

**NOMINATION COVER SHEET**  
**2010 Virginia Outstanding Faculty Awards**

<b>1. <u>NAME</u></b>	
Full (Legal): Maura Jenkins Borrego	Preferred First Name: Maura
<b>2. <u>INSTITUTIONAL INFORMATION</u></b>	<b>3. <u>PROFESSIONAL INFORMATION</u></b>
Institution: Virginia Tech	Academic Discipline: Engineering Education
Rank/Position Title: Assistant Professor	Specialization/Field: Engineering Education
Year Rank/Title Attained: 2004	Type of Terminal Degree: Ph.D.
Years at Institution: 4.5	Year Awarded: 2003
Campus Email Address: mborrego@vt.edu	Awarding Institution: Stanford University
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***Please check only one box:***

- RESEARCH/DOCTORAL INSTITUTION NOMINEE:
- MASTERS/COMPREHENSIVE INSTITUTION NOMINEE:
- BACCALAUREATE INSTITUTION NOMINEE:
- TWO-YEAR INSTITUTION NOMINEE:
- TEACHING WITH TECHNOLOGY NOMINEE:
- RISING STAR NOMINEE:

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Signature (President or Chief Academic Officer) Mark McNamee

Printed Name: Mark McNamee

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***Excerpts from Mission Statement.***

Virginia Tech's complete Mission Statement is as follows:

Virginia Polytechnic Institute and State University (Virginia Tech) is a public land-grant university serving the Commonwealth of Virginia, the nation, and the world community. The discovery and dissemination of new knowledge are central to its mission. Through its focus on teaching and learning, research and discovery, and outreach and engagement, the university creates, conveys, and applies knowledge to expand personal growth and opportunity, advance social and community development, foster economic competitiveness, and improve the quality of life.

[http://www.president.vt.edu/mission\\_vision/mission.html](http://www.president.vt.edu/mission_vision/mission.html)

### **Summary of Accomplishments**

In just under five years, following a dramatic departure from her Ph.D. training in Materials Science and Engineering, Dr. Maura Borrego has distinguished herself in research, teaching, service, and integration toward the broad goals of recruiting, retaining and preparing a diverse STEM workforce in Virginia, the nation and the world. Dr. Borrego's chosen field of engineering education seeks to meet these goals in part through rigorous research with strong implications for educational practice. This reflects the mission of Virginia Tech, which places discovery and dissemination of new knowledge at its core.

Dr. Borrego's department head explains, "Maura has had a phenomenal start to her career as a faculty member in both the areas of teaching and research." The editor of the top-ranked STEM education journal, *Journal of Engineering Education*, describes Dr. Borrego as "*the leading young researcher in engineering education worldwide.*" This is exemplified by her influential articles in top journals, many research grants including a National Science Foundation CAREER award, and the first ever U.S. Presidential Early Career Award for Scientists and Engineers in the field of engineering education. Dr. Borrego developed four new graduate courses in the emerging field of engineering education (for which there are no existing textbooks) and worked to move the Ph.D. in Engineering Education through all levels of approval. As an expert in assessment, she helps evaluate many educational efforts in the department, college, university and beyond. Dr. Borrego has provided significant service to the profession through peer review and committee work, and to diversity at Virginia Tech through mentoring and recruiting activities.

### **Teaching**

Dr. Borrego's excellence in teaching is exemplified by College of Engineering Awards, including a Certificate of Teaching Excellence (2007) and the Dean's List for teaching (earning an average rating of 3.6/4.0 or above on teaching evaluations) every eligible semester (Spring 2005, Fall 2006, Fall 2007).

During her first two years at Virginia Tech, Dr. Borrego was assigned to teach first-year (freshman) engineering courses, and to advise these students on their selection of specific engineering majors. Assistant Department Head and Co-Director of the First-Year Program Dr. Richard Goff explains,

As a new assistant professor at Virginia Tech in 2005, she hit the ground running; teaching multiple sections of our first-year engineering course. Maura has always been focused on engaging students and following a learner-centered pedagogy. She has always learned all of her students' names, even when class sizes went from 32 seat classes up to 125 seat classes. During this time she also spent considerable time advising these students because she knew them from class and they felt comfortable coming to her for advice.

One former student wrote, "I wanted to thank you for a great semester in EngE1024. You kept the class interesting and fun, and always offered advice in and out of our fields. I hope next semester is just as enjoyable!" A student athlete wrote, "Also, thank you for understanding my swimming schedule throughout this semester and allow me to re-schedule my tests and turn in my HW late. That made my life a lot easier. I also want to thank you for meeting with me in your office numerous times. Thanks." (Similar comments are included in the excerpts from

support letters and additional documentation.) On the “concern for students” item of Virginia Tech teaching evaluations, Dr. Borrego earned an average of 3.8/4.0 from 412 cumulative teaching evaluations. Benchmarking values for this question are not available, but the Spring 2008 College of Engineering Average overall for all 1000 (freshman) level courses was 3.0.

In the past three years, Dr. Borrego has concentrated on developing and teaching graduate level courses in engineering education, which count toward the Graduate Certificate in Engineering Education and the Ph.D. in Engineering Education. Virginia Tech is home to one of just two Engineering Education departments with Ph.D. programs in the entire country, and perhaps the world. There are no existing textbooks, and not even clear organizational structures to define a core curriculum. Each semester, Dr. Borrego draws from the available literature from engineering education conferences and journals as well as education texts (book chapters) to help students integrate educational methods into the engineering setting. Since these graduate students are the future leaders of a field that is still being defined and negotiated, Dr. Borrego does not lecture. Rather, small group discussions around carefully planned assignments and questions help the class construct understanding about how to assess and research learning in engineering. Her approach was summarized by one of her former students:

Dr. Borrego is a great young, enthusiastic and innovative teacher. She uses active learning techniques, fostering discussion among students, and encouraging students to research and present information relevant to the course objectives. For example, Dr. Borrego engaged students in individual presentations, providing each of us the opportunity for constructive feedback through both oral and conversational means.

