Our values
We value the following attributes of our teaching, research, and service activities:

- Pursuit of excellence
- Highest standards of professional and scholarly ethics
- Innovative solutions to electrical and computer engineering problems
- Collegial, creative, and supportive learning environment
- Enrichment by diversity
- Service to the profession of electrical and computer engineering
- Service to humanity

Our goal
To advance the Department of Electrical and Computer Engineering from excellence to eminence.

Our purpose
To disseminate and advance the science and technology of electrical and computer engineering for the well-being of the people of Ohio and the global community.
The Department of Electrical and Computer Engineering has made significant progress toward its goals during the last five years. Successful faculty hires, major new research programs, and a dramatic growth in enrollment all have contributed to improving the department’s reputation and impact. It is critical that we continue this progress with a thoughtfully developed plan firmly in hand to ensure we are enriching and advancing our educational program, improving our research reputation, ensuring our faculty and students represent a depth of diversity, growing our department resources, and optimizing the use of those resources to support our goals in education, research, and service.

We also know we cannot manage what we cannot measure. To that end, we are striving to ensure our goals are specific, measurable, attainable, realistic, and time-appropriate. For our charted course to achieve our stated goals, our faculty and staff must be engaged and accountable for our success.


We continue to make progress toward these goals, and this plan will help us keep them firmly in our sights.

Joel Johnson
Department Chair
Performance Goal
Enrich and advance our educational program

Strategy 1
Assess and refine course curriculum

- Analyze student surveys and performance data from sophomore sequence to improve instructional outcomes
- Grow integration with EEIC to enhance ECE presence in freshman year and to increase ECE participation in interdisciplinary capstone design program
- Complete implementation of MS non-thesis design project program
- Improve laboratory offerings through MS non-thesis project participation
- Grow relationship with regional campuses

Strategy 2
Build partnerships with international universities and industry

- Build industry/government laboratory sponsorship and guidance for undergraduate capstone and MS non-thesis programs
- Create a departmental committee to define and manage international partnerships and grow the number of partnerships and student participants

Strategy 3
Expand distance education programs

- Define and implement incentives for faculty participation in distance education programs
- Create distance offerings for junior-level entry courses to facilitate co-op and internship experiences for students
- Increase number of professional education offerings
- Create focused programs for MS degree in “niche areas” of department expertise
Measuring our Progress
Enrich and advance our educational program

Resource requirements and sources

- Course release provided to faculty as necessary
- Funding from industry/government laboratories for MS program projects
- Financial incentives for faculty distance education participation (e.g. return of portion of tuition or enrollment charges)
- Tuition support for students participating in international programs
- COE support for faculty EEIC participation

Key metrics

<table>
<thead>
<tr>
<th></th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of distance courses offered</td>
<td>3</td>
</tr>
<tr>
<td>Number of industry/government laboratory sponsored design projects</td>
<td>0</td>
</tr>
<tr>
<td>Number of international partnerships</td>
<td>3</td>
</tr>
<tr>
<td>Number of Ohio State ECE students studying abroad through international partnerships</td>
<td>4</td>
</tr>
<tr>
<td>Number of ECE faculty involved in EEIC activities</td>
<td>2</td>
</tr>
</tbody>
</table>
Performance Goal
Improve research reputation to the level of the top 10 in the nation

Strategy 1
Enhance department culture, reward, and support system to promote research growth, especially the growth of centers

- Continue growth of research expenditures
- Support leadership of large-scale projects and proposals (MURI, NSF centers, etc.)
- Support participation in multi-disciplinary teams beyond engineering and physical sciences (for example, with medicine, business, economics, and education)
- Complete transition of ElectroScience Laboratory to a college center and develop plan for growth of ElectroScience Laboratory
- Focus departmental student support on research active Ph.D. students

Strategy 2
Recruit outstanding faculty via success in Discovery Theme and other college/university initiatives

- Recruit faculty in strategic areas for advancement of the department (See Page 9)
- ECE faculty lead or co-lead Discovery Theme proposals in all competitions and participate in multiple proposals in all competitions
- Implement proactive recruitment procedure in personnel committee
- Work with college leadership to define future college research initiatives and to support participation of ECE faculty in these initiatives

Strategy 3
Promote visibility of our research strength and impact

- Increase number of research items with broad publicity potential
- Consistent and compelling industry engagement for student and research support
- Incentivize activities that promote faculty and department visibility
  - Leadership of conferences and conferences organized in Columbus
  - IEEE Fellow awards
  - Editorships of top journals of each field
  - Publications in high-impact journals
  - NAE membership support and promotion
  - Leadership in national and international technical societies
- Increase number of department internal awards
# Measuring our Progress

Improve research reputation to the level of the top 10 in the nation

## Resource requirements and sources

- New staff position for major proposal development and project management
- Matching funds from department and college
- Departmental funds
- Course release for faculty service activities

