment and Retention Bridge Funds supervised by PI.</p> <p>Mandated Search Committee Tutorial for all tenure-track searches; focus on active recruitment of diverse candidates; developed by PI.</p>	<p>Focus group discussion with 3 groups of STEM women faculty (24 total).</p> <p>Focus group with post-doc women (35 total).</p> <p>Analysis of tenure and promotion outcomes.</p>	<p>Women's Center Studies in Women and Gender Program; Carter G. Woodson Institute for African American and African Studies; Post-doc and pre-doc fellowships.</p> <p>Faculty Senate, Committee on Faculty Recruitment, Retention and Welfare.</p>

Professors as Writers Fellowships, all teaching and research faculty eligible; Funds used for writing coaches or editors. Once monthly fellows meeting.	Promotion and Tenure Workshops;  Contingent or emergency dependent care program—subsidized rate and in-home providers.	Faculty Senate Faculty Satisfaction Survey 2007, 2011; COACHE survey 2005; 2007.	Engineering School Center for Engineering Diversity; Department of Science and Technology Studies.
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customized to the changing needs of faculty, these are representative of a rich array. As a part of our institutionalization efforts, five to ten slots for the Leadership in Academic Matters (LAM)—our hallmark leadership development program—will be reserved for STEM women faculty. In addition, with the establishment of the U.Va. ADVANCE offices, there will be a specific space for formal and informal gatherings to encourage women and men STEM faculty to connect across their departments, schools and lab silos. Our ADVANCE initiatives will be built on a solid foundation of established and very successful professional development offerings.

The Faculty Senate co-chair of the Faculty Recruitment, Retention and Welfare Committee will partner with U.Va. ADVANCE on its initiatives and will be conducting a university-wide faculty survey in 2011 which will provide a benchmarking document. The senate will conduct another survey at the end of the ADVANCE IT grant to assess its impact. There is a commitment by school leadership that STEM women in the LAM program will be nominated for leadership of key school and university-wide committees, including promotion and tenure (P&T) and departmental strategic planning. These women will be positioned to be organizational catalysts through their involvement in university-wide networks.

The provost is committed to a robust annual review process for deans and department chairs and will expect accountability for diversity related goals. He supports the inclusion of diversity related activities as recognized service in faculty annual reports. As a part of the collection of equity data, the provost will be assessing the state of salary compression on faculty salaries and its impact on those in mid-career and as well as the growing junior faculty. He will be working with the deans on a strategic plan for responding to these issues over time with merit and compression adjustments. The provost will review promotion and tenure policies at the central level and examine how interdisciplinary scholarship is recognized and rewarded. Furthermore, the plan is to create two new senior positions, one to lead interdisciplinary and the other international strategy. These new leaders will be selected from the faculty and will be expected to fully integrate women scientists into the strategic planning for global and interdisciplinary STEM initiatives. The Office of Equal Opportunity Programs will work with the U.Va. ADVANCE program to ensure that all searches utilize the electronically available candidate pool data and will conduct pool certification audits. The EOP director has agreed to partner with the Office of the Provost to meet with all search committee chairs early in the hiring process.

### **Conceptual Background: Technical and Adaptive Challenges**

We draw on the work of Heifetz and Laurie (1997) to distinguish between organizational challenges that are technical or routine and those that are adaptive. Technical or routine challenges in an organization are those for which there are known or knowable solutions—usually connected to implementing procedures or applying established knowledge—and which have limited possible outcomes. Technical challenges are situationally clear—which is not to say that they are easy.

