

## PROJECT DESCRIPTION

### INTRODUCTION

The problem of women's underrepresentation in Science, Technology, Engineering and Mathematics (STEM) is described by the Committee on Maximizing the Potential of Women in Academic Science and Engineering (2006) in "Beyond Bias and Barriers":

*"The fact that women are capable of contributing to the nation's scientific and engineering enterprise but are impeded in doing so because of gender and racial/ethnic bias and outmoded 'rules' governing academic success is deeply troubling and embarrassing. It is also a **call to action**. Faculty, university leaders...must unite to ensure that all of our nation's people are welcomed and encouraged to excel in science and engineering in our research universities. Our nation's future depends on it."*

Chancellor Harvey Perlman, Senior Vice Chancellor Barbara Couture (PI of this proposed project), Vice President and Vice Chancellor John Owens, and Vice Chancellor Prem Paul unite with college deans David Allen (Engineering) and David Manderscheid (Arts & Sciences and co-PI), chairs of STEM departments, and university faculty in accepting this call to action: to transform the University of Nebraska-Lincoln (UNL) into a campus where all faculty can thrive. We recognize that making the university more hospitable to women scientists and engineers is not just a matter of equality; it is a matter of competitiveness. Women comprise less than 20 percent of the faculty in STEM departments at UNL. We embrace the need to increase the number of women on our STEM faculty to promote diverse and innovative research in STEM fields and to provide our future graduates with the knowledge and experiences they will need to succeed in a more diverse world (Bollinger 2007).

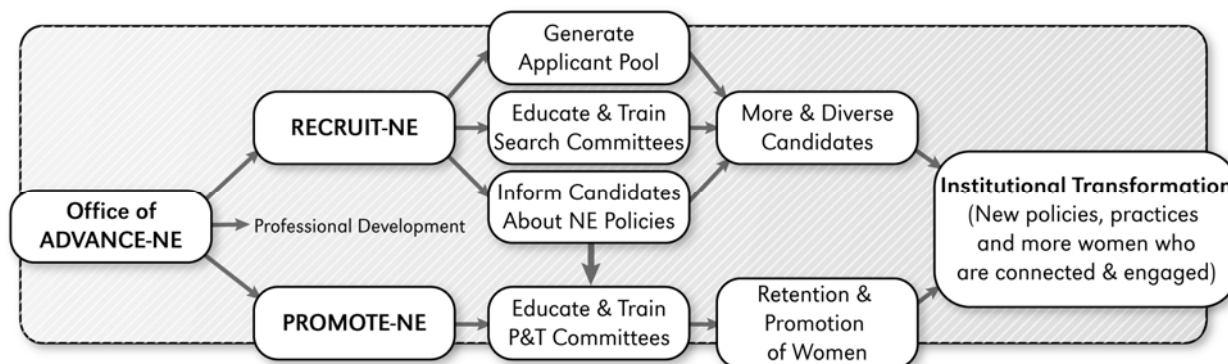
The UNL administration pledges \$300,000 per year during the life of the project to support qualified Dual Career partner hires, up to \$1 million for start-up funds for qualified Dual Career hires, and funding for the proposed ADVANCE-Nebraska (NE) Office Director for five years beyond the life of the cooperative agreement. Office space for the ADVANCE-Nebraska office in the administration building has been committed to demonstrate the strong, central support for the goals and values that this program will promote. UNL also pledges \$55,000 to foster conducting new and innovative research on networks in STEM (see p. 9) that will form an essential formative evaluation tool through the life of the program. These commitments and others that support multiple aspects of the program are described in the letters of commitment.

We are poised to make a significant advance in the gender diversity of our faculty. The advance proposal team held a series of meetings and public forums throughout 2007 to discuss the low numbers of women STEM faculty and the barriers that are the likely causes. We have communally developed strategies to lower these barriers and increase the number of faculty STEM women. We have considerable buy-in from department, college, and supportive units (e.g., Sociology, Psychology, and Women's and Gender Studies), and central administration, which are dedicated to and have the authority to make the necessary changes in policies and practices to bring forth institutional transformation.

### PROGRAM OVERVIEW: ADVANCE-NEBRASKA

To accomplish our vision of creating an environment where all STEM faculty thrive, we will launch an ADVANCE-NE Office that will capitalize on the current momentum and help institutionalize the necessary structures (Fig. 1) for overcoming our identified barriers to the advancement of women STEM faculty. Two committees composed of faculty, RECRUIT-NE and PROMOTE-NE will compile and disseminate "best practices" to increase the number of STEM women in our applicant pools and in faculty positions. Professional Development workshops for faculty and chairs will provide the necessary skills for women in STEM to achieve promotion and advancement to leadership positions and for chairs to promote these goals. An institution-wide set of policies promoting Flexible Work Arrangements (FWAs) (e.g., stop-the-tenure clock, part-time positions), Dual Career and Family-Friendly Policies (FFPs) (e.g., parental, eldercare leave), disseminated by the ADVANCE-NE Office and implemented by the Office of the Senior Vice Chancellor for Academic Affairs, will make UNL more attractive to women applicants and will allow faculty to better balance work and family. These programs and policies will effect Institutional Transformation, as measured by increased numbers of women STEM faculty and their connections and engagement through integration into formal and informal networks. These activities will be assessed by a

novel method. We will pioneer the application of social network mapping and analysis in the academic setting to advance our understanding of how formal and informal networks of STEM faculty contribute to their academic success.



**Figure 1.** Components of the Office of ADVANCE-NE and their interactions to achieve institutional transformation for women.

### GOALS AND OBJECTIVES OF ADVANCE-NEBRASKA

Our specific goals and objectives for implementing ADVANCE-NE are as follows:

Goals	Objectives	Program Elements
<b>1. Increase the number of women STEM faculty.</b>	1. Match STEM departments' applicant pools to the national doctoral/post-doctoral pool beginning Year 2 of the program; match hiring composition to the national doctoral/post-doctoral pool by program Year 3.	RECRUIT-NE Committee, p. 8, Recruitment Ambassadors, p. 7, and Exposure Visits
<b>2. Increase the retention of women STEM faculty and support their promotion into positions of professional leadership.</b>	2. Make UNL more family-friendly by developing and systematizing institution-wide policies on Dual Career Partner Opportunities, Flexible Work Arrangements and Family Friendly policies and practices; ensure that this information is widely disseminated; administratively encourage the use of these policies. 3: Increase informal networking and enhance professional development to foster academic success for women STEM faculty.	PROMOTE-NE Committee, p. 9; Guest Speaker Luncheons, Writing Retreats and Professional Development Workshops, p. 8
<b>3. Conduct innovative research on what network structures best support the academic success of women STEM faculty, and what factors contribute to the development of supportive networks.</b>	4: Map network structures through a network mapping survey of faculty in target STEM departments and empirically correlate network structures with faculty productivity and job satisfaction. 5. Replicate programmatic elements that enhance formal and informal faculty networks.	Network Research, p. 9, Climate Survey, p. 12

### EXPECTED SIGNIFICANCE

The momentum already generated by broad interest in ADVANCE goals at the flagship university in Nebraska will fundamentally transform how we formulate and execute searches for new faculty and in how we promote all of our faculty to ensure that they reach their full potential. We will foster more effective evaluative decision making (Ridgeway & Correll 2004) by broadening awareness of the implicit

biases inherent in evaluations of applications, annual evaluations, and promotion/tenure dossiers, and by providing strategies to minimize the impact of these biases. Accountability for transformation will be shared among faculty, department chairs, deans, and central administration. The centralization and widespread dissemination of a Dual Career program, Family-Friendly Policies and Flexible Work Arrangements will make UNL more attractive to women applicants and improve campus climate.