## Key metrics

<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Increase research expenditures per FTE tenure track faculty</strong></td>
<td>$460K</td>
<td>$468K</td>
<td>$476K</td>
<td>$484K</td>
<td>$492K</td>
<td>$500K</td>
</tr>
<tr>
<td><strong>Number of ECE-led proposals of more than $1M/year each year</strong></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>Discovery theme proposals w/ECE participation (per contest)</strong></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td><strong>US News graduate ranking</strong></td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td><strong>Number of IEEE Fellows</strong></td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>21</td>
</tr>
<tr>
<td><strong>General/program conference chairs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><strong>Faculty editors of leading journals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><strong>Number of industry projects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><strong>Funding from industry</strong></td>
<td></td>
<td>+5%</td>
<td>+5%</td>
<td>+5%</td>
<td>+5%</td>
<td>+5%</td>
</tr>
<tr>
<td><strong>Annual internal department awards</strong></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td><strong>Faculty officers of technical societies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><strong>Conversion of ESL to center</strong></td>
<td></td>
<td>complete</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Performance Goal
Improve research reputation to the level of the top 10 in the nation
### Strategic areas of emphasis and alignment with Discovery Themes

<table>
<thead>
<tr>
<th>Areas of Application</th>
<th>Discovery Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sensing and Information</strong>&lt;br&gt;Environmental Monitoring, Security and Defense, Medical Imaging, Personalized Healthcare, Data Analytics, Optoelectronics, THz systems</td>
<td>Health and Wellness&lt;br&gt;Medical imaging and sensors are crucial in disease diagnosis and treatment and in personalized healthcare. Data analytics and information analysis are also crucial to the future of our healthcare system.</td>
</tr>
<tr>
<td><strong>Energy Efficient Electronics and Systems</strong>&lt;br&gt;Ultra-low Power Electronics, Power Electronics, Energy Distribution, Alternative Energy Sources, Transportation, Manufacturing, Aviation, Implantable Electronics</td>
<td>Energy and Environment&lt;br&gt;Environmental sensors are key enabling technologies for monitoring and understanding the global climate. Information technologies are important components of “smart grid” energy systems.</td>
</tr>
<tr>
<td><strong>Computation and Cyber-Physical Systems</strong>&lt;br&gt;Manufacturing, Robotics, Aviation, Machine Intelligence, Data Analytics</td>
<td>Food Production and Safety&lt;br&gt;“Smart grid” and highly efficient electrical energy delivery systems are of high importance in achieving energy efficiency. Highly efficient power electronics devices are an emerging enabling technology of high future impact for manufacturing, automotive, and aviation needs.</td>
</tr>
<tr>
<td><strong>Advancement in computer technologies are crucial in decoding genetic information to achieve truly personalized healthcare. Robotics and cyber-physical methods will play key roles as future assistive systems technologies to improve quality-of-life for the elderly or disabled.</strong></td>
<td><strong>Cyber-physical sensor networks are emerging as crucial components in environmental and energy grid monitoring. Intelligent transportation, energy grid optimization, and advanced robotics for manufacturing are also key technologies to improve energy efficiency.</strong></td>
</tr>
</tbody>
</table>

Particular focus areas of interest for faculty recruitment in the 2014-18 period have been identified as *Sensing and Information, Energy Efficient Electronics and Systems,* and *Computation and Cyber-Physical Systems.* These cross-cutting areas couple strengths across the ECE discipline to achieve high impact results in a variety of applications.

Our strategic areas are also each of high impact to all three of OSU’s Discovery Themes: *Health and Wellness, Energy and Environment,* and *Food Production and Security.* Over the next 10 years, the Discovery Themes will provide the basis for the recruitment of 500 new tenure-track faculty, both as individual scholars and as well as groups of faculty in critical areas.

Because of the diverse areas of emphasis within ECE and because of the importance of ECE technologies across the research enterprise, the department is uniquely positioned to play an integral role in the success of all the three Discovery Themes. The Department will emphasize the development and leadership of proposals in the Discovery Theme competitions, including partnerships with other departments and colleges, to create transformational “Big Ideas” in the research areas proposed.
Performance Goal
Promote a representative faculty and student body; increase our stature and public awareness

Strategy 1
Increase representativeness of the ECE students, faculty, and staff

- Recruit a diverse undergraduate population
- Provide incentives for recruitment of graduate enrichment fellows
- Establish strategic relationships with minority serving institutions
- Ensure that hiring activities result in increased representativeness of faculty
- Promote welcoming culture for underrepresented students, faculty, and staff
- Eliminate gender or cultural biases in recruitment processes
- Work with COE leadership to advance department representativeness and culture
- Promote humanitarian engineering activities in student recruitment

Strategy 2
Expand public relations activities

- Develop department procedure to identify and announce news items for every Ph.D. dissertation, project award, and publication
- Establish procedure for faculty to report new results and innovations consistently
- Create informative and appealing promotional material for placement in Dreese and Caldwell
- Expand shared resource of ECE public relations presentation materials
- Continuous development and refinement of current departmental “talking points” on recent developments
- Implement consistent branding across external and internal communications
Performance Goal
Promote a representative faculty and student body; increase our stature and public awareness

Strategy 3
Expand outreach activities

- Expand hands-on activities that can be taken to schools through participation of undergraduate capstone and MS program design projects
- Transition leadership of COE FIRST program from MAE to ECE
- Work with alumni association to expand activities and increase participation
- Develop reward system to encourage faculty to participate
- Work with college to leverage COE outreach efforts
- Expand department participation in humanitarian activities
- Expand communication efforts associated with outreach programs
# Measuring our Progress
Promote a representative faculty and student body; increase our stature and public awareness

## Resource requirements and sources
- Course release for faculty involvement
- Department funds provided for materials and supplies
- Staff support for outreach efforts
- Partnership with college and university communications offices
- Volunteer efforts of department alumni society
- Pooled resources and college/university funds for hiring of women/minority faculty members
- College initiatives in graduate recruitment

