Final Report to the US National Science Foundation
February 15, 2016

Workshop on the Strategic Shaping of Electrical and Computer Engineering:
Vision, Branding and Advocacy
January 20-21, 2016
Georgia Tech Hotel & Conference Center, Atlanta, GA

Organizing Committee
Sheila Hemami, Professor and Chair, Northeastern University
John Janowiak, Executive Director, ECEDHA
John Kelly, Associate Professor and Chair, North Carolina A&T University
Steve McLaughlin, Professor and Chair, Georgia Institute of Technology
George Pappas, Professor and Chair, University of Pennsylvania
Bill Sanders, Professor and Head, University of Illinois at Urbana-Champaign

Workshop website and materials
Click here to access.

Overview and Summary of Goals
On January 20-21, 2016, a strategic workshop focused on the future direction of Electrical and Computer Engineering (ECE) as a discipline was held at Georgia Tech Hotel & Conference Center. Three main themes shaped the 1.5 day event: vision, branding, and advocacy. Appendix A provides the final program for the workshop and Appendix B provides the final attendee list. In advance of the workshop, participants were required to share their institution's perspectives on a vision for ECE, as well as best practices or forward-thinking proposals on both branding and advocacy. More than 50 one-page white papers were received. With the help of a professional facilitator a set of questions were sent to the committee ahead of time together with background information informed by the vision statements that participants had submitted. Plenary and breakout sessions were prepared with a detailed set of questions for participants.

One of the first outcomes of the workshop was the group recognizing that the term "advocacy" was not the right term to describe what we set out to accomplish. We recognize that it would be best described as "engaging our community and stakeholders," or simply "community" for short.

The overall goals of the workshop included:
- Prepare a set of recommendations at the March 2016 ECEDHA Annual Conference regarding vision, branding, and community engagement. What are the right vehicles for pushing them forward?

Vision:
- Vision comes first; branding and community engagement follow. Vision is a living thing, something we need to tend to and update. For this workshop we need to frame important issues and feed them into the community engagement and branding discussions.

Branding
- How we tell our story–and to whom–is fluid and not the same for everyone. We need to shape a plan and make recommendations that can be carried out at the ECEDHA Annual Conference in March 2016.

Community
- Think about engaging our community and stakeholders in terms of an organization, framework, or

partnership. Can we be the group that government and industry leaders, the media, and others, go to when they need information regarding ECE-related technology? Could it be the home or vehicle for the ongoing vision and branding activities and conversations?

- What would such an organization look like and what are the next steps?

Summary of outcomes and next steps:

Overall the workshop was extremely successful. The energy level, excitement, and optimism was high, and moving ahead with an ambitious and carefully planned set of actions was strongly supported. The actions that resulted are all directed toward a broader engagement with the ECE community at the ECEDHA Annual Meeting in March 2016.

Outcomes can be summarized as:

- We need a single vision, but it needs to be dynamic and projected across different audiences.
- A renewed vision needs to impact people and society in addition to the tools and technical and scientific contributions.
- We need to develop an ECE brand that is exciting and inspiring for students and their parents.
- We need to instill in the minds and hearts of students that through an ECE education they can address the most pressing societal problems such as health, energy, and security.
- We need to convince them that ECE is the natural home for innovation, where, for example, most of the Internet-of-Things breakthroughs will take place, impacting our economy and world.
- We need an organization that acts on behalf of the broader ECE research and education community.
- We need to collaborate and partner with organizations like CCC.
- We need to establish a Leadership Academy for ECE.
- We should offer services and expertise to multiple government agencies.
- Work on a planning grant for discussion at the March ECEDHA meeting.
- Work on full grant in the following six months.

Actions in advance of the March 2016 ECEDHA Annual Conference:

- Report and make recommendations to the ECEDHA Board.
- Establish a second working group on Education and Diversity.
- Develop a Branding Working group.
- Develop a working group to prepare an NSF planning grant.

Intellectual Merit: The intellectual merit of the workshop was the collective discussion of a strategic vision and a compelling scientific and technological agenda that will impact research and education in all electrical and computer engineering departments across the nation. We have taken the first steps toward developing a roadmap for a sustainable model that provides ECE departments with a vibrant voice in funding agencies, support in developing and solving grand challenges, and a vehicle to assist agencies in making wise investments from a scientific and technological perspective.