Our ground-breaking research on networks of STEM faculty will be instrumental in shaping our program so that it addresses the most recalcitrant dimension of change – the interactional/cultural (Risman, 2004). This research will enable us to map the extent to which current faculty and new hires become increasingly integrated into key networks on campus as we foster greater interaction through Professional Development workshops and informal networking opportunities (Realff, et al. 2007).

## **UNL STRATEGIC PLAN AND ADVANCE-NEBRASKA**

ADVANCE-NE is consistent with two key elements of UNL's most recent Strategic Plan:

- “Recruit and retain exceptional faculty and staff, with special emphasis on women and persons of color.” Diversity will improve overall campus climate and competitiveness.
- “Support inter-disciplinary work that matches educational opportunities to future work-force needs and enhances research competitiveness.” Diversity is a key component of the future work-force (Beyond Bias and Barriers, 2006).

UNL faculty and the administration are collaborating to create a Strategic Plan for Diversity. UNL has increased the racial and ethnic diversity of its undergraduate student body from 7 to 10 percent and of its overall faculty to 12 percent in the last five years through concerted efforts (e.g. hiring a person charged to increase student diversity). “Diversity of ideas and people” is a core value of UNL, and the Chancellor has emphasized the importance of diversity repeatedly in recent State of the University speeches. Our proposal is designed to enhance and extend these efforts by adding a specific focus on women STEM faculty.

## **UNL IS READY TO ACCEPT THIS CHALLENGE**

The University of Nebraska-Lincoln has pursued multiple methods to improve the hiring and retention of women faculty. The Chancellor's Commission on the Status of Women, convened and funded by the Chancellor, conducted a survey of faculty to assess child care needs in 2006. Construction on the new day care center begins in 2008. The Commission is also, at the Chancellor's direction, disseminating information on family-friendly policies to current and prospective faculty. ADVANCE funds will provide us with the means to expand, coordinate, and implement campus-wide efforts to promote family-friendly policies and reduce bias toward faculty and students who use them through the ADVANCE-NE Office and the PROMOTE-NE Committee (p. 9). The Chancellor's Commission on the Status of Women (CCSW), the Women's and Gender Studies program, and the Women's Center are enthusiastic about the shared focus on work/life issues (e.g., FFPs/FWAs, dual career, child care; see letters of commitment and Hornig, 2003, for the importance of collaboration with these units).

There is considerable evidence that key UNL community members are eager for the major ADVANCE initiative in order to elevate smaller and less coordinated efforts into a systematic, campus-wide program. We had a high rate of participation in meetings and forums wherein we assessed ways to include more women in STEM departments. More than 70 faculty members, department chairs/heads from 20 STEM departments, college deans (Arts & Sciences and Engineering), and administrators from the offices of the Senior Vice Chancellor for Academic Affairs and of the Vice Chancellor for Research participated.

We have a variety of programs currently run by several departments, colleges, centers, and individuals on campus that target retention of women at different points of exodus in an academic career. The UNL Office of the Senior Vice Chancellor for Academic Affairs, which will house the ADVANCE-NE Office, offers several programs to increase retention of newly hired faculty, including a Promotion and Tenure Guide, Big 12 Faculty Fellowships designed to increase collaborations in the region, and Pre-Tenure Faculty Events. These events provide newly hired faculty the opportunity to meet the Chancellor, Senior Vice Chancellor, Vice Chancellors, and Associate Vice Chancellors informally. Two workshops are held in the first semester to acquaint new hires with their “Rights, Requirements, Expectations” and with on-campus teaching support services, including “Developing a Teaching Portfolio.” In addition, the Office of the Senior Vice Chancellor for Academic Affairs provides Chair, Head, and Dean Workshops to

promote leadership skills. The UNL Office of Research offers professional development workshops on grant writing for graduate students and faculty to increase research productivity and faculty retention. The Department of Mathematics was awarded a 1998 NSF Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring when chaired by Dr. Jim Lewis. He will chair our Internal Advisory Board (p. 11). The Mathematics Department at the University of Iowa received the award in 2005 when chaired by co-PI and Arts and Sciences Dean David Manderscheid. The ADVANCE-NE Office will build on this expertise to provide professional development workshops for women STEM faculty and STEM department chairs, coordinating and focusing efforts to increase retention and advancement of women STEM faculty. As a result of the high interest on campus, PI Barbara Couture is leading the application on UNL's behalf to the University of Washington's ADVANCE program to host the 2009 Leadership, Excellence for Academic Diversity (LEAD) workshop for STEM chairs and other leaders.

## **NATIONAL AND CULTURAL CONTEXT**

The barriers we identified at UNL, based on all of our meetings and data analysis, are common across STEM disciplines throughout academia (e.g., Xie & Shaumann 2003; Rosser 2004; Beyond Bias and Barriers, 2006). Handelsman and others (2005), including ADVANCE-IT awardees, recognize four principal barriers to women's advancement in STEM fields: the availability of women candidates (the pipeline); departmental climate; implicit biases; and life-work balance (see also Martinez et al. 2007). These barriers arise from 1) institutional policies that assume scientists have no dependent care responsibilities: "the ideal worker norm" (Bielby 2000; Britton 2000; Reskin 2003; Williams 2000), 2) gendered cultural expectations about science (Fox 2001; West & Zimmerman 1987), and 3) individual implicit (cognitive) biases (Ridgeway & Correll 2004; Valian 1999).

Institutional transformation is challenging. Ridgeway (1997) recognized the persistence of gender-based hierarchies even when multiple efforts were used to dismantle them. Risman (2004) described three dimensions or "levels" of social structure (institutional, cultural ["interactional"], and individual) that both reflect and create our beliefs about appropriate behavior for men and women. These beliefs give rise to the complex of barriers that women must navigate to be successful in STEM in academia (Ledin et al. 2007). Risman showed that the levels are dynamically interrelated and mutually reinforcing. Designing programs that address all levels is essential for institutional transformation. Our proposed program addresses our identified barriers at all three levels. Other NSF-ADVANCE institutions have used a similar multilevel approach, recognizing that gendered processes at any level at any time can override one another (e.g., Iowa State [Bystydzienski & Bird 2006] and the University of Rhode Island [Mederer, Sherwood & Silver 2007]).

## **CURRENT STATUS OF WOMEN AT UNL**

We initially focus on and present data from the 13 departments at UNL with academic and administrative structures that are most accessible to the ADVANCE proposal team: six in the College of Arts & Sciences and seven in the College of Engineering in Lincoln. In Year 2, the program will be expanded to the remaining three engineering departments in the College that are housed in Omaha. In Year 3, we will plan the adaptation and implementation of the ADVANCE program to STEM departments in the Institute for Agricultural and Natural Resources (IANR), and implement in Years 4 and 5. We use this phased implementation to take into account the individual needs and cultures of the differing units, while continuing to learn and improve the program with progressive experience (see "Implementation Time Line", p. 14).

To determine the barriers for women's advancement at UNL and thus target strategies for recruitment and retention appropriately, we compiled data on faculty gender, age, and rank for STEM departments in the colleges of Engineering and of Arts & Sciences (Table 1), and on the applicant pools for openings in these colleges over the last year (Table 2). The proportion of female faculty in the College of Engineering is comparable to the national average of 9 percent in 2003 (Chubin et al. 2005) and has not changed in the College since 2001. For Arts & Sciences, the proportion of STEM faculty women is comparable to national data compiled by Nelson (2007) for these six departments (combined). Biological Sciences rates higher than the national average. The departments of Mathematics and Computer Sciences have proportions of women equal to national averages for those disciplines. We conclude from these data that these departments are already exercising strategies to recruit and retain women and that UNL is capable of fostering women in STEM. The national average for women in STEM departments is a low target, however, and we can improve.