## Key metrics

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Representativeness of ECE faculty</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Number of females in ECE student body*</td>
<td>U: 106</td>
<td>G: 71</td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Number of students from underrepresented minorities**</td>
<td>U: 73</td>
<td>G: 9</td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Number of strategic relationships with minority serving institutions</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Number of “major” ECE news items per year</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Active participants in ECE alumni society</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Students participating in humanitarian activities</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Number of student contacts via outreach per year</td>
<td>1550</td>
<td></td>
<td></td>
<td></td>
<td>2000</td>
<td></td>
</tr>
</tbody>
</table>

* U= Undergraduates, G=Ms and Ph.D. students
** Represents African American, Hispanic, American Indian / Alaskan Native, and Native Hawaiian/Pacific Islander students
Performance Goal
Grow departmental resources & optimize their use to support goals in education, research, and service

Strategy 1
Allocate significant efforts to and achieve success in development

- Work with college development office and department development officers to create and execute a “roadmap” for development on both the alumni and corporate fronts
- Complete departmental campaign committee and support its development efforts
- Increase communication with potential donors
- Create environment in ECE to maintain long-term ties with current students
- Plan for Caldwell renovation/replacement
- Obtain funds for new endowed chairs or professorships
- Promote proposals to foundations

Strategy 2
Hire and retain the best faculty members

- Hire based on department priorities and hire for excellence
- Enhance mentorship program for junior and mid-level faculty
- Ensure department culture and work environment promote retention of productive faculty
- Increase number of faculty members in leadership positions in the college and university, including placing faculty in the President and Provost’s leadership institute
**Performance Goal**
Grow departmental resources & optimize their use to support goals in education, research, and service

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**Strategy 3**
Provide excellent customer service to faculty, staff, students, alumni and the community

- Eliminate current deficits for staff support
- Add department staff to improve operational efficiency and provide greater support for faculty and departmental initiatives
- Review current processes and support staff functions to identify methods to enhance, automate, simplify, and standardize, while increasing efficiency and productivity
- Implement an effective annual performance evaluation process that is consistent with department priorities
- Promote professional development opportunities for staff
- Provide timely financial information to the chair and faculty
- Implement audit recommendations efficiently and effectively

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**Strategy 4**
Expand and improve facilities

- Expand industry support for research and educational facilities
- Develop plan for continued renovation of Caldwell Laboratory prior to future replacement
- Develop plan for expansion of department research facilities on West Campus
# Measuring our Progress

Grow departmental resources & optimize their use to support goals in education, research, and service

## Resource requirements and sources

- College funding for staff positions and elimination of staff deficit
- Department funds for additional development activities and associated travel expenses
- Departmental cash and staff support for alumni society activities
- College/university support for counteroffers

## Key metrics

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Total dollar amount of donations to ECE</td>
<td>$1.5</td>
<td>$1.65</td>
<td>$1.8</td>
<td>$2.0</td>
<td>$2.2</td>
<td>$2.4</td>
</tr>
<tr>
<td>Number of ECE-specific endowed chairs</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foundation proposals per year</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of faculty members in leadership positions in the college and university</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of national and international awards received by ECE faculty members per year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>

*in millions/year*
### Antonio Conejo

**Professor, ECE and Integrated Systems Engineering**

Antonio Conejo joined The Ohio State University’s Department of Electrical and Computer Engineering in 2014, with a joint role in Integrated Systems Engineering. He previously was a professor at the Universidad de Castilla-La Mancha, Spain. His expertise includes electric energy systems and mathematical tools for decision-making in energy systems. He has contributed to the current design of electricity markets and the development of methods and policies for their efficient operation. His interests include devising ways to enable a large-scale integration of renewable sources in electric energy systems. He is editor-in-chief of the *IEEE Transactions on Power Systems*, an IEEE Fellow, and chair of the IEEE PES Power System Operations Committee.

He earned his master’s degree at Massachusetts Institute of Technology and his PhD at the Royal Institute of Technology, Sweden.

### Lisa Fiorentini

**Assistant Professor of Practice**

Lisa Fiorentini was one of two professors hired in 2013 to evolve the department’s master’s degree program by developing an innovative approach for those students whose focus is working in industry.

She has been conducting research at The Ohio State University Center for Automotive Research since 2010, most recently as a senior research associate. Her research spans the field of control and system theory with emphasis on nonlinear systems, robust and adaptive control, and applications in aerospace and automotive engineering.

Fiorentini earned a PhD in electrical and computer engineering from The Ohio State University in 2010.

### Liang Guo

**Assistant Professor, ECE and Neuroscience**

Liang Guo joined The Ohio State University Department of Electrical and Computer Engineering in 2013, with a joint role in neuroscience.

He conducts research in neural interfaces, neural prosthetics, biomedical microdevices, and biological circuits engineering.

Guo earned a PhD in bioengineering from the Georgia Institute of Technology in May 2011. He was formerly a postdoctoral associate at the Massachusetts Institute of Technology.

### Wladimiro Villarroel

**Assistant Professor of Practice**

Wladimiro Villarroel was one of two professors hired in 2013 to develop an innovative approach to master’s degrees for students whose focus is working in industry.

He has more than 15 years of industry experience, including 10 years at AGC Automotive Americas, where he was division manager for fundamental technologies. At AGC Villarroel managed research and development programs and innovation activities in the U.S. for the world’s largest automotive glass supplier. His work related to antenna, glass-forming simulation, acoustics, and solar technologies.