Another student wrote,

Just wanted to say thank you for all the time and effort you put to give us feedback for our proposals. My proposal has come a long way from the first week of the course until now, and it's all because of your class and feedback. The class did require a lot of effort by both professor and student, but I appreciate that I am a better researcher and writer because of it.

To continuously improve her teaching, Dr. Borrego regularly attends Virginia Tech Faculty Development Institute sessions on topics such as Scholar: Unpacking After the Move from Blackboard, New Strategies and Tools for Teaching with Technology, and Tablet PCs: Opening New Possibilities for Student Engagement. She has participated in two university Faculty Study Groups to discuss interdisciplinary teaching and learning. She regularly attends engineering education conferences, and in May 2007, completed an Effective Teaching workshop over two days.

Even Dr. Borrego's advising reflects the theme of interdisciplinarity that pervades her professional work. Dr. Borrego continues to guide up to 150 new general engineering freshmen each year in selection of their specific engineering majors, which requires a broad understanding of various fields and career opportunities. She is also advisor to three engineering education Ph.D. students, and co-advisor to three other doctoral students in other disciplines. Two of these students are research assistants on her grants, and these students will use the data they have collected in their dissertations for Science and Technology Studies and Public Administration and Policy. In the third case, she provides important methods expertise to a Civil Engineering student conducting interview research. Dr. Borrego has already graduated a master's student in Industrial and Systems Engineering and a doctoral student in Planning, Governance and Globalization.

## Discovery

Discovery of new knowledge is central to Virginia Tech's mission, and accordingly, this is where Dr. Borrego's accomplishments are most remarkable. Maura Borrego is the recipient of the first U.S. Presidential Early Career Award for Scientists and Engineers (PECASE, 2008) in the field of engineering education. She was also honored with a National Science Foundation CAREER Award (2006), and College of Engineering Awards for Excellence in Research (2009, first and only in her department) and Outstanding New Assistant Professor (2007).

Interdisciplinarity is an important theme in Dr. Borrego's research. The field of engineering education seeks to meet the broad goals of recruiting, retaining and preparing a diverse STEM workforce. While these goals are not new, interdisciplinary approaches of applying education theories and methods to engineering settings and conveying the results in usable form to engineering faculty members is novel and challenging. Dr. Borrego's early research focused on the issues of engineering faculty members learning educational research methods and valuing educational expertise. These 6 articles appear in *Journal of Engineering Education*, which has the highest impact factor of all STEM education journals and an acceptance rate of 7.5%. One of these was awarded Outstanding (Research) Publication by the American Educational Research Association, Division I: Education in the Professions (2008). Mentor Elizabeth Creamer explains,

There is no question in my mind that to receive an award from AERA is a testament to Dr. Borrego's expertise as a researcher. I take it as an indication that her work is cutting edge. I must confess that based on previous experience chairing several awards committees for AERA, I warned Dr. Borrego that the competition was very keen for this award and that they tend to go very senior people who have a long track record of attending and presenting at the conferences. I do not regret that I was proven wrong on this prediction.

Dr. Borrego's more recent research has focused on interdisciplinary graduate education across a broader range of STEM disciplines. Important organizations such as the National Institutes of Health and the National Science Foundation include statements in their strategic plans emphasizing the importance of interdisciplinary research to attacking the most critical technological and socio-technological challenges facing the world today, including climate change, sustainability, energy, and public health. Graduate students are identified as central to increasing interdisciplinary research capacity. This new focus, funded by her CAREER grant and more recent grants focusing on graduate education, allows Dr. Borrego to expand the impact of her research beyond engineering education. She has been successful publishing in international and interdisciplinary journals. Recent articles explore specific interdisciplinary learning outcomes, interdisciplinary faculty job postings and their implications for placement of Ph.D. graduate, and ways that interdisciplinary programs develop community across departments and colleges. Presentations, seminars and guest lectures help her share her results locally. One graduate student wrote,

George forwarded your comments to the EIGER interdisciplinary class and I wanted to take the time to thank you for your response and for coming in to talk to the EIGER class on Tuesday. I really appreciated the chance to hear comments from young (women) faculty pursuing interdisciplinary related careers. Thank you for sharing some of your experiences with us, I think it is important for us as students to be aware of and prepared

for the environment we may be facing as future faculty members.

To fund this research, Dr. Borrego has helped to bring \$3.0 million in external funding to Virginia Tech, of which \$1.5 million is her personal share. Although engineering education is usually categorized along with other engineering disciplines, the research is not as equipment intensive and not as well-funded, so this amount is doubly impressive. These include grants to study interdisciplinary collaboration, how engineering faculty members learn about and are convinced to use educational innovations, and opportunities for international engineering education collaborations. Dr. Borrego's collaborators on these grants include faculty members from her department, college, university, and other institutions including Purdue University and Texas A&M. This portfolio demonstrates Dr. Borrego's ability to bring together collaborators from multiple organizations to meet important research and educational goals.

### **Knowledge Integration**

An important measure of the value of engineering education scholarship is meaningful implications for practice. Through her service, graduate student mentoring, teaching, and research, Dr. Borrego has found many creative ways to integrate research and practice toward systematic improvement of engineering education. This is evidenced in awards such as the American Society for Engineering Education Graduate Studies Division Best Student Paper Award (2009, with Erin Crede) and the Helen Plants Award for Best Nontraditional (Interactive) Session at the ASEE/IEEE Frontiers in Education Conference (2007). In this session, Dr. Borrego and two colleagues presented a workshop on applying educational theories to the design of interdisciplinary curricula.