**Table 1.** Gender distribution by rank in each target college at UNL for academic year '00-01 & '05-06.

	Assistant		Associate		Full		Total 2001	Assistant		Associate		Full		Total 2006
	F♀	M♂	F♀	M♂	F♀	M♂		F♀	M♂	F♀	M♂	F♀	M♂	
A&S	5	23	5	33	6	73	145	7	25	10	34	7	72	155
Eng	6	23	3	48	0	32	112	2	22	6	47	3	47	127

Most women on the STEM faculty in both colleges are of Associate Professor rank (Table 1). The proportion of women at both Assistant and Associate Professor ranks has grown in Arts & Sciences since 2001, but the proportion at Full Professor rank has remained constant (8 and 9 percent, 2001 and 2006, respectively). In the College of Engineering, the numbers of women faculty at Assistant Professor rank have declined, in part due to promotions, but these have not been replaced with new female hires. The numbers of women in Associate and Full Professor ranks in the College of Engineering have increased moderately: for the Associate Professor rank, the numbers doubled, but only from three to six women. The number of Full Professors increased from 0 to 2 women. An examination of women faculty's flux into, within, and out of the two colleges (Fig. 2) indicates a loss of five STEM women from UNL, but one of

**Table 2.** Percent of women in applicant pools for open searches compared to that of PhD pools.

	U.S. PhDs, '05	UNL Applicant Pool, '06
Arts & Sciences*	30%	12%
Engineering**	16%	14%

\*Biological Sciences, Chemistry, Computer Sciences, Geosciences, Mathematics, Physics (8 positions).

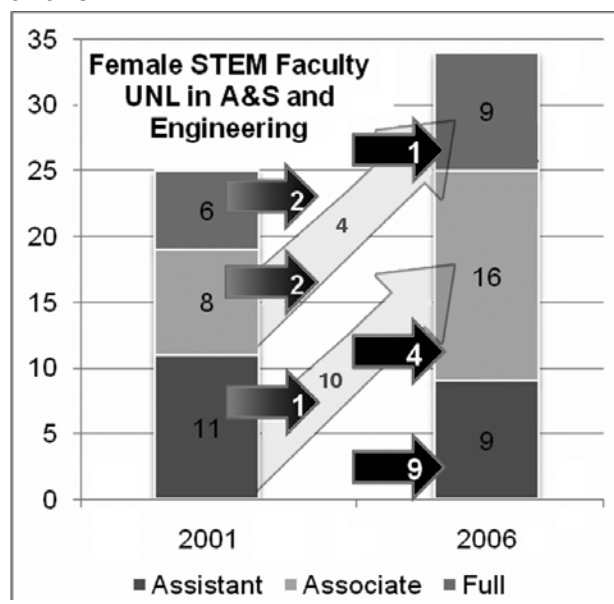
\*\*Electrical Engineering, Construction Management (2 positions).

these was a promotion to administration and one was a retirement. In exit interviews with women who left UNL STEM departments before and after tenure between 2001 and 2006, the following reasons for leaving were identified: the lack of uniformly applied, flexible work arrangements, on-campus child care facilities, and dual career partner accommodation. In addition, some departments still harbor a chilly climate for women as revealed by a focus group of 20 STEM women faculty in 2004. Our proposed programs are designed to address chilly climates in departments and marginalization of women in STEM by mapping formal and informal network structures and using network maps to design informal networking programs.

UNL successfully promotes and tenures women in STEM: 10 out of 11 women Assistant Professors in UNL STEM departments were promoted to Associate Professor with tenure between 2001 and 2006 (Fig. 2). Although unequal salaries are an issue for many women in STEM nationwide (MIT Report 2002), data from UNL's Institutional Research and Planning reveal no statistically significant differences in salary between men and women in either college. Salary differences can present huge barriers for STEM women's sense of a welcoming climate and we are proud that we do not at this time have to address salary inequities to women who are already here. ADVANCE-NE will continue to track salary levels of faculty in STEM.

Our applicant pools for open searches have lower proportions of women applicants than the national doctoral recipient pools, especially for departments in the College of Arts and Sciences (Table 2). These

**Figure 2.** The horizontal arrows on the left indicate departures between 2001 and 2006 (out of boxes); the horizontal arrows on the right indicate hires (into boxes). Promotions are indicated by upward arrows.



data support what many of us at UNL suspect – that we are not attracting diverse talent to all departments. At our exploratory meetings, department chairs urgently expressed the need for assistance to attract top, diverse talent. Our proposed RECRUIT-NE Committee is designed to aid us in diversifying our applicant pools.

**TABLE 3.** UNL faculty in STEM departments of the Colleges of Arts & Sciences and Engineering with partners in academic positions at UNL.

	% ♂ w/partner in Dual Career position at UNL	% ♀ w/partner in Dual Career position at UNL	% of partners of ♂ in Dual Career at UNL who are tenure- track	% of partners of ♀ in Dual Career position at UNL who are tenure-track
Arts & Sciences	14%	40%	19%	64%
Engineering	2%	11%	50%	100%

To assess if our limited Dual Career policies inhibit women applicants, STEM department chairs compiled data on the proportion of tenure-track faculty with academic partners in their departments (Table 3). Nineteen percent of the male faculty has an academic partner compared to 64 percent of the women faculty. Of these academic partners, two-thirds of males’ partners are in tenure-track positions; three-fourths of female partners are. Most recent hires of women in STEM departments have occurred with some accommodation for an academically careered partner, which has been accomplished largely through a patchwork of decentralized efforts by interested faculty, department chairs, deans, and central administration. That some departments are more successful at attracting and hiring dual careered partners (e.g., Mathematics and Biological Sciences), suggests that the community of Lincoln itself (with limited employment opportunities for academic spouse/partners) is not a barrier if the university is more proactive regarding partner hiring. These data show that UNL is fertile ground for our ADVANCE program.

**BARRIERS FOR WOMEN’S ADVANCEMENT: WHY THEY PERSIST; PROGRAMS TO ADDRESS THEM**

From an analysis of our data and from campus-wide discussions, we have identified five principal barriers to women’s full inclusion in UNL STEM departments. One over-arching barrier that we perceive is the lack of a centralized office to coordinate diverse efforts and disseminate information among the faculty and administration. To address this lack of coordination, we will create an ADVANCE-NE Office with co-PI Holmes as Director. The Office will coordinate recruitment- and retention-enhancing activities, disseminate information to the campus and the academic community at large, monitor, and evaluate ADVANCE-sponsored programs, and serve as liaison for diversity-focused activities on campus. (See “Program Management” for details on the operation of the Office.)

**BARRIER #1: LIMITED AND INCONSISTENT DUAL CAREER PARTNER POLICY.**

**Why it Persists:** UNL supports qualified dual career hiring, but it is not easy to implement, primarily due to: 1) short time span to put an offer together after discovery of a Dual Career Opportunity, 2) no straightforward mechanism for information flow across departments and colleges when Dual Career Opportunities arise, and 3) lack of funds to provide a competitive salary and startup for qualified Dual Career Opportunities.

**Proposed Programs to Address Barrier:** 1) To address the short time span we will inform all applicants of dual career policies as soon as the application is complete. The mechanisms to effect this program will be a) the ADVANCE-NE Office and b) the RECRUIT-NE Committee. The Project Director will establish a Higher Education Recruitment Consortium (HERC) to broaden the possibilities for non-academic positions in the Lincoln area. A HERC is a cooperative agreement among local businesses, the school system, and colleges to mutually advertise positions to attract Dual Career partners. The Assistant to the Chancellor for Equity, Access and Diversity Programs (EAD) will include ADVANCE-NE promotional material on the HERC and on UNL Dual Career Opportunities for each applicant.