In addition to his PhD in electrical engineering, he earned a JD from the Thomas M. Cooley Law School in Ann Arbor, Mich., and an MBA from Cleveland State University.

### Jiankang Wang

**Assistant Professor, ECE and Integrated Systems Engineering**

Jiankang Wang joined The Ohio State University Department of Electrical and Computer Engineering in spring 2014, with a joint role in integrated systems engineering.

Her research areas of expertise are emerging technologies of modern power systems, especially variable energy resources and demand side participation. Her research has contributed to two categories: electricity market operation and design, and transmission and distribution systems automation and planning.

Wang received her master’s degree and PhD in electrical engineering and computer science from MIT in 2009 and 2013 respectively.

### Mohammadmahdi Rezaei Yousefi

**Research Assistant Professor**

Mohammadmahdi Rezaei Yousefi joined The Ohio State University as a research assistant professor in 2013.

He conducts research in genomic signal processing, optimal control of gene regulatory networks, cancer therapy, systems biology, pattern recognition and small-sample classification.

Yousefi received a PhD in electrical engineering from Texas A&M University in 2013.
A successful strategic plan requires two fundamental components. It must be designed around a strong and compelling vision that provides context and identifies overall direction and goals. Second, the organization needs strategies to achieve that vision, and the capacity and the will to execute those strategies.

The department’s previous strategic plan was developed in 2009 and guided activities for 2009-2013. Progress toward the goals defined in 2009 is reviewed to highlight successes and to provide context for future actions.

Our overarching goal is that The Ohio State University Department of Electrical and Computer Engineering will be recognized internationally for the quality and impact of its research, teaching, and service.

It will be the major contributor in achieving the strategic goals defined for College of Engineering and will be a key asset to The Ohio State University in becoming the premier public university in the United States. The knowledge we create and disseminate will stimulate economic growth in Ohio, the nation and the world.

The department will perform world-class research, will recruit and retain distinguished faculty, and will attract, educate, and graduate outstanding students. It will be a catalyst for the development of Ohio’s technology-based economy, especially in sectors related to electrical and computer engineering.

Collaborations with the private sector will enhance research, transfer ECE technology that addresses important technological challenges and promotes Ohio’s Information Age economy, and provide “real-world” experiential learning for students.

The department will discover, develop, and document fundamental new engineering and scientific principles. It will be recognized as a center of excellence for pioneering research and scholarship in electrical and computer engineering.

Our students will learn in a diverse environment characterized by professional conduct and scholarship. The quality of our physical facilities will be consistent with our pursuit of excellence.

Our graduates will be aggressively recruited for their valuable education. Our alumni will become recognized for their abilities, leadership, creativity, teamwork, adaptability, focus on quality, and capability for lifelong learning.
The Ohio State University officially launched its Center for High Performance Power Electronics (CHPPE) in October, opening the door for tremendous advances in power electronics and superconductor technology.

CHPPE was established through $9.1 million in Ohio Third Frontier grants beginning in 2010. Additional project partners have included GE Aviation, Air Force Wright-Patterson Research Lab, Ford, and Texas Instruments. Grant funds were invested into equipment, software, test hardware and facility upgrades that will make future research possible. The center is expected to provide facilities for 50 graduate students and five core faculty members.

The center will allow Ohio State researchers exploit the advantages of silicon carbide-based power devices over the current standard silicon-based devices.

The Ohio State electrical engineering and computer engineering graduate programs have both been recognized as being among the nation’s top 20 graduate programs in each discipline, according to the U.S. News and World Report 2015 rankings. The rankings were released in March 2014.

U.S. News ranked Ohio State’s electrical engineering graduate program 18th in the nation out of 173 programs, the same spot it held for 2014 and up from 19th in 2013. Ohio State’s computer engineering graduate program was ranked 18th our of 140 programs for 2015, up from 19th in 2014 and 23rd in 2013. Ohio State ranked best in Ohio in both programs.

The Ohio State electrical engineering graduate program is tied at 18th with programs at UC-Santa Barbara and Texas A&M. The computer engineering program is tied with programs at UC-Santa Barbara and Rice University.

ECE Department ranks 18th in 2015 US News Rankings

CHPPE promises advances in power electronics, superconductors
How far are we from our ideal?

Many consider the US News and World Report rankings to be an important indicator of the quality of an educational program. This ranking is compiled from a survey of ECE department chairs in 175 United States programs, with results from an averaged department quality score ranging from 1 (worst) to 5 (best). For 2014, the department's score was 3.7 out of 5.0, the highest in recent history.

We are on the cusp of the top 10% of ranked departments and the top 10 public institutions. Ohio State ECE was the only department to achieve a score of 3.7 in 2014. Four schools tied for 14th with the next-highest score of 3.8. A score of 3.6 resulted in a seven-way tie for 19th position.

It is worth noting that the nation's top programs are dominated by public university departments with large faculties and by elite private universities. (See graph, left.)

Our department faculty FTE is shown by the red line. Of the 17 departments ranked higher than Ohio State, only five have a comparable or smaller number of tenure track faculty. Of these five, three (Cal Tech, Cornell, and Princeton) are elite private universities.

Note that some of the departments listed (MIT, University of Michigan) include both computer science and electrical engineering faculty, but such cases remain larger than the current Ohio State faculty even if the numbers provided are halved.
In other cases (e.g., UCLA), computer engineering is excluded from the tenure track count when this discipline is part of a computer science department.