Dr. Borrego has invested significant effort into developing the Ph.D. in Engineering Education, which was approved by SCHEV in September, 2007. She served on the department graduate committee since her first semester at VT, and was named Director of the Graduate Program in February 2009 (a special exception to department policy prohibiting assistant professors from chairing committees). Dr. Borrego helped prepare forms, rationale, and narratives for approval of the Ph.D. at department, college, university, and state levels. She prepared reports and hosted external visitors for SCHEV approval of the Ph.D. She reviewed and voted on proposals for new graduate courses and proposed three of her own. Dr. Borrego planned fall and spring graduate recruiting days since fall 2008, and hosted a very successful Graduate Program Review in 2009; the report reads, "The Review Committee was very impressed with the progress that the Ph.D. program in Engineering Education has made in its short lifetime." She led the committee in developing procedures and administering the first qualifying exam, as doctoral student Erin Crede explains, through frequent communication with the graduate students:

As a member of the graduate committee for the newly formed Ph.D. Program in Engineering Education, Dr. Borrego has worked hard to ensure the success of the program by helping to establish a warm, collegial environment. The current size of the Ph.D. program allowed for the graduate committee to solicit students' input for the qualifying exam, and even hold a meeting to discuss the current program requirements with the students. Dr. Borrego then took the initiative to write sample qualifying exam questions, which were given to students in our Assessment Techniques course (EngE 5404). Dr. Borrego reviewed the questions and gave feedback to all students to ensure that we understood the material covered and expectations of the qualifying exam questions.

All of these activities involved a high level of understanding the new field of engineering education, and applying appropriate research on graduate education and how engineers learn educational research methods (most students come from engineering undergraduate programs). Developing and promoting this pioneering graduate program ensures that the next generation of engineering faculty members are better prepared to recruit, retain, and promote the success of a diverse STEM workforce.

Dr. Borrego has applied her research and others' to development of engineering education graduate courses. Advanced Engineering Research Methods is designed around the four "centerednesses" highlighted in the book *How People Learn*. Students from across the College of Engineering propose dissertation research on authentic, situated research problems in their own disciplines, receive detailed peer and instructor feedback, and develop an interdisciplinary community in the process. Civil Engineering doctoral student Chris Strock explains:

The course syllabus reflects her style of teaching and mentoring that I would summarize as *empowering*. The College of Engineering offers the course across the entire College and I particularly appreciated the unique mix of fellow students from interdisciplinary backgrounds and experience. However, such a mix carries with it a distinctive set of challenges for the teacher. We each pursued different topics and research methods that Maura had to master separately while remaining attentive to the class as a whole. In the classroom, she balances well the role of instructor and advisor through in-depth class discussions and frequent peer review throughout the process of writing a proposal. This style created a sense of community as we learned from each other and Maura's constructive critiques. I felt myself grow in confidence and the improvement and growth in confidence of my fellow peers struck me even then. Another unique experience Maura offered was how to transform our proposals and short-term plans towards lifelong career goals. We spent time developing five-year plans using the skills she passed on to us such as searching for applying for job postings and navigating funding sources.

Assessment Techniques in Engineering Education increasingly applies Problem-Based Learning to place students in realistic assessment situations. This semester (Fall 2009) the class is working with the Department of Mechanical Engineering as a client to develop an electronic portfolio system for evaluating graduate students and their graduate program. Engineering Education doctoral student Erin Crede explained the previous year's class project to develop electronic portfolio assessment for the Engineering Education Department:

The course was designed to utilize active learning, and included authentic problems from the literature, examples from the freshman courses many of the grad students were teaching, and a project designed using e-portfolio. The e-portfolio project was especially useful because the graduate students were able to give feedback directly into the department's assessment of the Ph.D. program, as well as create an assessment device that we could use to gage our own degree progress and professional development. Dr. Borrego creatively used this project to give the graduate students a chance to design a real assessment, and give the department useful recommendations resulting from the e-portfolio implementation. We are going to be using the e-portfolio designed in Assessment Techniques in our seminar class this spring (also co-taught by Dr. Borrego). Students are excited about the chance to use this project in another course and continue the process of personal and professional growth.

The graduate seminar is offered jointly with the Department of Engineering and Science Education at Clemson University and includes activities to build community between the two

programs despite the limitations of technology.

This and similar work has resulted in a number of conference publications presenting and archiving this work. These include assessment of a College of Engineering graduate teaching fellowship program, employment demand data for engineering education graduate degrees, preliminary assessment of a freshman engineering program, and identifying learning outcomes for undergraduate research and capstone design. Most of these are coauthored by graduate students, postdoctoral researchers, or other faculty colleagues who also worked with these programs and learned about assessment in the process. Again, Erin Crede explains:

...last year Dr. Borrego conducted an assessment of the Graduate Teaching Fellows program, which focused on the Graduate Teaching Assistants (GTAs) assigned to the first year freshman engineering exploration courses. The results of her assessment detailed what the department was doing well, as well as some holes in the mentoring and feedback to GTAs about their teaching. Following her assessment, she worked with feedback from TAs and faculty to develop a department-specific form for freshmen to evaluate their TAs. Current teaching assistants (of which I am one) are much happier, and have learned more, from the feedback given on this new evaluation.

## **Service**

In addition to serving on and chairing the department graduate committee, Dr. Borrego's service to the institution focuses on increasing diversity. She has served on the College Diversity Committee for three years (and has committed to a fourth), with responsibilities for assessing ongoing efforts. The committee has successfully implemented an undergraduate research funding program that brought eight underrepresented students to Virginia Tech last summer. Dr. Borrego regularly participates in recruiting and welcome events for underrepresented engineering students, including Women's Preview Weekend (2005-2009), welcome receptions/picnics (2005, 2006, 2008) and a one-time dinner with residents in the engineering women's learning community (2006). She has also helped other faculty members write NSF CAREER proposals, giving presentations to the university (2007) and college (2008). She helps numerous faculty develop their education plans for these proposals, and she internally peer reviewed one proposal that was successfully funded later that year.

In the community, she volunteers at the Science Museum of Western Virginia, assessing the impact of outreach and in-museum programs (2009). Her findings will be used to increase the effectiveness of programs in attracting young students to science.