In the Heifetz model, adaptive challenges are primarily those that are maximally disruptive to a system. The crisis can be externally derived, but it may also be triggered by internal dynamics or some combination. Basic values and beliefs are threatened, and there is a sense of hazard or crisis. Adaptive challenges press organizational participants to face “radically altered environments,” where there is ambiguity and uncertainty and no well-bounded, consensually agreed upon set of solutions. Adaptive challenges are not rule-based; they are complex, subject to change, and require flexible, collaborative, nonlinear thinking from many points of view and people in the system. Public higher education in the United States is experiencing systemic challenges that are adaptive in nature. Efforts to engage majority

male departments in transformational change constitute an adaptive challenge. Indeed, any shifts in values or culture, whether voluntary or not, may be so categorized. Institutionalization of STEM transformation at a large research university is also an adaptive challenge. Heifetz suggests that such change produces tension which may be creatively harnessed, but that “adaptive problems require innovation and learning among the interested parties and, even when a solution is discovered, no single entity has the authority to impose it on the others. The stakeholders themselves must create and implement the solution because the problem itself lies in *their* attitudes, priorities or behavior and only a change within and between them will produce a solution” (Heifetz and Laurie, 6).

The comprehensive suite of initiatives we offer in this ADVANCE proposal will promote systemic change. It focuses at the organization’s structural middle and then reframes the symbolic and physical environment to raise STEM women’s profiles everywhere.

We hope that the ADVANCE initiatives will help the University become as diverse as the population it serves—but equally important, we intend to generate cross-cutting institutional conversations about what is gained when we create inclusive environments that draw on the full range of human capacities and strengths. The ADVANCE offices, occupying quality space at the School of Engineering, will be conveniently located in the science and engineering precinct of the University where it will be walking distance from faculty offices, with many chances for drop-in and hallway conversations to occur. This will be an especially welcome gathering spot for STEM women as U.Va. has no faculty club. Co-PI Pam Norris, endowed chair and highly respected senior engineer, active university citizen and extrovert, will take on her role as U.Va. ADVANCE’s director. We know that the office will become a hub of activity.

What qualities of mind do we cultivate when students and faculty work comfortably in heterogeneous groups, with great variance in skills, life experiences, and ways of thinking about and seeing the world? What questions would we ask to discern whether we are underutilizing the knowledge and social capital inherent in a diverse STEM workforce? What new social schemas and communicative strategies would we develop to demonstrate our deeply held commitments to diversity and inclusion? And how would we take action as a community if we agreed that diversity was an embedded rather than peripheral dimension of scientific and engineering thought and practice? These questions provide the framework for an approach to transformation that is influenced by a complex systems model.

There is a growing body of research that supports a “multiple points of intervention” approach to sustained change in higher education. We will model that approach in our U.Va. ADVANCE initiatives.

Kezar (2001), in a review of theories of change in higher education, notes that “realizing that strategies are interconnected and nonlinear increase an institution’s success in the change process” (90). She further advocates that universities engage in organizational self-discovery, with multiple opportunities to discuss and reframe: “Being open to ambiguity and a non-linear process is important for institutional leaders and change agents” (119).

## **TRANSFORMATIONAL ACTIVITIES: The ADVANCE Initiatives**

**Initiative One: Departmental Diversity and Action Transformation (DDAT)** will increase the involvement, awareness and critical mass of male faculty in efforts to improve the gender equity climate within their departments. Our work builds on ADVANCE programs such as Michigan’s STRIDE and West Virginia University’s WVU PRIDE project that have centered their efforts on departmental transformation and on developing male allies to support women colleagues’ change efforts. It will use a complex diversity framework to examine gender, race/ethnicity and social class as dimensions of the organizational culture and structure within which science and engineering faculty interact and conduct their scholarship. We recognize the adaptive challenge this presents at U.Va. but also aspire to the tremendous transformative potential of creating diversity-effective departments which recognize the value brought to the group by uniquely experienced individuals (Mannix and Neale 2005). Only cultural change at the departmental level, where faculty spend most of their time, will have long term effects on women’s faculty satisfaction, and their sense of connection and fairness.