Although the US News and World Report graduate program ranking is only one measure of a program’s status, programs in the top 10 of this ranking are widely regarded as premier departments. Rightly or not, this ranking is used by potential students and other external parties in assessing our status and quality.

It is noted that Ohio State ECE’s undergraduate program has not been ranked in the past five years. While graduate rankings are provided for the top 100 programs, undergraduate rankings are only given for the top 20 programs. In general, undergraduate program rankings are very similar to the graduate program rankings, although a few private universities such as Rice and Northwestern have a significantly higher ranking for their undergraduate program, thereby displacing the public universities.

Data shows ECE program reputation is related to the tenure track faculty size. Therefore, improving Ohio State ECE’s rank to premier status means we must employ strategies that increase our number of tenure track faculty members.
Points of Pride
Promotions to Associate Professor in ECE

Atilla Eryilmaz
Expert in systematic design and practical operation of energy-efficient, low-complexity, high-performance, secure, and reliable sensor and mobile ad hoc networks (MANETs). Received the NSF CAREER award, the College’s Lumley Research Award, and multiple research projects including projects sponsored by the Qatar National Research Fund and the Defense Threat Reduction Agency.

Waleed Khalil
Expert in design, fabrication, test, and characterization of analog integrated circuits, who joined the department after 15 years experience at Intel, Inc and holds 12 issued patents. Lead PI of a $1M DARPA program on integrity and reliability of integrated circuits, along with other support from AFOSR, NSF, and AFRL.

Emre Koksal
Expert in wireless communication systems and networking. Received the NSF CAREER award, and the College’s Lumley Research Award, and multiple research projects from NSF (2 as PI and 3 as co-PI) and the Qatar National Research Fund.

Siddharth Rajan
Expert in semiconductor materials with a focus on Gallium Nitride based materials and devices. Co-investigator on 3 MURI programs with OSU funding exceeding $3.5M, as well as multiple NSF and ONR programs of more than an additional $1M of research support.

Jin Wang
Expert in high power energy systems and high voltage power electronics. Lead PI of a $3.7M Department of Energy program to improve power engineering curriculum and NSF CAREER awardee.
Our Strengths

Broad expertise in critical enabling technologies

ECE is a broad discipline, encompassing fundamental innovations in electrical physics, materials science, electromagnetics, and electronics through information theory, signal processing, system control, computer design, robotics, transportation and power engineering. The tremendous impact of electronics and electronic systems on all aspects of technology makes ECE an important component, and in many cases the most important component, of all current science and technology innovation.

The expertise of current ECE faculty is directly applicable to all the 14 grand challenges identified by the National Academy of Engineering, as well as the University's Discovery Themes of Health and Wellness, Energy and Environment, and Food Production and Security. ECE expertise also applies to the College of Engineering's cross-discipline areas of sensing, manufacturing, and advanced materials. Our research includes excellence at the levels of fundamental physics, in the development and demonstration of new component technologies, in the design and deployment of major systems and networks, and in the areas of energy, sensing, control, and information. The fundamental importance of electrical technologies makes ECE a desirable partner for collaboration across departments and colleges.

Recent hires include joint appointments with Industrial and Systems Engineering, Neuroscience, and Ophthalmology. ECE collaborations across disciplines have been increasing in recent years, including many joint projects with The Ohio State University Medical Center.

Outstanding faculty members

ECE's internationally renowned faculty members include 19 IEEE fellows and 3 AAAS fellows. A number of our faculty members have large research programs with ample funding, vibrant research groups, and significant research output. Faculty members hired during the last decade also have been very successful, with multiple major funding awards. The department's increasing ability to attract high-quality faculty members is promoting a virtuous positive feedback that improves impact and reputation.

ECE is also expanding its faculty diversity. Recent hires of faculty members Assistant Professor Jiankang Wang and Assistant Professor of Practice Lisa Fiorentini brought the percentage of female members into the double digits for the first time in the department's history. Our faculty also hold significant university leadership positions, including Steven Ringel, director of the Institute for Material Research (IMR), and Randy Moses, associate dean for Research in the College of Engineering.

Scholarship

Our faculty author more than 120 publications annually in high-impact archival journals, along with many publications for highly selective conferences. More than half of the department's faculty receive more than 100 citations per year.

Ph.D. Graduates

The department has a strong Ph.D. program and a culture that emphasizes doctoral education. The metrics for the number of Ph.D. students per faculty member and doctoral degrees granted are important components of the College of Engineering's US News and World Report ranking. The department's ratios of Ph.D. students per faculty member and Ph.D. graduates per faculty member exceed the averages of the College of Engineering.
The Department of Electrical and Computer Engineering is proud of the incredible and diverse research in which our faculty members are actively involved. Their research includes serving as principal investigators or Ohio State team leads for nine current multidisciplinary university research initiatives.