In the profession, Dr. Borrego is very active in promoting more systematic scholarship (scholarship of teaching and learning, scholarly teaching) among engineering faculty members. She co-chaired one of the working groups of the recent American Society for Engineering Education report *Creating a Culture for Systematic and Scholarly Engineering Educational Innovation*. Since 2005, she has been the Virginia Tech representative to the Center for the Advancement of Scholarship on Engineering Education at the National Academy of Engineering, conveying recent research results to this prestigious organization for wide dissemination. She is one of three program chairs for the Frontiers in Education conference to be held in Arlington in October, 2010, which will bring scholarly engineering education results and opportunities to Virginia. She is chair of the best paper committee for the Educational Research and Methods Division of the American Society for Engineering Education, articulating criteria for exemplary research and incentivizing it with this new award. She regularly reviews for a number of engineering education journals, conferences, and the National Science Foundation.

## ***Personal Statement***

A lot of people ask me how I found my way to engineering education, where I came from, and what qualifies me to do this work. I do not have a Ph.D. in engineering education—the first graduates were in 2005 and 2006. My formal training is very traditional materials science and engineering, in the area of microelectronic packaging. I dressed up in a bunny suit and went to a cleanroom on Stanford's campus to prepare my specimens. I stuck it out long enough to earn my Ph.D., but I never felt like I was particularly good at it, or making much of an impact. It seemed like if I wasn't there to do the work, they could easily find someone else. During that time (and to the disappointment of my dissertation advisor) I kept my sanity by continuing the peer advising, mentoring, and participating in student organizations like Society of Women Engineers that I had begun as a freshman. I'd always wanted to be a teacher or professor, but to do so in materials science would have meant several more years as a postdoc hidden deep in a lab far away from undergraduate students. Instead, I took a risk and pursued academic staff positions. I had many mentors and contacts who helped in my job search, and my unique experience going through engineering school as a woman helped me land my first full-time job as Retention Coordinator in the School of Engineering at University of Southern California.

That same year, I also applied for a faculty position in what was then the Division of Engineering Fundamentals at Virginia Tech. Teaching and advising engineering freshmen sounded like the perfect job for me. Although I wasn't interviewed that year, I kept in touch with the department head, who is of course my current supervisor, friend, colleague, and mentor. Although my primary responsibilities at USC were advising, developing programs and teaching. I knew Virginia Tech was planning big changes. I spent that year traveling to engineering education conferences to present my work, reading educational research textbooks, and collaborating with USC faculty members. When Virginia Tech posted another tenure-track opening the following year, I was ready. During the interview process, we knew the division would become the Department of Engineering Education and that research and graduate education would be important expectations for tenure. I still can't believe my incredible fortune in landing a full-time tenure-track job working to improve the way we recruit, retain and prepare a diverse STEM workforce. Most of my engineering colleagues have to do this on the side, after their "regular work" is completed.

This process of retooling to enter a new field (which continues to this day) has really defined my research direction and teaching philosophy. My first research studies focused on how engineering faculty members learn educational research methods. With the help of a seed grant from AdvanceVT, I had the confidence to cold call Ruth Streveler (now at Purdue University) who had been running a workshop program to do just that. I explained that I was interested in studying the workshop and could pay my own way to attend it. She graciously allowed me to gather data that year, and later asked me to become the program evaluator for the next two years. I learned a lot myself about educational research methods, but also wrote an article about the process using the data I had collected. It took me many tries to get the tone exactly right (not offending the engineering faculty peer reviewers), but eventually the article was published. Formally, it's the one that was awarded AERA Division I Best Paper. Informally, it's one that people as far away as Australia have told me resonates with their personal experience and really makes them think about the field. I think part of the reason I could finally get it right is because I was going through many of the exact same struggles myself, and my engineering background gives me a good sense of how to communicate to other engineers. I've used much of what I've learned about how trained engineers learn educational research

methods to develop my graduate courses in engineering education research and assessment. As noted elsewhere, since engineering education is an emergent field, these are some of the first graduate courses ever, and there are no established textbooks or curricula. Knowing how others have reacted to the material helps me plan class activities, including open discussion to stay flexible to new insights.

But engineering education is really just a special case of interdisciplinarity. In many areas, there are faculty members doing research that extends beyond their formal training. How do they learn? Why are some people more successful or better suited to interdisciplinary work? And how do they train their graduate students in ways they never experienced themselves? My CAREER grant allows me to focus on graduate education, but I spend considerable time talking with faculty members running interdisciplinary programs about their own experiences and what they are trying to convey to students. The studies quickly expanded beyond engineering disciplines, perhaps initially out of a practical need to find truly interdisciplinary programs. Now that results are emerging, I am excited about the significant potential for impact of my work beyond the engineering education community, to all disciplines of engineering and graduate education in the sciences as well. Interdisciplinary training in particular is an important trend in engineering and many other disciplines. My long-term strategy is to publish in engineering education and social science, U.S. and international journals to impact a broad audience for this work. The combination of journals, conferences and workshops funded by my grants will target audiences who value both the practical and theoretical value of my findings.

Through this work, we have developed a deep understanding of how traditional university structures restrict interdisciplinary graduate education programs, as well as creative solutions to fund and administer such programs. We have found that engineering and science faculty define interdisciplinarity as teamwork, but that the integration skills necessary for collaboration are better described in the humanities (interdisciplinary studies) literature. We are beginning to bridge the gap between collaborative values and solitary dissertation research efforts in interdisciplinary graduate education. These results have direct applicability to engineering and science faculty designing interdisciplinary graduate programs; they will be the target audience for three workshops in 2011-12 funded by my CAREER grant. I also publish and present this work in higher education venues. I'm particularly intrigued by our finding that graduate divisions/schools/colleges, as one of the only traditional organizations designed to work across disciplines and departments, can be particularly effective at promoting policies that enable interdisciplinary research and graduate education at an institution. In the next few years, I hope to gain experiences that would help me decide whether I want to become a graduate dean someday.