Leadership involvement by the deans and the provost will help keep the focus on this process. Rewards and incentives will include: small ADVANCE grants (up to \$3000); integrating these efforts in annual reports; and recognizing their success on the U.Va. ADVANCE website and campus-wide. But there will be no sanctions for risk-taking in testing ideas or strategies which fail. This initiative draws upon a conceptual model of the campus climate for diversity (Hurtado, Milem, Clayton-Pedersen, & Allen, 1999; Milem, Chang, & Antonio, 2005). Although the original model has been used primarily to assess the racial/ethnic climate for diversity, it can be easily adapted to the gender climate and benefits from an integration of race/ethnicity into the model. The model posits that there are five intersecting dimensions of departmental climate : 1) Compositional diversity, or the gender/ race or ethnic balance among the faculty within the STEM disciplines, as well as the results of faculty and administrative hires in STEM field; 2) Historical legacy of exclusion, or the historical vestiges of prejudice and discrimination at the institution, and the subtle manifestations of this exclusion that still remain; 3) Psychological dimension, or perceptions of tension regarding gender bias, discrimination, or other related issues; 4) Behavioral dimension, or scholarly, curricular, administrative, or social interactions among men and women; 5) Organizational-structural dimension, or the policies, budgetary allocations, or other official decisions institutions make regarding women in STEM.

The approach we take will be a gradualist one, initiating work with volunteer departments (four have agreed to pilot the effort over the next two years) and then moving outwards to other department with the help of male and female influencers and senior leaders. It is critical that participation is voluntary; however, we hope to engage faculty through rational, emotional and values persuasion (Davidson 1999), with openness to multiple perspectives on the issue and shared commitment to science and fairness. It will be important to encourage participants to reframe their equity and diversity stories to positively connect good science and inclusion. Our expectation was influenced by a cross section of practitioner/theorists on change who advocate for “small wins” (Jordan and Bilmoria 2007) and phased, modest interventions (Heifetz and Laurie 1997; Davidson 2011; Meyerson and Fletcher 2003).

The U.Va. ADVANCE program will provide department chairs with two kinds of consultancies. To help with the assessment and technical aspects of measuring climate and initiating structural changes (dimensions 1, 4, and 5), we will offer the services of equity consultants, based on the National Center for Women & Information Technology (NCWIT) extension services model. These equity consultants, trained by Co-PI Joanne Cohoon—who is a Senior Research Scientist with NCWIT and a respected member of the faculty community—will provide chairs and departmental faculty with technical assistance to: conduct a needs assessment using data supplied by the department; compile a summary report on findings from the needs assessment, with relevant and prioritized recommendations on climate and equity issues; present analysis and recommendations to faculty and department chair; and encourage discussion about next steps. Department chairs would request these technical services and Co-PI Cohoon will match them with a consultant with the necessary expertise. Consultants will be trained professionals, many of whom have worked in the NCWIT department equity program.

For the cultural dimensions of change (dimensions 2 and 4), department chairs and faculty members will be introduced to a facilitation process used to “nudge” conversations and expand participant’s frame or point of view—starting from their own situations and encouraging a process of taking on the perspective of other participants in the situation or action they described. Faculty will be encouraged to reflect upon their personal and professional experiences as scientists and faculty members. We will draw on the expertise of subcontractor Jeff Galbraith, who has designed processes for these change conversations for corporate and academic settings. He also successfully partnered with us on our recent “Engaging Across Difference Conference” (see Initiative Two). This structured dialogic process will also align with dimensions 2 and 3 (history and psychology) in the diversity model. Open-ended, discovery-based thinking about transformative solutions and pathways that may be tested and implemented will be encouraged. In the first year, we intend to pilot the facilitated conversation program in four early adaptor volunteer departments: Mechanical and Aerospace Engineering, Biology, Chemical Engineering, and Computer Science. Over the course of the ADVANCE grant, we expect that 12 STEM departments will



participate in this initiative. These departments would forego two 2-hour departmental meetings each semester to participate in U.Va. ADVANCE dialogues.