<table>
<thead>
<tr>
<th>MURI Ohio State Lead</th>
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<tbody>
<tr>
<td>Steven Ringel</td>
<td>Randy Moses</td>
<td>Ness Shroff</td>
</tr>
<tr>
<td><strong>DRIFT: Design-for-Reliability Initiative for Future Technologies</strong></td>
<td><strong>Modeling, Analysis, and Algorithms for Stochastic Control of Multi-Scale Military Networks</strong></td>
<td><strong>Multivariate Heavy Tail Phenomena: Modeling and Diagnostics</strong></td>
</tr>
<tr>
<td><strong>Goal:</strong> Develop models and methods to identify fundamental physical mechanisms of GaN transistor degradation during operation, leading to the development of a physics-based predictive model of device reliability in high power high frequency GaN RF electronics.</td>
<td><strong>Goal:</strong> Develop a theoretical foundation for modeling, analysis, and control of highly heterogeneous, complex and mobile tactical military networks to produce provably efficient and practical control mechanisms to achieve high performance, robustness, and security.</td>
<td><strong>Goal:</strong> Develop reliable diagnostic, inferential and model validation tools for heavy-tailed multivariate data; to generate new classes of multivariate heavy tailed models that highlight the implications of dependence and tail weight; and to apply these statistical and mathematical developments to the key application areas of network design and control, social network analysis, and signal processing.</td>
</tr>
<tr>
<td>Partner schools: UC Santa Barbara (lead), Stanford, Arizona State, Yale, MIT and Harvard</td>
<td><strong>Partner schools:</strong> MIT, Georgia Institute of Technology, Univ. of Maryland, Purdue, Univ. of Illinois at Urbana-Champaign, Cornell</td>
<td><strong>Partner schools:</strong> Cornell (lead), Columbia, Univ. of Massachusetts-Amherst, American, Univ. of Illinois at Urbana-Champaign, Univ. of Minnesota</td>
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<td><strong>John Volakis</strong></td>
<td><strong>Emre Ertin</strong></td>
<td><strong>Siddharth Rajan</strong></td>
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<td><strong>Associate Professor</strong></td>
<td><strong>Research Assistant Professor</strong></td>
<td><strong>Associate Professor</strong></td>
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<td><strong>MURI Principal Investigator</strong></td>
<td><strong>MURI Ohio State Lead</strong></td>
<td><strong>MURI Ohio State Lead</strong></td>
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<tr>
<td><strong>Materials with Extraordinary Spin-mediated Thermal Properties</strong></td>
<td><strong>Value-centered Information Theory for Adaptive Learning, Inference, Tracking, and Exploitation</strong></td>
<td><strong>Devices and Architectures for Terahertz Electronics (DATE)</strong></td>
</tr>
<tr>
<td><strong>Goal:</strong> To develop new materials with extraordinary thermal properties based on spin effect, converting heat into a quantum mechanical operation.</td>
<td><strong>Goal:</strong> Develop a comprehensive set of principles for task-specific information extraction and information exploitation that can be used to design the next generation of autonomous and adaptive sensing systems.</td>
<td><strong>Goal:</strong> Develop III-nitride semiconductor devices that operate above 1 Thz.</td>
</tr>
<tr>
<td>Partner schools: Univ. of Michigan (lead), Arizona State, MIT, UC Berkeley, UCLA, UC San Diego</td>
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<td><strong>Partner schools:</strong> Notre Dame (lead), Johns Hopkins and Wright State</td>
</tr>
<tr>
<td><strong>High-power RF devices using metamaterials</strong></td>
<td><strong>Extreme Electron Concentration Devices (EXEDE)</strong></td>
<td><strong>Randy Moses</strong></td>
</tr>
<tr>
<td><strong>Goal:</strong> Adapt metamaterial concepts to develop smaller and optimal high power microwave devices.</td>
<td><strong>Goal:</strong> Investigate electronic and plasmonic applications of oxide semiconductors with extremely high charge density</td>
<td><strong>Associate Dean / Professor</strong></td>
</tr>
<tr>
<td>Partner schools: Univ. of New Mexico, MIT and UC-Irvine</td>
<td><strong>Partner schools:</strong> UCSB (lead), Yale and Stanford</td>
<td><strong>MURI Co-Principal Investigator</strong></td>
</tr>
<tr>
<td><strong>Dielectric Enhancements for Innovative Nitride Electronics (DEFINE)</strong></td>
<td><strong>Modeling, Analysis, and Algorithms for Stochastic Control of Multi-Scale Military Networks</strong></td>
<td><strong>Associate Professor</strong></td>
</tr>
<tr>
<td><strong>Goal:</strong> Explore and develop a fully characterized, robust set of dielectrics for GaN to enable novel functionalities in GaN electronic devices.</td>
<td><strong>Partner schools:</strong> MIT, Georgia Institute of Technology, Univ. of Maryland, Purdue, Univ. of Illinois at Urbana-Champaign, Cornell</td>
<td><strong>MURI Primary Investigator</strong></td>
</tr>
<tr>
<td>Partner schools: UC Santa Barbara (lead), Stanford, Arizona State, Yale, MIT and Harvard</td>
<td></td>
<td><strong>MURI Primary Investigator</strong></td>
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Points of Pride
MURIs in the Department of Electrical & Computer Engineering
Our Strengths (cont.)

Center-level funding

ECE faculty have been very successful in obtaining center-level funding. Faculty members currently lead or have involvement in nine multi-university research initiatives (MURIs, See Page 19), a National Science Foundation Materials Research and Engineering Center, an NSF Nanoscale Science and Engineering Center, two NSF Industry and University Cooperative Research programs, an Air Force Research Laboratory Automatic Target Recognition Center, and the Crash Imminent Safety University Transportation Center. Our faculty have been very successful in obtaining Ohio funds as well, including the Center for High Performance Power Electronics (CHPPE), which is sponsored by the Ohio Development Services Agency.