One of the technical terms for this continuous retooling is *lifelong learning*. I suppose more than anything, I want students in my graduate courses to develop skills and attitudes that will serve them in whatever career they choose. (This is more challenging in a highly structured freshman engineering course—there I concentrate more on helping students adjust to college, understand what engineering is, and make sure it is right for them.) In the literature and my own research, I find a respectful attitude is an important precursor to interdisciplinary collaboration. Nearly every class period, students work in pairs to interpret their assignments and construct knowledge, and then we discuss our findings as a group. I try to stay open to new interpretations and never tell students they are “wrong.” Even though I've taught some of these courses four times, they're always interesting, and I always learn something. This is more than a love of learning—it's finding a wide range of contributions interesting and worthy and modeling this for students. I've learned how concrete bridges are repaired, how Disney's FastPass system works, and some of the challenges of designing unmanned aerial vehicles. And I love it!

**Abbreviated Curriculum Vitae**  
MAURA (JENKINS) BORREGO

**EDUCATION**

Ph.D., Materials Science and Engineering, Stanford University, 2003  
M.S., Materials Science and Engineering, Stanford University, 2000  
B.S. Materials Science and Engineering, University of Wisconsin – Madison, 1998

**PROFESSIONAL APPOINTMENTS**

Department of Engineering Education, Virginia Tech, Blacksburg, VA  
December 2004-present: *Assistant Professor*  
February 2009-present: *Director of the Graduate Program*  
Engineering Student Affairs, University of Southern California, Los Angeles, CA  
August 2003-December 2004: *Retention Coordinator*

**AWARDS (selected)**

- US Presidential Early Career Award for Scientists and Engineers (PECASE), 2008
- National Science Foundation CAREER Award, 2006
- Outstanding (Research) Publication, American Educational Research Association, Division I: Education in the Professions, 2008
- Helen Plants Award for Best Nontraditional Session, ASEE/IEEE Frontiers in Education Conference, 2007
- Excellence in Research, College of Engineering Dean's Awards. Virginia Tech, 2009
- Outstanding New Assistant Professor, College of Engineering, Virginia Tech, 2007
- Certificate of Teaching Excellence, Virginia Tech, 2007
- New Faculty Fellow Award, National Academy of Engineering Center for the Advancement of Engineering Education, 2005

**PEER-REVIEWED PUBLICATIONS (Selected) (\*graduate students)**

(14 journal articles and 35 conference papers since appointment)

- Newswander, L. K.\* & Borrego, M. (forthcoming). Using Journal Clubs to Cultivate a Community of Practice at the Graduate Level. *European Journal of Engineering Education*.
- Borrego, M., & Newswander, L. K.\* (forthcoming). The Interdisciplinary Academic Job Market and its Implications for Interdisciplinary Graduate Education. *Journal of the Professoriate*. Acceptance rate: 37%
- Newswander, L.K.\* & Borrego, M. (2009). Engagement in Two IGERT Interdisciplinary Graduate Programs. *Higher Education*, 58(4), 551-562.
- Borrego, M., Newswander, C.B.\*, McNair, L.D., McGinnis, S., & Paretto, M.C. (2009). Using Concept Maps to Assess Interdisciplinary Integration of Green Engineering Knowledge. *Advances in Engineering Education*, 2(1), Winter 2009, 1-26. Acceptance rate: 18%
- Borrego, M., Douglas, E. P., & Amelink, C. T. (2009). Quantitative, Qualitative, and Mixed Research Methods in Engineering Education. *Journal of Engineering Education*, 98(1), 53-66. Acceptance rate: 7.5%
- Jesiek, B. K., Newswander, L.K.\*, & Borrego, M. (2009). Engineering Education Research: Field, Community, or Discipline? *Journal of Engineering Education*, 98(1), 39-52. Acceptance rate: 7.5%
- M. Borrego & L. K. Newswander\*. (2008). Characteristics of Successful Cross-disciplinary Engineering Education Collaborations. *Journal of Engineering Education*, 97(2), 123-134. Acceptance rate: 7.5%

- M. Borrego, R. A. Streveler, R. L. Miller, & K. A. Smith (2008). A New Paradigm for a New Field: Communicating Representations of Engineering Education Research. *Journal of Engineering Education*, 97(2), 147-162. Acceptance rate: 7.5%
- M. Borrego & E. G. Creamer. (2007). Factors Contributing to Difficulties Experienced and Satisfaction with Interdisciplinary Collaboration: Sex, Disciplines, and Experience Level. *Journal of Women and Minorities in Science and Engineering*, 13(4), 353-376.
- M. Borrego. (2007). Conceptual Hurdles Experienced by Engineering Faculty Becoming Engineering Education Researchers. *Journal of Engineering Education*, 96(2), 91-102. Acceptance rate: 7.5%
- M. Borrego. (2007). Development of Engineering Education as a Rigorous Discipline: A Study of the Publication Patterns of Four Coalitions. *Journal of Engineering Education*, 96(1), 5-18. Acceptance rate: 7.5%

#### **RESEARCH GRANTS (Selected)** (Total: \$3.0 million Personal Share: \$1.5 million)

- CAREER: Interdisciplinary Graduate Education, NSF Engineering Education, \$524,400, PI: M. Borrego, 7/1/07 – 6/31/12.
- The Role of International Students in Domestic Engineering Graduate Student Recruitment and Retention, NSF Engineering Education and Centers. \$200,000, PI: M. Borrego, 08/01/09 – 01/31/12.
- Collaborative Research: Are Engineering Departments Adopting Engineering Education Innovations? A National Survey to Assess Contributing Factors, NSF Engineering Education and Centers. \$134,999 to Virginia Tech and \$15,000 to Texas A&M, PI: M. Borrego, Co-PIs: Jeffrey Froyd (Texas A&M) and Erin Leahey (Univ. of Arizona), 01/01/09 – 12/31/09.
- Expanding Global Engineering Education Research Collaboration (PI), NSF CCLI program, \$165,001, PI: M. Borrego, Co-PI: B. Jesiek (Purdue University), 3/15/08 – 2/28/10.
- Preparing Engineering Students for the Challenges of Interdisciplinary Design Teams, NSF Engineering Education, \$433,273, PI: L. McNair; CoPIs: M. Borrego, R. Goff, M. Paretti, J. Terpenny, 1/1/08 - 12/31/10.
- Building Interdisciplinary Collaboration Skills Through a Green Engineering Capstone Design Experience, NSF CCLI, \$142,715, PI: M. Paretti; CoPIs: M. Borrego, L. McNair, and S. McGinnis, 1/1/07 – 12/31/08.