2) To provide a mechanism for information flow, the Project Director will serve as a point person to coordinate Dual Career Opportunities for qualified partners seeking an academic position in a department and/or college that was not the target of the search. We anticipate 10 to 15 searches in the target STEM

departments each year. Hiring plans for the upcoming academic year are formalized in April of the preceding year by PI Barbara Couture's Office (Office of the Senior Vice Chancellor for Academic Affairs) and searches in target STEM departments will be relayed to ADVANCE-NE Director Holmes. The EAD office will notify Dr. Holmes of short list candidates. Following Michigan's STRIDE example, subsets of the RECRUIT-NE Committee will meet with each short-listed candidate to further explain the Dual Career policy in a general way without violating restrictions on direct questions about personal issues. In addition, the Project Director will meet with each short-listed candidate for further clarification and discussion of the policies.

3) Funding for bridge hires for qualified dual career partners will be pooled among the allocation provided by the Chancellor, proportionately matched funds managed through the Senior Vice Chancellor's office provided by the colleges and hiring departments, and the NSF-ADVANCE cooperative agreement. Startup funds will be provided, estimated at \$117,650 for each qualified partner, by the Vice Chancellor for Research's office, the colleges, and departments (see letter). The Vice Chancellors have pledged funds to continue this program for five years beyond the life of the cooperative agreement to ensure sustainability.

**Institutional Transformation Effected by these Programs:** Resolving UNL's Dual Career barrier by providing a point person to facilitate negotiations among constituent units will increase recruitment as well as retention of women at UNL, as post-tenure women have continued to leave because of the lack of a position for a qualified dual career partner. Three times as many women faculty as men at UNL have a partner who is an academic (64 percent v. 19 percent). The last several offers to women for tenure-track positions in Arts and Sciences included a Dual Career opportunity partner. Unfortunately, Dual Career hires were successful only when both partners were hired in the same department, again substantiating the need for better coordination through the ADVANCE-NE Office.

***BARRIER #2: A PERCEIVED LACK OF FAMILY-FRIENDLY POLICIES AND FLEXIBLE WORK ARRANGEMENTS.***

**Why it Persists:** 1) Faculty and chairs do not always know about family-friendly policies (FFPs; such as parental leave) and Flexible Work Arrangements (FWAs; such as stop-the-tenure clock) because of the lack of a centralized office to disseminate this information; 2) Faculty are intimidated from using FFPs/FWAs, in part because "no one has used them before" and Assistant Professors, in particular, fear that taking advantage of these policies will lead to them being perceived as not serious about their research and scholarship (Drago et al. 2006; Kirby & Krone, 2002).

**Proposed Programs to Address Barrier:** 1) To raise awareness of FFPs/FWAs, the Director of ADVANCE-NE will centralize efforts of the President, the Chancellor, the Senior Vice Chancellor and the Chancellor's Commission on the Status of Women to compile and widely disseminate these policies. 2) To overcome intimidation, the PROMOTE-NE Committee (see below) will meet with faculty evaluation committees to foster a campus-wide philosophy that encourages the use of FFPs/FWAs. This can be successful because the Chancellor, through the Office of the Senior Vice Chancellor of Academic Affairs, will implement the policies and by doing so, communicate support from the highest levels of the administration to faculty and prospective faculty.

**Institutional Transformation Effected by these Programs:** Individuals alone may find ways to accommodate gendered inequity in academia, but this leaves the system unchanged (West & Zimmerman 1987; Rideway & Correll 2004). We will transform the institution's implementation and dissemination of FFPs/FWAs. To prevent FFPs/FWAs from generating negative reactions from colleagues, we will ensure that a clear, consistent message from top administrators encourages their use (Kalev et al. 2006; Reskin 2003). The unifying tasks of male and female faculty working together on RECRUIT-NE and PROMOTE-NE committees and with Recruitment Ambassadors will reduce the impact of bias at the interactional level (Snyder 1979). In this process, faculty will learn to expand their beliefs regarding ideal workers (Williams 2000), thus reducing the impact of gender bias at the individual level.

***BARRIER #3: UNDER-RECRUITMENT OF WOMEN INTO APPLICANT POOLS IN STEM DEPARTMENTS.***

**Why it Persists:** 1) Many STEM faculty underestimate the number of women receiving PhDs in their fields and do not know from which institutions these PhDs come, and many faculty are unaware of Best Practices (e.g., Moody 2004) to recruit women, including aggressive recruitment at national meetings, 2) faculty do not know female colleagues who may be potential recruits, and few potential candidates are aware of what a great place UNL is to work, and 3) some faculty see no value in increasing the diversity of their applicant pools.

**Proposed Programs to Address Barrier:** We will enact three programs: 1) To educate faculty on numbers of women PhDs and Best Practices for recruitment, we will establish a RECRUIT-NE Committee. This committee of six faculty members (five members and a chair) is modeled after U-Michigan's STRIDE Committee (Mukasa et al. 2004). RECRUIT-NE will a) compile and disseminate information to faculty at department meetings (by invitation) and to search committees (required by the Office of the Senior Vice Chancellor for Academic Affairs) on the composition of national applicant pools and on Best Practices to recruit more women, b) meet with each short-listed candidate to ensure the candidate is aware of the Dual Career and FFP/FWA policies and to discuss concerns about these when the candidate initiates such discussion, and c) select a Recruitment Ambassador from each target STEM department to assist with recruitment of women.

2) To acquaint faculty with potential women candidates, and to acquaint potential women candidates with UNL, the Office will disseminate grants to departments to bring in women speakers for "Showcase Visits" to increase the likelihood that women who might not otherwise consider UNL and apply for positions. The Vice Chancellor for Research has agreed to fund these visits (see letter). Most visitors are pleasantly surprised when they visit Lincoln and find it a great place to live and raise a family. Readers of *The Scientist* rated UNL eighth in the magazine's annual "Best Places to Work in Academia" rankings (Oct. 2007). In addition, to assist with Best Recruiting Practices, the ADVANCE-NE Office will help departments disseminate ads in more diverse venues. The Office's webmaster will help ensure that UNL ranks high on web searches for universities with FFPs/FWAs in the design of the website.

3) To enhance buy-in from faculty that currently see no advantage to diversifying their applicant pools, departments will be rewarded for reaching one or more of the ADVANCE-NE goals with an ADVANCE-NE grant. These funds of up to \$4,000 per grant will be used to expand diversity-enhancing activities, such as attending more conferences. or inviting women from industry to visit UNL as speakers. Departments can experiment with the funds and the Office will assist them in evaluating what works most effectively for that discipline/department. In addition, the Chancellor will give an annual award for the department that achieves the greatest strides towards faculty diversity (see letter).

**Institutional Transformation Effected by these Programs:** Both Michigan and Virginia Tech interviewed first-round ADVANCE-IT awardees and found "disappointing outcomes" for recruitment interventions due to resistance by department chairs (ADVANCE PI Meeting 2006). In striking contrast, the combined STEM chairs of the colleges of Arts & Sciences and of Engineering at UNL heartily support this program (see letters from all target Chairs and Deans) and several have already volunteered to serve on the RECRUIT-NE Committee. Significantly, because of the activity of the Office of the Senior Vice Chancellor for Academic Affairs, these chairs are aware of the institutional commitment at UNL to the ADVANCE goals. The successful implementation of programs developed by the RECRUIT-NE Committee will help transform the institution by changing the way we approach and conduct searches. ADVANCE-NE grants are expected to help reluctant departments see the value of incorporating these practices. These programs will expand ideas about who makes a good scientist/engineer by exposing faculty and students to a wider range of women in STEM.