Commitment to teaching

The department requires that non-laboratory courses are taught by faculty members, ensuring student receive the highest-caliber instruction. ECE faculty have an average rating of 4.4 out of 5.0 on the Student Evaluation of Instruction.

Facilities

Ohio State has one of the largest ECE departments in the nation in terms of space, with access to facilities that are on par with the best in the nation in the areas of high performance computing, electromagnetics/microwaves, medical imaging, intelligent transportation systems, energy systems, solid state, and robotics. Our facilities include space in Dreese Laboratory, Caldwell Laboratory, and two buildings of the ElectroScience Laboratory (West Campus). We have the ability continue to expand through access to new West campus facilities.

Alumni

Our alumni’s success contributes to our strong reputation. Many of our alumni hold or have held executive-level positions in top technology companies and government entities in the United States and abroad. Many alumni are actively engaged in research collaborations with department faculty and are continuing advocates for hiring Ohio State students in their companies. Thanks to the department’s longevity and size, we have one of the largest alumni bases (close to 10,000) of any ECE department in the country.

Strong demand from students

Demand for our undergraduate and graduate programs was identified as a weakness in the 2009 strategic plan. This period marked a low point in student demand for engineering studies nationally. Since that time, we have seen a resurgence of interest in ECE. The department is operating at capacity for undergraduate enrollment with more than 900 students and at an all-time high of 412 students in the graduate program. (See graphs, Page 24).
Our Areas for Improvement

Resource challenges
The College of Engineering is the major source of funds for the department. These funds are our general funds. Due to past budget cuts and the historical nature of these allocations, the current levels of general fund contributions result in a constrained resource environment for departmental operations. Currently, the general fund covers only faculty and staff salaries and benefits and a limited number of graduate teaching associates.

The department currently operates in a deficit situation with regard to staff support. Because the department remains understaffed compared to its peers, support for new initiatives is a major challenge. This situation has persisted for many years; as a result, many faculty have become accustomed to working in an environment of little internal support, limiting the growth of their research programs. The simultaneous dramatic growth in student enrollment has further strained internal resources.

Challenges in maintaining computer engineering program
Although there are a number of faculty members associated with the computer engineering program, most tend to do research on the periphery, such as in the areas of robotics, computer vision, and networking. Without dedicated recruitment efforts upcoming faculty retirements in the area will challenge the department’s computer engineering instruction.

Uneven faculty research contributions
The department has many outstanding faculty members who are very productive both in terms of quality and quantity of research; however, a significant number of faculty members do not contribute consistently to our research and graduate education missions, which dilutes our numbers in many of the quantitative metrics used to judge our program.

Minimal support for major research initiatives
Due to resource limitations, the department has had little capability to provide incentives for major proposal development or to provide dedicated staff support for such efforts. Although many of the department’s faculty have succeeded in major program efforts despite these challenges, the current environment remains a hindrance for encouraging major program development.

Public relations and recognition
Publicity was identified as a weakness in 2009 and remains so in 2014. The addition of a dedicated public relations staff member has resulted in improvement, but additional efforts are required to achieve the wider recognition deserved by the department’s personnel. This lack of recognition is also a challenge in promoting department personnel for major awards, including membership in the National Academy of Engineering.

Antiquated facilities
Caldwell Laboratory was built around 1950. Its condition is not consistent with that of a premier department. While some modest renovations have occurred in recent years, major renovations or a complete replacement remain necessary.
Representative faculty and student body

Increasing the representativeness of the faculty and student body with respect to gender and ethnicity is clearly important to ensure a diversity of experience and expertise and to provide role-models for students. The department has made progress with regard to the gender disparity among the faculty, but additional steps with regard to gender and ethnicity are needed.

Only 10.8% of current ECE undergraduate students are female, a value well below our peer institutions. Increasing the 8% of undergraduate students and 2.3% of graduate students from under-represented minority populations is also a departmental goal.
Our Challenges

Changing research and funding climate

The probability of a decline in overall federal research funding is high given concerns about the federal budget. Competition for federal funds, particularly major research programs, is expected to be fierce in the upcoming five-year period. Nevertheless, numerous major awards will be available, many of which will emphasize interdisciplinary research areas. The department must be prepared to compete successfully in this arena, while at the same time developing alternative sources of research funding (e.g. state, industrial, and foundation sources.)

Enrollment capacity

The department is operating at capacity in the undergraduate and MS programs. Student demand for our programs remains high. Accommodating additional students is desirable to increase our impact on the profession and to benefit the state and national economies; however, ensuring all graduates are well prepared, productive engineers is a standard that cannot be compromised. Meeting student demand while providing high quality experiential learning and outstanding graduates will be a near-term challenge. While some actions can provide increased capacity on a limited basis, investment in new facilities and faculty are necessary if a major capacity increase is to occur.
Insufficient and outdated facilities
The poor condition of some of the department’s facilities represents a challenge for achieving success in future research and education programs. Major efforts will be required to achieve success in addressing this problem.

Increased global competition and changing educational environment
The improving number and quality of international universities (for example, those in China, India, Korea, and other countries) provide alternative opportunities for prospective students. This trend is expected to continue, so only premier ECE programs will attract a large number of international students, particularly outstanding international graduate students. The increasing number of distance learning programs, including those operating at reduced costs for a degree program, also represents a shift in the educational environment.