#### **PROFESSIONAL SERVICE (Selected)**

- North American representative (international election) to Research in Engineering Education Symposium Governing Board, 2009.
- Educational Research Methods Division, American Society for Engineering Education
  - Board Member (elected), 2006-2008.
  - Inaugural Chair (develop procedures) of Best Paper Committee, 2008-2009.
  - Program Chair for Frontiers in Education 2010 Conference (800 abstracts for 500 papers anticipated, divided among three program chairs).
- Regular reviewer for *Journal of Engineering Education*, *Advances in Engineering Education*, and *European Journal of Engineering Education*.
- National Science Foundation review panelist 2005, 2007-2009.
- Vice-Chair of Report Impact and Report Research working group for the American Society for Engineering Education project Creating a Culture for Systematic and Scholarly Engineering Educational Innovation, 2008-2010.
- Virginia Tech representative to the National Academy of Engineering Center for the Advancement of Scholarship on Engineering Education, 2007 – present.

### ***Letters of Support (Excerpted)***

#### **From Students:**

I like the opportunity of having small classes at Virginia Tech and actually getting to know the teacher so I thought writing a letter to you saying thanks would be appropriate. Engineering first semester was one of my hardest classes in dealing with the workload and understanding the material. Having you as a teacher second semester really helped me to start understanding Engineering and also like the major more. I think one of the main reasons was because you really helped try to show us to not take the class in a too stressful manner. I liked that because it made me realize it was not the only class I was taking compared to first semester where I found myself concentrating on just mainly the Engineering class. I was unsure at first if Engineering was really what I wanted to study at Virginia Tech. After taking EngE 1114 I have more confidence that Engineering is what I want to do for my remaining years at this University. Also as a teacher you really treated us all fair in the class and were really easy to talk to for advice. During first semester I heard you were a really good teacher and was happy to see I had you when I saw my second semester schedule. I am definitely going to recommend to my friends coming here next year if you are still teaching. I hope everything goes well for you in your future and hopefully I will run into you sometime on campus.

–Former engineering freshman Trevor Begley

It is my utmost privilege to write this letter of recommendation in support of Maura Borrego ... I first met Maura as one of her students in ENGE 6604 Advanced Engineering Research Methods during the Spring Semester of 2007. I asked her to serve as my dissertation co-advisor after developing a strong respect and appreciation for her mentoring and enthusiasm that continues to influence my work positively. I say with confidence that Maura's teaching philosophy and commitment to each of her students is truly admirable and reflects strongly our motto of *Ut Prosim* [That I May Serve].

The Methods course served as my introduction to Maura. ...The experiences of this course alone were enough to influence my future career. However, I credit Maura's dedication to me as a Ph.D. Student that inspired me to follow my vision. The cliché that the best teachers extend their influence beyond the classroom hold true for her. What she taught us in class she demonstrates daily in practice. My work spans committee members across three colleges and four departments. Maura has risen to the *de facto* leader of the committee coordinating across departments and negotiating a research plan that synthesizes my degree requirements, my personal vision, and the expertise and opinions of a truly interdisciplinary committee towards a common goal. Her invaluable guidance includes interpreting feedback, foreseeing and avoiding problems, and building consensus outside and inside of committee meetings.

-Civil and Environmental Engineering Doctoral Student Chris Strock

Her teaching and advising ability, both inside and out of the traditional classroom setting, have strongly contributed to my personal success and satisfaction with the PhD program.

-Engineering Education Doctoral Student Erin Crede

I had the pleasure and honor of taking her course in the Fall Semester of 2005 and it was a very educational and also very enjoyable experience. Plus, Dr. Borrego is a great young, enthusiastic and innovative teacher. ...Throughout the course, students work on real problems based on personal research interests, bringing their own research vision into the class and enriching everyone's perspective. Dr. Borrego helps students move their research ideas

forward and motivates them toward career goals. Her approach and relationship with students is very collegial, encouraging students to work with her to improve and not hierarchical by any means. Dr. Borrego does an excellent job instructing her students to complete a research proposal by the end of the class and providing invaluable input on ideas and techniques for improving their “persuasive writing” skills. She shows a genuine interest in her students, which was a great motivator for me and many of my colleagues. The load of the course is very reasonable and most of the assignments are in one way or another related to the final goal: GETTING A RESEARCH PROPOSAL DONE!!!!

I have been awarded 3 fellowships as a Ph.D. candidate since completing this course, including a prestigious NSF EIGER-IGERT fellowship. I attribute much of what I have accomplished to this course and the wonderful instruction of Dr. Maura Borrego.

-Civil and Environmental Engineering Doctoral Student José Manuel Cerrato Corrales

### **From Professional Colleagues:**

I am very familiar with the global communities of engineering education researchers, and I can say unequivocally that Dr. Borrego is *the* leading young researcher in engineering education worldwide. What is even more amazing is that she has accomplished this by age thirty-three and in just over four years in the tenure track following a significant change in research direction from her doctoral training in materials science and engineering.

-Dr. Jack Lohmann, Vice Provost, Georgia Institute of Technology and Editor, *Journal of Engineering Education*

We are writing to nominate “Conceptual Hurdles Experienced by Engineering Faculty Becoming Engineering Education Researchers” by Maura Borrego for Division I’s Outstanding Research Publication Award. This peer-reviewed article appeared in the April 2007 issue of *Journal of Engineering Education* (Vol. 96, No. 2, pp. 91-102), and has sparked important discussions in the international engineering education community. ...

This study addresses the important problem of research capacity in engineering education. Research on how students learn engineering is critically needed, but few researchers interested in this area are adequately trained. The article describes collaboration between AERA Division I, the Professional and Organization Development Network in Higher Education (POD), and the American Society for Engineering Education to develop a community of practice in engineering education research and all three professional associations contributed to the project leadership and took part as workshop facilitators. ...