Broader Impact: We expect that this effort will have an enormous impact that reaches beyond ECE departments. It could have significant economic impact as we steer the intellectual capital of ECE departments toward 21st century grand challenges for the nation.

Introduction

Our goal is to articulate a collective vision of an exciting and attractive future for ECE for the next 50 years that is highly relevant to scientific, technological, and societal progress. Such a vision will form the basis for both a community model with relevant stakeholders in funding agencies in Washington, as well as branding and diversity efforts to ensure that students have a much more informed understanding of the impact they can make through an ECE career. We also need to consider community building and engagement mechanisms that will ensure ECE is aligned with and on the forefront of the nation's grand challenges. This is a task that no individual researcher or department can accomplish. This is a national agenda and is a challenge that needs to be taken on by the whole community collectively. In that spirit, and with the support and encouragement of the ECEDHA organization (ECE Department Heads Association), we assembled thought leaders across many universities, intellectual areas, and geographical regions to discuss three important and interrelated topics:

1) An intellectual vision for ECE for 50 years
2) An community-building and engagement model for ECE
3) A national effort for ECE branding and diversity

1. A vision for ECE in the post-Moore's Law era

ECE is an enormously broad field that ranges from physical engineering (applied physics, nanotechnology) to information engineering (signal processing, information theory, control). This breadth means ECE becomes a kind of "default engineering" because with a degree in ECE one can become almost any other form of engineer.

And while ECE can claim to be the broadest form of engineering, we need to ask what distinguishes ECE from other forms of engineering? What is unique about ECE when there are other fields of physical engineering? The answer is that ECE is unique because it bridges the world of physics with the world of information, making that information available anywhere in the world within seconds. These tremendous achievements have powered many of the extraordinary changes in our economy and quality of life in the last 50 years.

The connection between the physical world and the information world happens in the areas of circuits and computer engineering, and ECE research ensured that Moore's Law became a reality. What will ECE be beyond Moore's Law? How do we harness the power of nanoscience toward nanotechnology in a way that will impact economic and societal challenges? What will be the next grand challenges regarding the interface between the physical and the information world? Will the Internet of Things be an enormous opportunity for ECE departments that are uniquely positioned for research that blends physics and information? How can ECE position itself in a leading role with respect to grand challenges such as health, energy, security, and water?

In advance of the workshop participants submitted a strategic vision document. The word cloud below captured the main ideas from the vision statements.
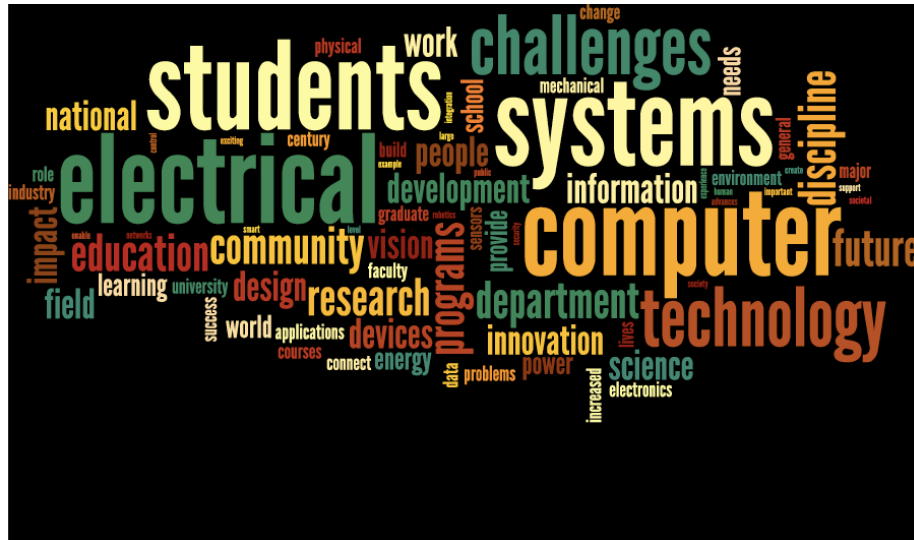
The vision statements informed the structure of the first session of the workshop. The organizing committee agreed that vision comes first and any branding and community engagement actions that follow rely on a clear vision. We also realized that vision is a living thing, something we need to tend to and update. For this reason we chose not to focus on the formulation of a concrete vision statement, but rather to discuss it in the context of the branding and community engagement themes that followed.