Increased faculty retirement
Recent changes to the State Teachers Retirement System (STRS) create additional incentives for faculty hired in 1991 or earlier to retire. One third of the department’s tenure-track faculty are in this category. These faculty members have unique capabilities that have benefited the department; ensuring these positions are filled with faculty who possess needed expertise represents a major recruitment challenge.

Achieving representativeness
Achieving the goal of increased representativeness among the ECE faculty and student body will be a major challenge given the limited populations available for recruitment. Proactive efforts will be necessary to meet departmental goals in this area.
Our Opportunities

Discovery Themes

The university’s commitment to hire a large number of new faculty through the Discovery Themes initiative represents a major opportunity for ECE to grow and to build partnerships across the college and the university. New Discovery Theme competitions in specified topics are expected to continue throughout the upcoming five-year period. The department must dedicate a significant effort to developing successful teams and to participating in the resulting interdisciplinary institutes that are created.

College initiatives

The College of Engineering has defined several strategies for the 2011-2016 period and has begun implementation through resource commitments and by hiring new college staff members. Particular strategy areas include development initiatives, enhanced industry relations, participation in the university’s proposal development center, global initiatives, and distance learning. These emphases align well with departmental goals, and the college’s leadership in these areas will provide opportunities for ECE to participate and to benefit.

Distance education

The increased interest in and demand for distance education represents both an opportunity and a challenge for ECE. Distance learning for currently enrolled students can make our program more desirable and allow greater participation in co-op and internship programs by our enrolled students, thereby improving the experiential component of our training. Increased production of distance learning materials by our faculty could also increase our professional education activities, which are desirable to enhance connections with industry, provide exposure for our faculty, and create new sources of revenue for the department.

Global initiatives

ECE has launched two successful student exchange programs with international universities. Such programs make our program more attractive for students interested in international training, assist in recruiting outstanding international students, and build bridges for international cooperation in a variety of areas. The emphasis on global initiatives at both the college and university levels also will provide opportunities for additional initiatives. The growing involvement of ECE faculty and students in international humanitarian engineering programs also will provide continuing and new opportunities for international engagement.

Sustainable center funding model

The impending development and implementation of a college-wide center funding model is expected to impact the department positively by supporting the growth of successful research centers. The ElectroScience Laboratory is one such center that is poised for additional growth, given a sustainable support model. The potential transition of the ESL to a college center in the next five years represents an opportunity that will benefit the department. The creation and growth of other college centers under ECE faculty leadership is an additional opportunity given a sustainable support model.

West Campus growth

The expected growth in facilities on West Campus will provide opportunities for new ECE facilities and for potential relocation of some research areas to improved work and research environments. Potential opportunities include expanded industrial partnerships in the new ESL building and additional build-out of the CEMAS facility to accommodate related ECE efforts.
**Retirements**

The expected increased rate of faculty retirement over the next five-year period represents both a challenge and an opportunity. New faculty recruits can contribute to the department’s educational program while expanding research into new and strategic directions. These new faculty also will be expected to spur collaboration across traditional research boundaries into the multi-disciplinary arena of future major research opportunities.

**Development activity**

Development of relationships with department alumni and potential donors until 2013 was largely performed only on an ad-hoc basis by the department chair as time allowed. As a result, the department’s endowment is modest and there are a very small number of endowed chairs and professorships. The College of Engineering’s allocation of department-specific staff is expected to provide a more systematic approach to development for the future, but there is a significant opportunity for improvement in this area, particularly thanks to dedicating full-time development professionals to nurture relationships with alumni and other supporters.
Researchers at The Ohio State University hope to save lives and reduce the severity of human injuries in auto accidents by looking closely at what happens in the final seconds before vehicle collisions.

The goal of the university’s new Crash Imminent Safety University Transportation Center (UTC) is to increase understanding of technology design and improve the ways humans interact with intelligent, autonomous and semi-autonomous vehicles. The research will include developing advanced accident simulators, performing extensive modeling, analyzing past accidents and developing autonomous vehicles – all with the goal of making the U.S. transportation system the safest in the world.

The center and its research will be funded by a grant from the U.S. Department of Transportation. The university will receive $1.41 million in 2013 and has requested an additional $1.5 million for 2014. The award and associated cost sharing total $4.3 million over the first two years of operation.

Partner universities working with Ohio State on the UTC are Indiana University-Purdue University in Indianapolis; North Carolina A&T State University in Greensboro; University of Massachusetts in Amherst; and the University of Wisconsin in Madison.

By studying drivers’ actions and how vehicles behave in that short period of time, engineers should be able to design safer vehicles. This research will become even more critical in the years to come as even more advanced vehicles are developed.

A key component of the research will be development of a common, networked driver simulation that will allow researchers to experiment with pre-crash safety through simulated accidents.

UTC launched thanks to $4.3M grant

Buckeye Current third at Isle of Man

The Ohio State University College of Engineering’s Buckeye Current electric motorcycle team—along with UK native and world-renowned rider Rob “The Bullet” Barber—finished third in their first-ever appearance at the world-famous Isle of Man Tourist Trophy (TT) races. The only U.S. collegiate team to compete in the TT Zero, Buckeye Current steered to a podium finish with an average speed of 90.4 mph, besting both professional and collegiate competitors.

The Isle of Man is a self-governing dependent territory of the British Crown, located in the Irish Sea between the islands of Great Britain and Ireland.

First and second places went to MotoCzysz and Mugen, professional teams with multi-million dollar budgets. Ohio State’s student-led team designed and built their electric motorcycle—the “RW-2”—with approximately $50,000.