**Initiative Two: Reimagined Spaces—Voices and Visibility** seeks to increase the positive visibility of STEM women in the social and physical environment of the university campus in the following ways. We will host an additional “Engaging Across Difference Conference.” This national conference, initially funded by a Forward to Professorship grant and first held in August 2011, was designed in partnership with the PI’s Office of the Vice Provost for Faculty Recruitment and Retention (VPFRR), VCU’s School of Engineering and Norfolk State University. We invited a diverse group of STEM women at graduate, post-graduate and faculty ranks for a two day intensive facilitated dialogue conference during which they learned about each other’s struggles and victories in academic STEM departments and engaged in small group strengths-based exercises to problem-solve professional challenges and develop action steps for change. Likewise, this conference will empower women to be their own agents of change. At the same time, the conference will highlight the on-campus presence and work of women scientists and engineers. We will also document the lived experience and history of STEM pioneers, as well as the current generation of women at U.Va. Modeled on the University of Wisconsin’s STEM initiative, Discovery Interviews, which conducted structured conversations with senior women both to document their stories and to gain knowledge “about the structures that impeded or facilitated their careers (Sheridan et al. 2006), this documentary process may include photography and other media. With the projection of a wave of retirements, it is likely that senior women scholars will be leaving the university within the next five years or already are emeriti faculty. Through Lived Experience and History, we will provide the opportunity for STEM women across all generations to tell their stories, given the relatively small numbers of STEM women especially senior women, at U.Va. This Voices and Visibility initiative is linked to collective identity. Furthermore, because the University of Virginia is so powerfully and symbolically tied to a male founder—Thomas Jefferson—this project will provide other origin narratives to reframe the institutional cues which associate leadership and greatness with maleness. Besides the important ethnographic and documentary aspect of this work, this initiative derives from theories which suggest that role models can have a positive effect on the sense of belonging and productivity of isolated or less privileged group members.

Our social science component will further investigate questions of belonging through an innovative investigation of how cues in the physical environment signal or are perceived as safe or unsafe, as expressing belonging or detachment. It hypothesizes that such cues are differentially experienced across race and social class. Finally, this work will propose interventions to create new and more inclusive cues and test their effectiveness.

**Initiative Three: The ADVANCE Tournament of Ideas**, another aspect of innovation discovery and diversity, will be a competition for developing big ideas about what could transform structures, cultures, individual or group behavior, policies or practices, to enable universities to be more effective in reaching, recruiting and nurturing the talent pool of women in STEM. This competition will be open to the broader university community. Prize money would be \$3,000 for the winner and \$1,500 for runners-up, if any are identified. Why an idea tournament? Because increasing the number of women in the STEM professorate has been an enduring problem for thirty or more years, so it is important to find ways to generate creativity and new directions in this effort. This tournament is inspired by entrepreneurial competitions (Bullinger, Neyer, Rass & Moeslein, 2010; Terwiesch & Ulrich, 2009), which have long been a staple and an idea incubator at the University of Virginia’s Darden School of Business and other business schools. There have been tournaments focused on technical innovation (MIT), on improvements in the student experience (University of California, Berkeley) as well as tournaments designed to help create solutions for enduring social problems (University of California, Berkeley, in partnership with OpenIDEO, a private innovation company that provides an open platform for ideas to solve global social problems). Although we are concentrating on STEM issues, the institution as a whole should be invested and aware of this work. Innovation tournaments recognize that innovation often occurs at the margins

rather than at the center, or the top, of bureaucracy. That such a tournament may be a powerful intervention for transformational change derives from scholarship which argues that opening up complex problems to diverse minds and experiences—what Scott Page calls different toolboxes or distributed problem solving—increases the likelihood of powerful solutions (Page 2007). The tournament will also raise awareness of the status of women in STEM at U.Va. and nationally; we also hope that it will be an example of interdisciplinary collaboration and diversity at work, through the interactions of heterogeneous groups bringing their various cognitions, identities and experiences to bear on a shared problem.

**Initiative Four: Recruitment, Search and Selection** will develop a robust search, selection, and hiring effort that will actively engage the University community as a whole—with particular attention given to deans and other hiring authorities and search committee members—to cultivate women, but with a strong focus on increasing the number of URM candidates and hires. Central resources will help to recruit and fund such strategic hires; ADVANCE grants of up to \$1,500 per search will help to augment travel and outreach resources for those who commit to extra cultivation and nomination efforts. We will create a search portal that will expand the existing online tutorial as well as intensify face-to-face outreach efforts in partnership with the EOP, ADVANCE implementation team members, the ADVANCE Internal Advisory Board and the Office of the Vice Provost for Faculty Recruitment and Retention (VPFRR).