The workshop was kicked off by presentations from Drs. Pramod Khargonekar and James Kurose from the National Science Foundation. Both spoke about the importance of community engagement and the role of a unified and more concerted effort on behalf of the ECE community, and encouraged the attendees to take the vision, branding, and community engagement efforts seriously. Dr. Kurose talked at length about the Computing Community Consortium (CCC) which has been extremely effective in advocating for the computing research community.

Following the introductory presentations, the 50 participants broke into ten groups and discussed a range of questions and reported back. The following were points of agreement:
- We need a single vision, but it needs to be projected across different constituents.
- The vision needs to be dynamic.
- We need to include humans and society in the vision.
- The vision needs to involve solving societal grand challenges and making societal impact.

A vigorous discussion took place around the following questions:
- Do we need an ECE Vision 2025?
- How do we work most effectively with NSF, given that we are split across two directorate?

2. Branding: How do we better tell our story and to whom?

ECE wants to more effectively communicate to the general public, especially to particular cohorts including students, teachers, parents, and college counselors. The success of ECE as a magical yet invisible technology in the past 30 years is beginning to be outdated, creating misconceptions about the field. High school students typically associate ECE with electricity and, in some enlightened cases, with circuits and computers.

As an example, one of the first places a person may visit in order to learn more about our field is *Wikipedia*. The first sentence of the *Wikipedia* entry for electrical engineering highlights the general public's inaccurate perceptions: ***Electrical engineering*** *is a field of* engineering *that generally deals with the study and application of* electricity, electronics, *and* electromagnetism.

While robotics has been enormously successful in bringing students to science and technology, very few high school students associate robotics with electrical and computer engineering, typically choosing mechanical engineering. This results in students failing to see the vast potential that an ECE education can provide. In short,

- We need to develop an ECE brand that is exciting and inspiring for students and their parents.
- We need to instill in the minds and hearts of students that through an ECE education they can address the most pressing societal problems such as health, energy, and security.
- We need to convince them that ECE is the natural home for innovation, where, for example, most of the Internet-of-Things breakthroughs will take place, impacting our economy and world.

The 50 participants broke into ten groups and discussed a range of questions and reported back. The following were points of agreement:
- We need professional branding help.
- We need metrics.
- We need to identify the audience, and customize to the audience.
- We need to leverage existing resources to create curated content that can be used by everyone.
- We need a common tagline that all ECE departments are willing to put on their websites.

A vigorous discussion took place around the following questions:
- We need to do something different.
- What is ECE's FIRST LEGO League equivalent?
- Should we change the name of our field?

3. A sustainable model for engaging the ECE community and our stakeholder

Prior to the group discussions on community engagement, Professor Elizabeth Mynatt made an outstanding presentation on the CCC. Information on the role, structure, funding model, and activities were presented in great detail. Up to this point, the ECE community has lacked an organization that might serve as the national voice for ECE research and education in Washington, either in a model similar to CCC or through a partnership with an organization that could help push an ECE vision forward. The goal of such an organization would be to:

- Identify national grand challenges in which ECE departments can play a leading role and develop research roadmaps to address these challenges,

- Serve as a fast-response and critical resource to policy makers in creating research visioning efforts in areas that are critical to the nation,
- Collaborate with similar community engagement organizations (like the Computing Community Consortium) to develop interdisciplinary research roadmaps, and
- Improve the broader public's understanding of the exciting nature of ECE research and its impact.

In other words, we should be thinking of an organizational structure where the main objective is to be the outward facing arm of ECE departments and a fast-action resource to the nation's decision-makers and industry. Such an organization could accomplish this task through numerous activities including:

- Visioning workshops on specific national priorities that assemble scientific leaders to develop whitepapers outlining scientific grand challenges for the ECE community,
- Position papers, testimony, and briefings responding to requests from funding agencies and policymakers in Washington,
- Community building among research leaders and policy makers,
- Online repository for ECE information, events, and community building,
- Assist the government in recruiting top talent for critical leadership positions in funding agencies, and
- Annual meeting attached to the ECEDHA Annual Conference & Expo.

The 50 participants broke into ten groups and discussed a range of questions and reported back. The following were points of agreement:
- We need an organization.
- We need to collaborate and partner with CCC.
- Establish a Leadership Academy for ECE.
- We should offer services to multiple government agencies.
- Work on a planning grant for discussion at the March ECEDHA meeting.
- Work on full grant in the following six months.