***BARRIER #4: LACK OF RETENTION OF WOMEN ABOVE ASSISTANT PROFESSOR RANK***

**Why it Persists:** 1) Climate issues: some women faculty feel isolated and disconnected from information flow and some women sense a chilly climate in their departments. This isolation is more common among women than men faculty (e.g., Handelsman et al. 2005; Rosser 2004). This is true at UNL as well, as we learned from focus groups of women STEM faculty; 2) limited application of FFPs/FWAs and Dual Career partner policy (discussed above).

**Proposed Programs to Address Barrier:** Two programs will be designed and implemented to address women's lack of connection: 1) A network study will help UNL identify what networks promote greatest productivity and job satisfaction (see discussion below); 2) We will build on the informal networking and professional development opportunities already available on campus by adding two additional informal networking opportunities: Luncheons with visiting and on-campus speakers (Yen et al. 2007) and week-long writing retreats with writing coaches (O'Connell & Holmes 2007). UNL already has a nationally recognized program for improving writing for students that will be expanded to include faculty. As faculty participants work together on improving their technical writing skills, mutual faculty development and networking will emerge in an informal atmosphere (O'Connell & Holmes 2007). Informal networking is an effective way to advance junior faculty (Blake-Beard 2001).



In addition, the ADVANCE-NE Office will hold workshops for chairs of STEM departments. One workshop per year will be conducted by a chair who has been successful at promoting women on campus (such as Dr. Jim Lewis, Mathematics and Dr. Jack Morris, Biological Sciences). When we identify beneficial types of networks from network analysis (see below), chairs of those departments will be identified and the strategies they used or observed will be shared via the chair workshops. Deans will hold their chairs responsible for ensuring that all faculty in Associate Professor positions are encouraged to seek promotion based on explicit benchmarks and timelines(see letter from Deans).

**Institutional Transformation Effected by these Programs:** Dissemination of FWAs and opportunities to expand networks and eliminate isolation will contribute to a more positive climate for all faculty on campus. Network mapping and analysis (see below) will delineate what types of networks foster success for women faculty. Departments with positive networks will be used as models to inform how such networks can be replicated in other departments.

**BARRIER #5: IMPLICIT BIAS AND MISCONCEPTIONS OF WOMEN IN STEM FIELDS.**

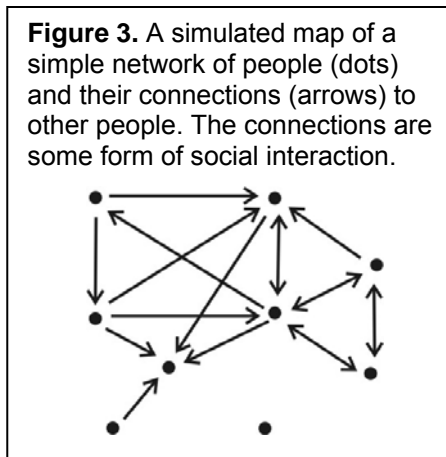
**Why it Persists:** The causes for this barrier are similar to those for lack of retention (#4), but we recognize an additional cause: difficulty for men and women to recognize their own implicit gender biases and their cumulative impacts.

**Proposed Program to Address Barrier:** To educate faculty about the impact of implicit gender bias, we will establish a PROMOTE-NE Committee of five faculty members (and a chair) who express interest in learning about implicit biases and developing strategies to reduce their impact on decision making. The committee will have two functions: a) to compile strategies from research on implicit associative biases that can affect evaluations and b) to produce promotional materials to present to all Promotion & Tenure committees. The Office of the Senior Vice Chancellor for Academic Affairs will require P&T committees to have this training. In addition, the PROMOTE-NE Committee will meet with chairs and faculty at workshops, and by invitation to departments at faculty meetings or colloquia. Because the literature on applicant pool data by discipline is so distinct from data on evaluation bias, we divide these tasks between the RECRUIT-NE and PROMOTE-NE committees. During a chair and PROMOTE-NE training session, Dr. Joyce Yen, Program/Research Manager of the University of Washington's ADVANCE Center for Institutional Change and a trained IAT administrator, will administer the Implicit Association Test (IAT; Greenwald et al. 1998; Nosek et al. 2007), a cognitive science tool that reveals implicit, associative biases to participants (see letter), in order to "ready" the participant for subsequent implementation of change.

**Institutional Transformation Effected by these Programs:** PROMOTE-NE will help to reduce the impact of bias at UNL. The requirement by the Office of the Senior Vice Chancellor for Academic Affairs that Tenure & Promotion committees meet with PROMOTE-NE demonstrates institutional buy-in: the administration will hold faculty accountable for increased recruitment, retention, and promotion of women STEM scientists regardless of individual implicit biases. We expect that this committee will promote consistent and fair evaluations, and thus more women in target departments. The communal ADVANCE efforts will establish practices that encourage more women to join and lead STEM departments at UNL.

### Network Analysis Study

Network analysis will advance basic understanding of the organizational structures influencing promotion and retention of women in STEM departments. Network Analysis is the statistical analysis of data to identify network structure. Network Structure is the pattern of ties among individuals in a network (Fig. 3). The structure of a network will reveal who is connected to whom, to what degree and in what capacity. We can distinguish faculty who are well connected from those who are more isolated. We can also identify the overall level of connectedness of an entire department. Network Mapping is a survey instrument that queries each faculty member on the presence and strength of a connection to other faculty members. We will examine three types of network connections and the strength of these connections: 1) research collaborations on publications and grants, 2) informal



mentoring, such as teaching advice and reading research manuscripts, and 3) social connections, such as sharing meals. These connections will be identified and mapped using a survey that provides the respondent with a list of all faculty in their department and with blanks that allow the addition of faculty outside of their department. Network analysis is the calculation of measures of network structure at the individual level, such as centrality (number of ties within the network) and eigenvector centrality (the number of ties that are close to resource-providers), and at the departmental level, such as density (the percentage of possible network ties that are actual network ties) and clustering (the extent to which network ties are segmented into partitions or subgroups based on actor commonalities (e.g., gender).

We theorize, building on Ibarra (1993) and McGuire (2000) that individual and department-level network structures play crucial roles in promotion and retention of women in STEM. Research in non-academic settings shows network structure is associated with worker productivity and work climate perceptions (Reagans & Zuckerman 2001; Brass et al. 2004; Wasserman & Faust 1994; Cummings & Cross 2003). Productivity and organizational climate should increase the probability of retention and promotion. A person's *position* in a network and the overall structure of the network presents opportunities but also imposes constraints on behavior and shapes individuals' perceptions of their work climates (Wellman 1988; Wasserman & Faust 1994; Pescosolido & Rubin 2000; Brass et al. 2004; Friedkin 2004; Kilduff 2006).

Data show that women in STEM departments perceive lower levels of inclusion in departmental networks, have lower rates of productivity and fewer positive perceptions of organizational climates (Plant & Devine 2003; Turner & Meyers 2000; Etzkowitz et al. 2000; Fox 2001 & 1996; Cole & Zuckerman 1984; Xie & Shauman 1996). However, we are aware of no research that has empirically tested the association between network structure, academic departmental climate and productivity of faculty in STEM departments. Although formal and informal networks are presumed to be critical in promotion and retention, we are aware of no systematic research that elucidates what type of network structure predicts these outcomes and fosters academic success. We will:

1. *Identify faculty network structures that are most conducive to high faculty productivity and positive perceptions of departmental climates.* We expect three positional characteristics to be important: connectivity, nestedness, and centrality. Faculty members with higher levels of these characteristics will be more productive and perceive a more welcoming climate. We expect three departmental network characteristics to be important: cohesion, hierarchy, and clustering. We expect departments with high cohesion, low hierarchy, and low clustering to be most productive.
2. *Identify gender variation in faculty members' position in their departmental network.* Women in departments with a poor climate should have low levels of connectivity, nestedness, and centrality.
3. *Identify gender variation in the effect of network structure on faculty productivity and climate perceptions.* We expect that departments with low cohesion, high hierarchy, and high clustering will have a more negative effect on women than on men. Furthermore, the benefits of having high levels of connectivity, centrality, and nestedness may not be larger for men as compared to women.