**Search Committee Learning Portal:** In 2005, the Office of the VPFRR developed an online tool designed to educate faculty members about current research and best practices in faculty search committees. This is just one component of the informational and outreach resources that the University makes available to search committees in an effort to sharpen and intensify their efforts to attract a strong, diverse pool of applicants. All search committee members are required to do the training once every two years. The tutorial has generated substantial interest from other schools and organizations—including Washington State University, Harvard, and the University of Rochester—which have used the content to develop their own search committee training documents—and from the Mid-Atlantic Higher Education Recruitment Consortium, which offered a special version as a tool for their members.

The current iteration is an online tutorial that provides detailed, text-based data and scholarship relevant to best practices and potential problems in faculty searches, along with information relevant to developing and sustaining diversity. However, once faculty have completed the online training, it is fairly difficult to return to the content without retaking the tutorial. Therefore, as part of the U.Va ADVANCE grant, we propose to conduct the necessary research, focus groups, and development to revise the search committee tutorial, making it a more dynamic, interactive resource that can be integrated into the change processes of the program.

We will initially use the PBS website for “Race: The Power of an Illusion” (PBS) as a model for how the search committee tool will look, feel, and function. On this website, the user can choose how to engage with the topic, clicking on topics of interest to go deeper as more is learned. Page content opens with common questions and misperceptions that lead into engaging self-tests that challenge the user’s perceptions and assumptions while providing information based on current research. Our restructured online tool will have a similarly engaging and dynamic interface that guides the user deeper into the topic. For instance, a user might want to know how implicit bias can inadvertently shape impressions of a candidate or influence a search committee decision. Accordingly, in the revised tool, the user might click on “How can I be sure I am not acting out of an unconscious bias?” or “What is the best way to rate candidates?” The online tool and self-tests can be made more personal by providing small videos of candidates’ discussions of their own experiences in the evaluation and interview process and their perceptions. Also, the user could read about relevant case studies from previous search committee experiences, or access relevant online resources and research.

In addition to the educational and training dimensions of the tool, we believe it will add a community component. We intend to develop the tool so that anyone interested in sharing their experiences in successful—or unsuccessful—searches can be contacted via in an informal, online community. Eventually, we envision extending this online community beyond U.Va.

**Initiative 5 will establish an ADVANCE Enhancement Fund** small grants program for women STEM faculty. They will be designed with maximum flexibility. Awardees may apply for fellowship funds to launch interdisciplinary collaborations, to provide bridge resources between grants, to prepare their portfolios for tenure or promotion or to extend their networks by travel to international conferences or to visit collaborators. We will strongly encourage underrepresented faculty and mid-career faculty who have been in rank for 5 years or more and wish to complete projects in order to submit portfolios to participate in this program. Increasingly, senior women may want to complete a legacy project before retirement and they would also be eligible for enhancement funds.

#### **PROGRAM EVALUATION**

The internal evaluation team will be led by Karen Kurotsuchi Inkelas, Associate Professor and Director of the Center for Advanced Study of Teaching and Learning in Higher Education (CASTL-HE) at U.Va. Other members of the team will include Margaret Harden, Director of the Institute for Faculty Advancement and Assistant to the Vice Provosts, who will be primarily tasked with responding to the ADVANCE toolkit data reporting. In addition, David Feldon, Assistant Professor of STEM education and Associate Director of CASTL-HE, will consult with technical aspects of the formative evaluation data collections. Finally, a full-time Postdoctoral Research Associate will be hired to work exclusively on the data collection in conjunction with this program.