A vigorous discussion took place around the following questions:
- Who are we advocating for and to?
- Breath of charge for: Workforce, Research, Education?
- What are the first things that should be done (years 1 & 2)?
- What should it be named?
- Who does the work? (It's not all department heads.)

Conclusion
Participants emerged from the 1.5 day workshop with a renewed sense of purpose and enthusiasm to move the discussion into concrete action items.

Action items through March 2016:
- Establish a task force for branding. Include industry partners.
- Establish a task force for community building. Include industry partners.
- Add 2-3 members to the original workshop committee; continue meeting weekly.
- Ask ECEDHA board to work on planning for the areas of education and diversity.
- Develop workshop summary presentation for plenary session at ECEDHA Annual Conference in March.

- Identify 4-5 advocates to facilitate small group discussions during and after the plenary session.
- Create materials for the advocates.
- Write planning grant application.
- Create repository of ECE branding materials.

Appendix A

Workshop Agenda
Georgia Tech Global Learning Center (84 5th St NW, Atlanta, GA 30308)

Day 1, Wednesday, January 20th

7:30 – 4:30 pm	**Registration (Auditorium 233 Foyer)**
7:30 – 8:30 am	**Breakfast (2nd Floor, down from Auditorium 233)**
8:30 – 8:45 am	**Workshop Introduction and Overview (Auditorium 233)** • John Janowiak, Executive Director, ECEDHA • Steve McLaughlin, Professor and Chair, School of Electrical and Computer Engineering, Georgia Institute of Technology; Member-at-Large, ECEDHA
8:45 – 10:00 am	**On the Need for a Coordinated Effort, with Discussion (Auditorium 233)** • Pramod Khargonekar, Assistant Director, Engineering, National Science Foundation • Jim Kurose, Assistant Director, Computer and Information Science and Engineering, National Science Foundation
10:00 – 10:15 am	**Break**
10:15 – 12:00 pm	**Interactive Plenary Session on Vision (Auditorium 233)** ➢ Work in groups to discuss key questions related to vision ➢ Report back
12:00 – 1:00 pm	**Luncheon (Georgia Tech Hotel & Conference Center Dining Room)**
1:00 – 1:20 pm	**An Introduction to the CCC Advocacy Model (Auditorium 233)** • Beth Mynatt, Executive Director, Institute for People and Technology; Professor, School of Interactive Computing, Georgia Institute of Technology; Chair, CCC
1:20 – 1:45 pm	**Questions and Discussions on the CCC Model (Auditorium 233)** • Moderator: Bill Sanders, Professor and Head, Electrical and Computer Engineering, University of Illinois at Urbana-Champaign

1:45 – 3:45 pm	**Breakout Sessions**
	➢ Create a task-based action plan including timelines
	   o **Advocacy groups (Classroom 330)**
	   o **Branding groups (Class room 331)**

3:45 – 4:00 pm	**Break**

4:00 – 5:00 pm	**Regroup with Action Plans (Auditorium 233)** ➢ Group leaders report back on action plans ➢ Questions and discussions
6:00 – 8:30 pm	**Dinner** ○ **The Spence**, 75 5th Street NW, Atlanta, GA

Day 2, Thursday, January 21st

7:30 – 11:00 am	**Registration (Auditorium 233 Foyer)**
7:30 – 8:30 am	**Breakfast (2nd Floor, down from Auditorium 233)**
8:30 – 10:30 am	**Moderated Panel Discussion – Next Steps led by George Pappas (Auditorium 233)** • Sheila Hemami, Professor and Chair, Electrical and Computer Engineering Department, College of Engineering, Northeastern University • John Kelly, Chairman, Electrical and Computer Engineering Department, North Carolina Agricultural & Technical State University • Steve McLaughlin, Professor and Chair, School of Electrical and Computer Engineering, Georgia Institute of Technology; Member-at-Large, ECEDHA • George Pappas, Professor and Chair, Department of Electrical and Systems Engineering, University of Pennsylvania • Bill Sanders, Professor and Head, Electrical and Computer Engineering, University of Illinois at Urbana-Champaign
10:30 – 10:45 am	**Break**
10:45 – 11:30 am	**Breakout Session: Summarizing Output for March and Beyond (Auditorium 233, Computer Lab 130 – 1st Floor)** ➢ Discuss the process moving forward ➢ Workshop summary and preparation for ECEDHA Annual Conference
11:30 – 12:00 pm	**Read Out and Closing Remarks (Auditorium 233)**
12:00 – 1:00 pm	**Luncheon (Georgia Tech Hotel & Conference Center Dining Room)**
12:15 – 2:00 pm	**Committee Meeting (Auditorium 233)**