Social network theory use is gaining favor across disciplines. Using network analysis will help us identify programs that enhance retention and promotion of women in STEM and aid in institutional transformation. Mapping departmental networks will provide departments with a visual representation of these connections and an objective and visually intuitive means of identifying "problem areas." Furthermore, knowing the network structure of the STEM departments with inclusive and productive climates will provide baseline data from which to help inform future ADVANCE programs.

The survey will be administered by UNL's Bureau of Sociological Research. Data will be analyzed by Dr. Christina Falci, Assistant Professor of Sociology, with consultation by Dr. David Knoke, Professor of Sociology at the University of Minnesota. Dr. Knoke is a nationally recognized expert on social network analysis within organizations having written a textbook on network analysis of corporations (see Budget Justification, Consultants). We will use the following software programs to analyze and graphically display faculty network structures: Pajek UCINET, and SAS (PROC IML, matrix language programming) software. Network structure measures will be correlated with climate survey results from the COACHE survey (see Evaluation Plan) and faculty productivity (measured by papers published and grants funded that is collected annually by departments for the purposes of annual evaluations).

## PROGRAM MANAGEMENT

ADVANCE-NE **Principal Investigator**, Senior Vice Chancellor for Academic Affairs Dr. Barbara Couture, is the UNL Chief Academic Officer and Professor of English. ADVANCE-NE **Project Director**,

Co-PI Mary Anne Holmes, will report directly to the PI. Dr. Holmes has been selected because of her expertise with issues women face in higher education: she successfully completed an ADVANCE-Leadership award and is Co-PI with Suzanne O'Connell of Wesleyan University on an ADVANCE PAID award. For these awards, Holmes and O'Connell have organized a nationally attended workshop entitled "Where are the Women Geoscience Professors?" and a writing retreat for women geoscientists in the northeast U.S. In addition, Holmes is a past president of the Association for Women Geoscientists. The ADVANCE-NE Office will be housed in the Canfield Administration Building, home to UNL's central administration, which will provide easy access to senior administrators and give the Office high visibility.

The **Co-PIs** – Stephanie Adams (College of Engineering Associate Dean of Undergraduate Education and Associate Professor of Industrial and Management Systems Engineering), Dr. Holmes (Associate Professor of Practice in Geosciences), David Manderscheid (Dean of the College of Arts and Sciences and Professor of Mathematics), and Julia McQuillan (Director of the Bureau of Sociological Research and Associate Professor of Sociology) – will advise the PI about strategic direction for activities, budget allocation, and help monitor overall performance in pursuit of program objectives. Drs. Adams and Manderscheid are Co-PIs because they are in positions to implement ADVANCE objectives within their respective colleges. Dr. McQuillan, as Director of BOSR, will provide the sociological perspective needed to guide and implement the ADVANCE program. Dr. Couture will meet quarterly with the Co-PIs. The Co-PIs also will serve on the Internal Advisory Board.

Tactical ADVANCE-NE activities will be coordinated and implemented by Project Director Holmes. She will direct the Office, serve as point person on campus for Dual Career Opportunity hires when they occur across departments and/or colleges, coordinate RECRUIT-NE and PROMOTE-NE, organize workshops for faculty development and chairs, organize writing retreats, disseminate information on ADVANCE-NE activities and FFP/FWA policies, and distribute funds to departments for visiting speakers and Recruitment Ambassadors. She will supervise a half-time **web developer** who will create/maintain the ADVANCE-NE website and a full-time **staff assistant** who will provide administrative support.

The **Internal Advisory Board (IAB)** will be composed of the Co-PIs (except for the Project Director) and other senior UNL STEM faculty. The IAB's primary responsibility will be to provide leadership, advice, feedback, and support to the PI and Project Director and meet quarterly as they develop and implement the project's activities. They will select members for the RECRUIT-NE and PROMOTE-NE committees, Recruitment Ambassadors, and department awardees of ADVANCE-NE grants. Dr. Jim Lewis (Professor and former Chair of the Department of Mathematics; see letter) will serve as chair of the IAB. The following faculty have agreed to serve on the board: Sally McKenzie (Professor, Plant Genetics and Project Leader of the Plant Science Initiative), Judy Walker (Professor of Mathematics), Sherilyn Fritz (Professor of Geosciences), M. Susan Hallbeck (Professor of Industrial and Management Systems Engineering), Jerry Hudgins (Professor and Chair of the Department of Electrical Engineering), Susan Fritz (Associate Vice Chancellor, Institute of Agriculture and Natural Resources), and Margaret Jacobs (Professor of History and Director of Women's Studies; see letter).

The **External Advisory Board (EAB)** will provide guidance to the PI and input on the evaluation process. The EAB will meet annually, and the PI will also seek advice from EAB members as needed. The following individuals have agreed to serve on the EAB (see letters): Shirley Malcom (Head, Education and Human Resources, American Association for the Advancement of Science), Karan L. Watson (Associate Provost and Dean of Faculty at Texas A&M University), Joyce Yen (Program/Research Manager of The University of Washington's ADVANCE Center for Institutional Change), Donald Tomaskovic-Devey (Professor and Chair, Department of Sociology, University of Massachusetts), and Carol Muller (CEO of MentorNet). These members are nationally known in their fields and have extensive experience in areas related to ADVANCE-NE. Dr. Joyce Yen, nationally recognized as a leader in ADVANCE efforts, is an alumna of UNL's Mathematics Department and is the recipient of a Distinguished Alumna Award in 2004.

## Evaluation Plan and Methodology

**Evaluation Team.** The **internal** Evaluation Team will be directed by Nancy Busch, Associate Dean and Professor of Libraries. Dr. Busch has conducted evaluations of multi-year, large-scale programs (e.g., Kellogg Foundation and Institute of Museum and Library Service grants), served on U.S. Department of Education Advisory Committees, and taught graduate-level Research and Survey Methods. She will work with Dan Hoyt, Director of UNL's Survey, Statistics, and Psychometric Core Facility (SSP); Julia

McQuillan, Director of the Bureau of Sociological Research (BOSR); Mindy Anderson-Knott, SSP Core Facility Manager; Christina Falci, Assistant Professor of Sociology; and William Nunez, Director of Institutional Research & Planning (IRP; see letter). Overall data management will be coordinated by Anderson-Knott. Specific data collection activities, including surveys, exit interviews, and formative assessment, will be conducted by BOSR, UNL's primary survey data unit with extensive experience in survey research. The Evaluation Team will develop and manage the evaluation process and organize data collection. The Team will bring in **external evaluator** Dr. Ann Austin of Michigan State annually for an independent review of the evaluation process and outcomes. Dr. Austin will also conduct a summative evaluation at the close of the project (Year 5) to assess the program's overall success (see letter).

**Evaluation Framework.** Initiative evaluation, a systems-oriented approach to evaluating social change efforts (W. K. Kellogg Foundation 2007) will serve as the framework for the evaluation. The fundamental elements of initiative evaluation include exploratory, predictive, self-organizing, and initiative renewal evaluations. These elements include both formative and summative evaluations and, combined, will provide a cohesive model for approaching assessment of this project. We will use quantitative and qualitative methods to measure the impact of each program component and changes related to the five objectives. These are summarized by objective in Table 4. Indicators from the ADVANCE Proposed Toolkit for Reporting Progress (2005) will be used to track short-term and long-term progress. Evaluation results will be disseminated on the ADVANCE-NE website; in appropriate, peer-reviewed journals; and locally through press releases to campus, city, and state newspapers.