Dr. Patricia Freitag of CEO Education Consulting will be the external evaluator. She has developed research and evaluation surveys and interview protocols for federally funded projects, such as the “Pay IT Forward” project to mentor and professionally develop STEM professionals. Her role will be to take a broad overview of the evaluation process and to help in the development of a five year evaluation plan. She will visit twice a year over the course of the grant. In the fall of 2012, she will collect baseline data and will work with us to develop consistent evaluation instruments. She will establish a preliminary interview protocol for faculty and administrators. She will conduct on-site visits, interviews and observations before the department interventions begin, at the 3<sup>rd</sup> year and then at the end of the U.Va. ADVANCE program. At each point in the formative evaluation process, we will be able to assess how we are doing and have the opportunity to adjust our activities in light of the interim reports. She will review the tournament format to evaluate potential for application at various organizational levels or departments, or for dissemination. Overall, indicators of sustainability and institutionalization will be reviewed using documents and policy review. A final summative report will be delivered to the implementation team and internal advisors in the summer of 2017; we will submit the report to NSF. At all stages, we will discuss evaluation with our External Advisory Board members to seek their input.

#### **Evaluation Framework and Plan**

Once again, we draw upon the conceptual model of the campus climate for diversity (Hurtado, et al., 1999; Milem, et al., 2005) for the program’s evaluation plan. To reiterate, the model identifies five intersecting dimensions of a campus’s climate: 1) compositional diversity; 2) historical legacy of exclusion; 3) psychological dimension; 4) behavioral dimension; and 5) organizational/structural dimension. Each of the above dimensions of the conceptual model will be woven into the formative and summative program evaluation in multiple ways. Both quantitative and qualitative methods will be utilized, and assessment activities will be tailored to the primary goals of the respective initiatives.

#### ***Initiative 1: Departmental Diversity and Action Transformation (DDAT)***

This initiative occurs on two levels: departmental and individual. On the departmental level, four initial and 12 total departments will participate in a needs assessment of their climate for gender equity. The needs assessment will result in a series of recommendations for the respective departments to consider. Each department, in turn, will identify a set of recommendations on which it wishes to focus. Through annual reports and periodic check-ins, the internal assessment team will monitor the departments’ progress on the execution of the needs assessment, the selection of recommendations to pursue, and their tangible advancement toward reaching the goals of their recommendations. On the individual level, participants in the ongoing facilitated conversations will have the opportunity to take part

in discussion boards between conversations in order to allow for deeper and more sustained reflection. The discussion boards will be prompted with key questions that will assist the participants in meaningful interim conversation dialogue, but also allow the conversation facilitators to revise and reframe subsequent conversations based upon gaps noted in the discussion boards. Finally, the summative evaluation for the facilitated conversations will be the comparison of the pre- and post-test climate surveys (such as the University of Michigan's Survey of Academic Climate & Activities) conducted in early fall semester and in late spring semester, respectively, among the men and women in the participating departments.

### ***Initiative 2: Reimagined Spaces, Voices and Visibility***

After both the "Engaging Across Difference" conference and the work from the Lived Experience and History project, the internal evaluation team will assess women STEM faculty, post-doctoral fellows, and graduate students' sense of empowerment and belonging as forms of formative feedback from the two programs. In conjunction with the social science component, the summative evaluation will further investigate questions of belonging through the examination of how cues in the physical environment signal or are perceived by academic women in STEM.

### ***Initiative 3: ADVANCE Tournament of Ideas***

Because this initiative involves a competition that has not yet occurred, the formative evaluation cannot be designed at this time. Instead, the developers of the innovations at the tournament will be required to create an assessment plan for their ideas, and CASTL-HE staff can offer assistance to individuals unfamiliar with social science research methods in the development of their assessment plans. The summative evaluation for this initiative will be the extent to which the goals of the awarded project ideas were fulfilled or implemented. In order to ensure the feasibility of the summative assessment, all awarded ideas from the tournament will be required to identify a clear and accessible set of goals or objectives.