The originality of this article lies in its attention to faculty development. As it should be, much of engineering education research is focused on the classroom. However, the quality of this work is limited, since many practitioners do not even realize their curriculum development efforts are not educational research. Opening up this issue, clearly describing the differences between development and research projects, and explaining why the transition to research is so challenging has forced a paradigm change within the engineering education community. Engineering faculty are now as likely to reflect on the educational expertise they need to enlist from others as they are to value the technical and pedagogical content knowledge they relied on in the past.

-Drs. Ruth Streveler and Karl Smith of Purdue University

### **From Virginia Tech Colleagues:**

I was asked to speak in particular to the significance of her receipt of a best paper award from Division I (Education in the Professions) of the American Educational Research Association. It is quite an honor to receive an award from this very large professional association with dozens of divisions and special interest groups that span all levels and types of

education but that always maintain an interest in rigorous research. More than 10,000 attend the annual conference and it is extremely competitive to have a research paper accepted, much less to receive an award. In most years, the acceptance rate for research papers is less than 30%. I have been attending this conference for many years, but I am well aware that the chances of getting a proposal for a research paper accepted is not very high.

There is no question in my mind that to receive an award from AERA is a testament to Dr. Borrego's expertise as a researcher. I take it as an indication that her work is cutting edge. I must confess that based on previous experience chairing several awards committees for AERA, I warned Dr. Borrego that the competition was very keen for this award and that they tend to go very senior people who have a long track record of attending and presenting at the conferences. I do not regret that I was proven wrong on this prediction.

-Dr. Elizabeth Creamer, Professor of Educational Research and Evaluation at Virginia Tech

She is extraordinary in the classroom. She is very organized, knowledgeable, and enthusiastic. Maura introduces discussion topics and is quite adept at facilitating class discussion; allowing all students to speak and construct knowledge while adding insight and leading students deeper in the conversation. Students seemed very comfortable sharing their ideas in class and interacting with Dr. Borrego. She creates a safe environment for open and honest discussion of research, assessment topics, opinions, and issues.

-Dr. Richard Goff, Assistant Department Head of Engineering Education at Virginia Tech

It has been my extreme pleasure for the last few years to encourage, support, and observe the exceptional development of Dr. Maura Borrego. I believe Maura is definitely a Rising Star, not only in the Commonwealth of Virginia, but in the worldwide community of engineering education. Her local awards, including a Certificate of Teaching Excellence and the Dean's Award for Excellence in Research, national awards for best papers, best sessions, and the PECASE award, along with excerpts from extremely strong support letters from her students, her Virginia Tech colleagues, and her colleagues at peer institutions such as Purdue and Georgia Tech tell the story of a complete educator and researcher. Her participation in the global engineering education community and service to professional associations completes the picture of her dedication to Virginia Tech's mission of teaching and learning, research and discovery, and outreach and engagement. Maura has brought great recognition and praise to the Commonwealth as her amazing work has been recognized and assimilated by the rapidly growing engineering education community.

-Dr. Hayden Griffin, Professor and Department Head of Engineering Education at Virginia Tech

I am pleased to provide my strongest support to the nomination of Dr. Maura Borrego for the SCHEV Rising Star Award. Dr. Borrego exemplifies the characteristics we value extremely highly in the Virginia Tech College of Engineering. She is an excellent teacher, researcher/scholar, and citizen of the College. She has ...done an exceptional job of directing the Engineering Education Ph.D. program, and provided considerable service to the profession as well. She is widely recognized as one of the leaders of the engineering education field, even though she is still very early in her career. The incredible honor of winning the first ever PECASE award in the field of engineering education has attracted tremendous admiration for Maura and our Department of Engineering Education. We expect great things of Maura, and I believe the SCHEV Rising Star Award is an appropriate recognition of the leading role she plays in a number of venues.

-Dr. Richard C. Benson, Dean and Paul and Dorothea Torgersen Chair,

### Additional Documentation

#### Student Perceptions of Teaching:

Term	Year	Course	Enrolled	Evals	Concern & Respect	Success Communicating	Overall	
Spring	2005	ENGE 1114	33	32	4.0	3.5	3.8	
Spring	2005	ENGE 1114	32	29	3.8	3.4	3.7	
Spring	2005	ENGE 1114	33	31	3.8	3.4	3.7	
Fall	2005	ENGE 1024	28	21	3.9	3.4	3.6	
Fall	2005	ENGE 1024	31	23	3.8	3.7	3.7	
Fall	2005	ENGE 1024	32	18	3.7	3.3	3.5	
Fall	2005	ENGE 1024	28	12	3.8	3.3	3.5	
Fall	2005	ENGE 1024	32	19	3.8	3.6	3.8	
Fall	2005	ENGE 6604	6	5	3.8	3.6	3.6	
Spring	2006	ENGE 1114	33	30	3.8	3.6	3.7	
Spring	2006	ENGE 1114	32	29	3.9	3.8	3.8	
Fall	2006	ENGE 1024	29	29	3.7	3.4	3.6	
Fall	2006	ENGE 1024	18	18	3.9	3.6	3.4	
Fall	2006	ENGE 1024	21	21	3.7	3.6	3.5	
Fall	2006	ENGE 1024	18	18	3.8	3.6	3.6	
Fall	2006	ENGE 1024	19	19	3.5	2.9	3.2	
Fall	2006	ENGE 5404	3	3	3.7	3	3.3	
Spring	2007	ENGE 6604	N/A*					
Fall	2007	ENGE 5604	3	3	4.0	3.3	4.0	
Spring	2008	ENGE 6604	10	8	3.6	3.4	3.8	
Fall	2008	ENGE 5404	11	11	4.0	3.5	3.8	
Fall	2008	ENGE 5704	10	10	3.5	3.5	3.7	
Spring	2009	ENGE 5604	11	9	3.9	3.6	3.7	
Spring	2009	ENGE 5704	12	7	3.7	3.8	3.9	
Spring	2009	ENGE 6604	8	7	4.0	3.9	4.0	
<b>Total or Weighted Average</b>			<b>493</b>	<b>412</b>	<b>3.8</b>	<b>3.5</b>	<b>3.7</b>	
<b>College of Engineering Averages</b>								
1000 level Spring 2008							<b>3.0</b>	
5000 level, Spring 2008							<b>3.5</b>	

\* Course evaluations were not completed for Spring 2007 due to the events of April 16.