**COACHE Survey:** COACHE (the Collaborative on Academic Careers in Higher Education) is a survey used by colleges and universities to gather peer diagnostic and comparative data. The core element of COACHE is an electronic survey, administered by COACHE, which takes 20 to 30 minutes to complete online. This survey asks faculty to assess their experiences regarding promotion and tenure, the nature of their work, policies and practices, and the general climate, culture, and level of collegiality of their departments and campuses. Confidentiality of participants will be assured because no disaggregated data will be presented for any subset of fewer than five respondents. COACHE has agreed to provide identified data for the sole purpose of linking the network study data with that from the COACHE survey. We selected COACHE because we can obtain comparative data of our peer institutions through COACHE, COACHE will administer the survey and tailor it to suit our needs, several other ADVANCE institutions use the survey, and the survey has been tested over a five-year period.

**Network Mapping Survey:** The network mapping survey will be an additional, short survey sent to UNL faculty in STEM departments to learn who interacts with whom and in what ways. In addition, participants will be asked to provide data on productivity. In preparation for this project, UNL piloted the Network Analysis instrument as a web survey with faculty in the geosciences and psychology departments. Departmental participation was high (87 percent of faculty completing the survey). Network surveys will provide data to create maps of network structures among faculty; the COACHE survey will provide data on job satisfaction/perception of climate. In addition, the results of the COACHE and network surveys will allow us to evaluate changes in the UNL climate over time.

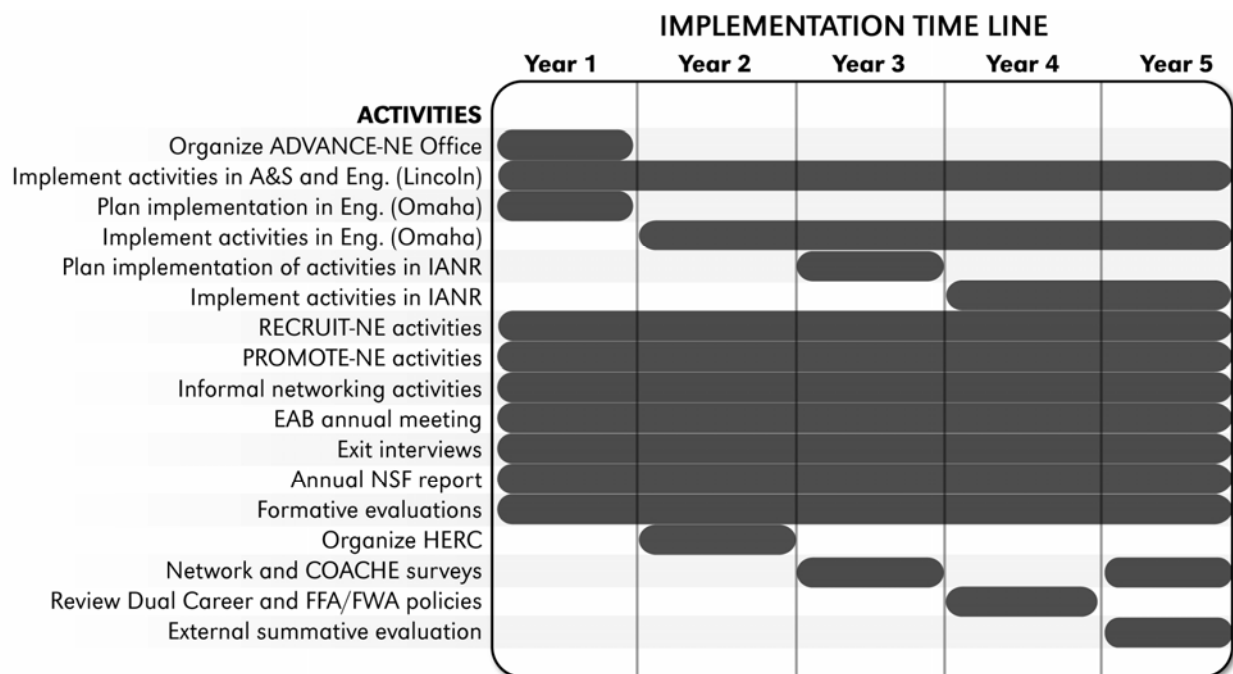
**Post Search Surveys and Exit Interviews.** To aid in understanding the extent to which implicit biases affect the recruitment process, BOSR will survey all search committee chairs and short-list candidates for STEM department positions about the search process. In addition, BOSR will conduct exit interviews of all STEM faculty members leaving UNL and with chairs of the respective departments. Demographic data on gender, ethnicity, and age will be cross-referenced with variables such as length of employment, reason for leaving, and COACHE data (factors affecting job satisfaction, job termination, and the extent of any perceived discrimination).

**Institutional Data.** To ensure gender equity, the PI and Co-PIs will work with UNL's Institutional Research and Planning (IRP) office to create an annual report of STEM statistics on hiring, promotion, salary equity, and other data relevant to the status of women faculty. This resource will be maintained throughout the project for use in evaluation and is intended to become a permanent resource for future institutional evaluation of gender and diversity goals. The internal Evaluation Team along with the PI and Co-PIs will work with chairs and the Office for Equity, Access and Diversity Programs to track demographics of the applicant pools for faculty positions. An inventory of lab and office space; lab, office, computer and other equipment; and human and other resources will be conducted by the IRP in Year 1 and repeated in Years 3 and 5. Inventory results will be disseminated to departments and administrators.

**Table 4. Evaluation Summary.** Proposed Toolkit for Reporting Progress Toward NSF ADVANCE: Institutional Transformation Goals. Prepared by ADVANCE Institutional Transformation Indicators Working Group. January 2005.

Program Elements	Anticipated Outcomes	ADVANCE Indicators	Evaluation Methods
<b>RECRUIT-NE: Increase the number of women faculty recruited into STEM departments.</b>			
<ul style="list-style-type: none"> <li>• Compile and Disseminate information on FFPs/FWAs</li> <li>• Optimize and Disseminate Dual Career Policies through Office Director as “point person” for negotiation</li> <li>• Startup Funds for Dual Career hires</li> <li>• Recruitment Ambassadors</li> <li>• Showcase Visits</li> <li>• ADVANCE Recruitment Grants</li> <li>• Chancellor’s Outstanding Achievements in Enhancing Diversity Award to a STEM Department</li> </ul>	<ul style="list-style-type: none"> <li>• Increased women applicants in STEM</li> <li>• More female STEM hires</li> <li>• Increased awareness of barriers to the recruitment of women in STEM departments</li> <li>• Increased activities by departments to diversify their applicant pools</li> <li>• Departments will see value in diversifying their faculty</li> </ul>	<ul style="list-style-type: none"> <li>• # of tenured and tenure-track faculty by department, rank gender, and race/ethnicity (A)</li> <li>• # of non-tenured men and women faculty (P)</li> <li>• # of faculty hired by rank, gender, and race/ethnicity department (A)</li> <li>• Study of salary and start-up packages of newly hired faculty by gender and race/ethnicity (P)</li> </ul>	<ul style="list-style-type: none"> <li>• Post-event evaluations</li> <li>• Review of recruitment plans</li> <li>• Monitor use of grants</li> <li>• Post search surveys</li> <li>• Hiring, start-up, faculty, and salary data from IRP</li> <li>• COACHE survey</li> </ul>
<b>PROMOTE-NE: Increase retention of senior women faculty in STEM departments and increase their promotion into positions of leadership.</b>			
<ul style="list-style-type: none"> <li>• Education for Promotion and Tenure Committees on implicit bias and strategies for minimizing their effects</li> <li>• Professional development workshops for STEM faculty and chairs</li> <li>• Coordinate informal faculty and networks</li> <li>• Chair workshops</li> </ul>	<ul style="list-style-type: none"> <li>• Increased retention of women in STEM departments</li> <li>• Awareness of need to address climate issues</li> <li>• Awareness of impact of gender stereotyping and implicit bias</li> <li>• Improved climate in STEM departments</li> <li>• Increased research activity by women STEM faculty</li> <li>• More women applying for and selected for leadership positions</li> <li>• More women receiving promotion and tenure in STEM departments</li> </ul>	<ul style="list-style-type: none"> <li>• # of faculty who leave their departments by rank, gender, and department (A)</li> <li>• Salary study(P)</li> <li>• Space allocation study of STEM faculty by gender (P)</li> <li>• # of faculty who submit tenure or promotion packets, and number awarded by gender and department (A)</li> <li>• # of tenured Associate Professors by department and gender with years-in-rank (A)</li> <li>• Number of STEM faculty in leadership positions (A)</li> </ul>	<ul style="list-style-type: none"> <li>• STEM COACHE Survey</li> <li>• Network Mapping Analysis</li> <li>• Track faculty development activities</li> <li>• Post-event evaluations</li> <li>• Performance evaluation</li> <li>• IRP data</li> <li>• Interviews with P &amp; T Committees</li> <li>• Exit interviews with faculty and chairs</li> </ul>