### ***Initiative 4: Recruitment, Search and Selection (Search Committee Learning Portal)***

In order to revise and redesign the learning portal, the internal evaluation team will conduct focus groups of portal users and collect recommendations for changes. In addition, the team will recruit a group of beta-testers, who will periodically be employed to test the portal during the development phase. Once the revised portal is up and running, use analysis will be conducted to assess aspects such as: 1) peak usage areas of the portal; 2) frequency of portal access; and 3) average length of time using the portal. Finally, STEM search committee members will be asked to provide examples of competencies they used in their searches (e.g., new marketing approaches, ways to avoid bias) and responses will be added to an ongoing "good practices" list for subsequent search committees to consult. For the summative evaluation, six to ten STEM-related faculty search committees (both successful and unsuccessful) will be randomly selected for case studies. Data collection for the case studies will include: 1) document analyses of materials; 2) interviews with search committee members, department chairs, and deans; and 3) interviews with female and URM female candidates (those ultimately extended offers and those who were not).

### ***Initiative 5: ADVANCE Enhancement Fellows Fund***

Since, like Initiative 3, this initiative involves a competition that has not yet occurred, the nature of the formative assessment plan is dependent upon the activities the competition chooses to fund. The internal evaluation team will make use of annual assessments and periodic check-ins to ensure that good progress is being made on the awarded projects. Summative evaluations will take the form of outcomes, or products, of the projects, such as 1) subsequent grants proposed and awarded by external agencies; and/or 2) products of the research, such as publications, presentations, patents, etc. Finally, because the Enhancement Fund is meant to assist women STEM faculty in career advancement, Fund recipients will be asked to reflect upon how the funded project contributed to their professional goals and future promotion and/or tenure.

## **Management Plan**

A program manager will be hired to coordinate the logistics and communication outreach for the U.Va. ADVANCE initiatives. The manager will serve on the Implementation Team co-chaired by PI Gertrude Fraser, an anthropologist and the Vice Provost for Faculty Recruitment and Retention, and Co-PI Pamela Norris, Frederick Tracy Morse Professor of Mechanical and Aerospace Engineering, who will also be the ADVANCE Program Director. Both will have main responsibility and oversight for U.Va. ADVANCE implementation, including organizing the five initiatives, soliciting participation in the chair transformation process and maintaining enthusiasm for the effort. Dr. Norris will initiate the development of a website and campus wide communication plan. PI Fraser will be responsible for program oversight, management of initiative fiscal resources, and will supervise the program manager. Co-PI Joanne Cohoon, Senior Research Scientist at NCWIT and on the faculty at U.Va., will take responsibility for training the equity consultants and working with the facilitated conversation sub-contractor to develop a plan of work for the first set of departmental volunteers. Sophie Trawalter, Assistant Professor in Psychology and the Batten School of Public Policy, will lead the social science component, testing interventions in the third and fourth year of the study to assess the impact of changing cues in the physical environment. Senior Personnel: Mary Lou Soffa, chair of Computer Science, will provide technical assistance for the search committee portal project; Dorothe Bache, Teaching Research Center, will work on the department transformation team and the candidate pipeline piece of the recruitment initiative; Archie Holmes, Electrical and Computer Engineering, and Dinko Počanić, Physics, will provide outreach to departments and will train in the facilitated conversation technique.

For an overview of all ADVANCE personnel please see the [Organizational Chart](#).

## **Dissemination**

We will publish the social science results and suggest interventions to render the physical environment more welcoming. We will broadly share our design for structured conversations at conferences and on our U.Va. ADVANCE website. In the second and fourth years of the grant, we will host a national conference, Engaging Across Difference, for diverse women to share challenges and build on strengths through a dialogic process. We will provide access to our interactive search committee portal and share the discoveries emerging from the innovation tournament. The stories and photographs of pioneer women scientists will be curated in a show for broad audiences. Presentations to the national ADVANCE meetings will describe the progress of the five initiatives. We will especially want to compare lessons learned with programs that are focusing on departmental level change. The U.Va. ADVANCE Website has the potential of being the digital repository for the oral histories and photographs of STEM pioneers. We also plan to interview men and women about their experiences of the change process.