Compiled results from "Virginia Tech Student Perceptions of Instruction" form

Enrolled = number of students enrolled in the course or section

Evals = number of student evaluations of teaching completed

Concern & Respect = average response to item 4 "How I rate the instructor compared with

others I have had at Virginia Tech... Concern and respect for students as individuals.”  
Success Communicating = average response to item 2 “...Success in communicating or explaining subject matter.”

Overall = average response to item 7 “...Overall rating of this instructor.”

Scale: 4 = Excellent, 3 = Good, 2 = Fair, 1 = Poor

ENGE 1114 = Exploration of Engineering Design

ENGE 1024 = Exploration of Engineering

ENGE 5404 = Assessment Techniques in Engineering Education

ENGE 5604 = Engineering Education Research Methods

ENGE 6604 = Advanced Engineering Research Methods

ENGE 5704 = Graduate Seminar (Co-taught with another colleague (50%), but with separate teaching evaluations.)

### **Student Comments from Teaching Evaluations:**

#### ***ENGE 1024: Exploration of Engineering***

“I also wanted to let you know that I greatly enjoyed your class and you did a terrific job.”

“She was enthusiastic, great attitude and caring.”

“She was energetic about not so energetic subject matter.”

“I think the instructor was very polite, respectful and tried to keep the class interesting.”

#### ***ENGE 1114: Exploration of Engineering Design***

“Made the material fun and easy to learn.”

“She cared about each student as an individual and helped when we needed it.”

“She definitely came to our level of thinking and drove home easy to understand teachings.

Definitely made coming to class way cooler.”

“Made class interesting and helped if a person had a problem.”

“Good at explaining things.”

“She knew everyone’s name the second day of class which I thought was impressive. Didn’t mind helping each individual during class.”

#### ***ENGE 6604: Advanced Engineering Research Methods***

“A nice variety of readings. Good use of assignments. I liked the way class built but yet had some variety away from just writing a proposal. A lot of methods challenged my view but it all made me think and most convinced me there are better ways. ...Overall, the class is most useful and needs no improvement.”

“The instructor was well organized and accessible. The information was presented in an organized and easy to comprehend manner.”

“Exposed students to a wide array of topics important to all researchers.”

“Made it easy to discern good and bad writing.”

“Tailoring it to each student.”

“Excellent prep for class & for encouraging & teaching us about our research proposals. Was a greatly helpful class for me.”



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Press Release 08-214

## Beginning Scientists Receive Presidential Awards

Twenty NSF nominees receive the government's highest honor for scientists and engineers beginning their independent careers



The 2007 PECASE winners are honored in a ceremony at the White House.

[Credit and Larger Version](#)

**December 19, 2008**

*Embargoed until December 19, 2008, 3:30 p.m.*

Twenty young scientists from among those taking part in the National Science Foundation's (NSF) Faculty Early Career Development Program (CAREER) have received an additional distinction as winners of Presidential Early Career Awards for Scientists and Engineers (PECASE) for the 2007 competition.

The PECASE program recognizes outstanding scientists and engineers who, early in their careers, show exceptional potential for leadership at the frontiers of knowledge. This Presidential Award is the highest honor bestowed by the U.S. government on scientists and engineers beginning their independent careers. In addition to NSF's winners, there are 48 scientists nominated by other government agencies.

By receiving awards through the CAREER program, the PECASE winners had already demonstrated their success in integrating research and education within the context of the mission of their organization.

"We take great pride in the PECASE winners," said Kathie L. Olsen, NSF's deputy director. "It is important to support the transformational research of these beginning scientists, and to foster their work in educational outreach and mentoring."

A complete list of NSF's PECASE awardees and their institutions follows:

Sonia Altizer, Odum School of Ecology, University of Georgia

Maura J. Borrego, Department of Engineering Education, Virginia Tech University

Xi Chen, Department of Civil Engineering and Engineering Mechanics, Columbia University

Kim M. Cobb, Department of Earth and Atmospheric Sciences, Georgia Institute of Technology

Michael Elowitz, California Institute of Technology

Nicholas Feamster, College of Computing, Georgia Institute of Technology

Alexander Gamburd, Department of Mathematics, University of California, Santa Cruz

Jeremy Gray, Department of Psychology, Yale University

Sanjay Lall, Department of Aeronautics and Astronautics, Stanford University

André W. Marshall, Department of Fire Protection Engineering, University of Maryland, College Park

Mónica Medina, School of Natural Sciences, University of California, Merced

Katrina M. Miranda, Department of Chemistry, University of Arizona

Subhasish Mitra, Department of Electrical Engineering and Computer Science, Stanford University

Stergios I. Roumeliotis, Department of Computer Science and Engineering, University of Minnesota

Sanjit Seshia, Department of Electrical Engineering and Computer Sciences, University of California, Berkeley

Aaron M. Thomas, Department of Chemical Engineering, University of Idaho

Paul Torrens, School of Geographical Sciences, Arizona State University

Anastasia Volovich, Department of Physics, Brown University

Joan Walker, Department of Civil and Environmental Engineering Center for Global Metropolitan Studies, University of California at Berkeley

Michael Yu, Department of Materials Science and Engineering, Johns Hopkins University

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*The National Science Foundation (NSF) is an independent federal agency that supports fundamental research and education across all fields of science and engineering. In fiscal year (FY) 2009, its budget is \$9.5 billion, which includes \$3.0 billion provided through the American Recovery and Reinvestment Act. NSF funds reach all 50 states through grants to over 1,900 universities and institutions. Each year, NSF receives about 44,400 competitive requests for funding, and makes over 11,500 new funding awards. NSF also awards over \$400 million in professional and service contracts yearly.*

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