(A)=ANNUAL; (P)=PERIODIC



\* COACHE and network surveys to be conducted spring 2008

## RESULTS OF PRIOR NSF SUPPORT

### Co-PI MARY ANNE HOLMES

**1. 0123669 ADVANCE Leadership Award; \$252,926.00; Sept 2001 – Sept 2004** (1-year no-cost extension); Where are the Women Geoscience Professors? With co-PI Suzanne O’Connell, Wesleyan University. **0410255 ADVANCE Leadership Award Supplement; \$45,503.00; Sept. 2004 – Sept 2005;** Where are the Women Geoscience Professors? With co-PI Suzanne O’Connell, Wesleyan University.

**Summary:** These awards had three objectives: 1) collect and disseminate data on women in the academic pipeline and in academic positions in geosciences in the United States, 2) conduct focus groups of geoscientists to learn their perceptions of women’s status in academia, and 3) convene a workshop of interested parties to gather data from the geosciences community and disseminate it. We compiled the most complete snapshot of the status of women in a specific discipline to date, including data on variation in perceptions by gender (91 focus group participants). The closest comparable data is that of Donna Nelson. We find that proportions of women in the geosciences are most similar to that of women in chemistry; there are more women in geosciences than in physics or mathematics, but fewer than in the biological sciences. We produced ten publications (see Biographical Sketch), including our workshop report (48 participants), which required a second printing. We have 200 copies left of a 6,000-print run due to high requests. In addition, we presented 10 abstracts between 2001 and 2007 at the annual meetings of the Geological Society of America (5), the American Geophysical Union (4), and the American Association for the Advancement of Science (1).

### Co-PI STEPHANIE ADAMS

Dr. Stephanie Adams, Co- PI on this application, is currently PI on two other NSF Projects. The first project is an NSF STEP proposal (**S**trengthening **T**ransitions into **E**ngineering **P**rograms; #0622274; \$1,648,354; 9/1/06-8/31/10). The overall goal of this program is to develop and institutionalize an effective pathway to enable students at Nebraska’s six community colleges to complete select freshman and sophomore engineering courses and transfer seamlessly into degree programs in the College of Engineering. Academic, financial, and social support is provided to ensure retention and encourage completion of a baccalaureate engineering degree in the traditional timeframe. The project has just concluded its first year. Fifty-two students are participating in the program and one engineering course is being taught at four of the six community college campuses, with the remaining two scheduled for the next academic term.

Dr. Adams is also PI on an EEC-CAREER grant (Designing Effective Teams in the Engineering Classroom for the Enhancement of Learning; #0237135; \$643,418; 2/15/03-1/31/09). The goal of this grant is to design, develop, and validate a model for the facilitation of effective teaming in the engineering classroom and for the enhancement of learning. To date, this grant has supported two doctoral dissertations, five master theses/projects, and four undergraduate research projects. It presently supports one doctoral student, two M.S. students, and one undergraduate student. The PI has received four REU supplements to this grant: two supporting domestic undergraduate research students and two supporting international research experiences for domestic undergraduate students in Venezuela.

#### **Co-PI DAVID MANDERSCHIED**

Building on a Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring from the White House and NSF, Manderscheid received NSF grant DMS-0602242 for the project "EMSW21-VIGRE: The Iowa Mathematics Initiative." The award is \$1,760,275 for the period Sept. 1, 2006 - Aug. 30, 2009, with a noncompetitive renewal possible through Aug. 30, 2011 (for a total of \$3,000,000). Vertical InteGration of Research and Education grants are part of the Division of Mathematical Sciences Educating the Mathematical Sciences Workforce for the 21st Century program. The goal of the project is to train high-quality U. S. mathematicians through successful integration of cutting-edge research and education. The project includes a partnership of the Department and the departments of mathematics at twelve other area colleges and universities. The project centers on vertically integrated research groups in areas of research strength. It also includes research experiences for U. S. undergraduates from the University of Iowa and schools in the partnership. Finally, it includes Graduate Traineeships, Postdoctoral Associates, and Workshops. The project provides a model for mathematical sciences departments at top research universities. The Department successfully launched the program last academic year. Results include an increase in research activity and an increase in vertical interaction, including more interaction between undergraduates and graduate students and graduate students and postdocs. The project is on target to reach its goals, including national dissemination of assessment, and has already resulted in numerous research publications (Manderscheid left after the first year of the project to become Dean of Arts and Sciences at the University of Nebraska at Lincoln and thus is no longer PI).

#### **BROADER IMPACTS**

Broadening participation of women in STEM is integral to all of our ADVANCE-NE research and activities and is the reason we began a systematic assessment of our needs for improvement. We are well-poised to institutionalize broader participation across our entire campus because our Chief Academic Officer is serving as the ADVANCE-NE PI and is second in our academic organization only to our Chancellor. Dr. Couture has pledged the funds and resources to sustain ADVANCE-NE for five years beyond the life of the award, at which time we will assess our needs and determine in what form ADVANCE-NE will continue.

New and enhanced networks and partnerships throughout our campus will be created through RECRUIT-NE and PROMOTE-NE, internal and external advisory board activities, and increased informal networking opportunities. These new partnerships will forge institutional transformation. We will attract and retain more STEM women faculty, and institutionalize the policies and practices that will sustain high numbers of women at UNL through a network of upper administration, deans of STEM colleges, and chairs of STEM departments.

Our network analysis research promises to provide a useful tool for academic institutions across the country to identify department network structures that promote a productive environment for all faculty. We will broadly disseminate findings and results from ADVANCE-NE research and activities to the research community and to the public. Holmes and her Co-PI on two prior ADVANCE awards, Suzanne O'Connell of Wesleyan, have eight publications on their results, three more in press, and have presented results at 10 conferences (five invited) and numerous seminars and colloquia, indicating their dedication to "getting the word out."

We have accepted the "call to action" of the Committee on Maximizing the Potential of Women in Academic Science and Engineering (2006) by uniting faculty and administrators at UNL to this cause. With the resources of an ADVANCE-IT award, we can make our vision of a diverse, competitive, productive university a reality.