Appendix B: Attendee list

First Name	Last Name	Institution	Title
Raj	Acharya	The Penn State University	Director, School of EECS
Betty	Anderson	The Ohio State University	Professor & Associate Chair
Rashid	Ansari	University of Illinois at Chicago	Professor and Department Head
Erwei	Bai	University of Iowa	Professor & Department Chair
Stella	Batalama	University of Buffalo	Professor & Department Chair
Miroslav	Begovic	Texas A&M University	Professor and Department Head
John	Booske	University of Wisconsin, Madison	ECE Department Head
Alexandra	Branzan Albu	University of Victoria	Associate Professor
Jonathan	Bredow	University of TX, Arlington	Professor & Department Chair
Mark	Budnik	Valparaiso University	Professor & Department Chair
Satinderpaul	Devgan	Tennessee State University	Professor & Department Chair
Magnus	Egerstedt	Georgia Institute of Technology	Professor & Associate Chair for Resear
Ahmed	Eltom	The University of TN, Chattanooga	Professor and Department Head
Nurgun	Erdol	Florida Atlantic University	Professor & Department Chair
Bonnie	Ferri	Georgia Institute of Technology	Associate Chair for Undergraduate Affa
Simon	Foo	Florida A&M University - Florida State University (FAMU-FSU)	Professor & Department Chair
Ashlee	Gardner	Georgia Institute of Technology	Communications Manager for School c
Monson	Hayes	George Mason University	Professor & Department Chair
Sheila	Hemami	Northeastern University	Professor and Department Head
Larry	Holloway	University of Kentucky	Professor & Department Chair
Khan	Iftekharuddin	Old Dominion University	Professor & Department Chair
Clem	Karl	Boston University	Professor & Department Chair
John	Kelly	North Carolina A&T University	Associate Professor and Department H
Ozlem	Kilic	The Catholic University of America	Associate Professor & Chair
Jelena	Kovacevic	Carnegie Mellon University	Professor and Department Head
Tony	Maciejewski	Colorado State University	ECE Department Head
Steve	McLaughlin	Georgia Institute of Technology	Professor and Department Head
Agneiszka	Miguel	Seattle University	Associate Professor & Chair
Don	Millard	National Science Foundation	Deputy Division Director, Engineering l and Centers (EEC)
Khalil	Najafi	University of Michigan	Professor & Department Chair
Jackie	Nemeth	Georgia Institute of Technology	Communications Manager
John	Nestor	Lafayette College	Professor and Department Head
Dan	Noneaker	Clemson University	ECE Department Chair
Shiv	Panwar	NYU	ECE Department Chair
John	Papapolymerou	Michigan State University	Chairperson and MSU Foundation Prof

George	Pappas	University of Pennsylvania	Professor & Department Chair
John	Peeples	The Citadel	Professor of ECE
Athina	Petropulu	Rutgers University	Professor & Department Chair
Stephen	Phillips	Arizona State University	Professor & Director of ECE School
Robi	Polikar	Rowan University	Professor & Department Chair
Radha	Poovendran	University of Washington	Professor & Department Chair
Zhihua	Qu	University of Central Florida	Professor & Department Chair
Badri	Roysam	University of Houston	Professor & Department Chair
Bill	Sanders	University of Illinois at Urbana-Champaign	Professor and Department Head
Dan	Stancil	NC State University	Professor & Department Chair
Todd	Sweet	University of Illinois at Urbana-Champaign	Director of Communications
Ahmed	Tewfik	University of TX, Austin	Chairman
Leon	Tolbert	The University of Tennessee	Professor and Department Head
Miguel	Velez-Reyes	University of TX, El Paso	Professor & Department Chair
Tom	Weller	University of South Florida	Professor & Department Chair
Doug	Williams	Georgia Institute of Technology	Professor & Associate Chair
Tim	Wilson	Embry-Riddle Aeronautical University	ECE Department Chair
Brian	Woerner	West Virginia University	Professor & Department Chair