WE ARE THE
TINKERERS, CREATORS,

AND **MAGIC MAKERS**

THAT
MAKE CHANGE HAPPEN.

THE POWER SOURCE
AT THE CENTER

OF
DREAMING, DESIGNING,

AND GETTING IT **DONE.**

Georgia Tech | **School of Electrical and Computer Engineering**

[2014-2015 Annual Report]

[+] FROM THE CHAIR

I am proud to present you with the 2014-2015 annual report for the Georgia Tech School of Electrical and Computer Engineering (ECE). Our faculty members received some of our profession's most prestigious accolades, while our students' achievements and ingenuity shined brightly.

In FY 15, we acquired $45.5 million to support our research efforts, and we surpassed our fundraising goal of $165 million for Campaign Georgia Tech. While it was thrilling to achieve that second milestone, we are not resting and are embarking on major initiatives such as the Van Leer renovation project and a rapidly growing student entrepreneurship program.

Our undergraduate and graduate student enrollments continue to rise, and the School awarded 794 degrees, 38 more than were awarded in 2013-2014. Our faculty and staff are committed to providing our students with educational and research programs that will prepare them for a vast array of career and educational choices.

I firmly believe that we have an exciting future ahead of us. If you are just now learning about ECE, thank you for taking time to get to know us. For our repeat and longstanding supporters, you have my utmost gratitude for your loyalty and hard work that have made it possible for us to be where we are today.

Sincerely,

Steven W. McLaughlin
Professor and Steve W. Chaddick School Chair

[+] ECE OVERVIEW

ECE at Georgia Tech offers interdisciplinary research and educational programs through 11 technical interest groups: bioengineering, computer systems and software, digital signal processing, electrical energy, electromagnetics, electronic design and applications, microelectronics/microsystems, optics and photonics, systems and controls, telecommunications, and VLSI systems and digital design.

In FY 15, our undergraduate enrollment comprised 1,473 undergraduate students, with electrical engineering majors totaling 928 and computer engineering majors totaling 545. Females represented 15 percent of the undergraduate population, and underrepresented minorities made up 16 percent. Graduate student enrollment totaled 1,359, with 16 percent consisting of females and five percent consisting of underrepresented minorities.

348
total undergraduate degrees awarded

[**239** B.S.E.E. + **109** B.S.Cmp.E.]

[+] **10%** female graduates
14% underrepresented minorities*

446
total graduate degrees awarded

[**334** M.S./M.S.E.C.E. + **2** M.S. in Bioengineering]

[**108** Ph.D. + **2** Ph.D. in Bioengineering]

[+] **19%** female graduates
5% underrepresented minorities*

* All underrepresented minority percentages represent Black/African-American and Hispanic/Latino students.

National Rankings, *U.S. News & World Report*

#6
E.E. undergraduate program

#6
Cmp.E. undergraduate program

#6
E.E. graduate program

#7
Cmp.E. graduate program

[+] FACULTY

In FY 2015, the School employed 110 academic faculty, nine academic professionals, 68 research faculty, and 81 administrative staff. The School welcomed one new faculty member, and one faculty member retired. A third faculty member was named executive director of an interdisciplinary research institute at Georgia Tech.

[New Faculty]

A. Fatih Sarioglu
Assistant Professor
Bioengineering and Microelectronics/Microsystems

[New IRI Executive Director]

Oliver Brand
Executive Director, Institute for Electronics and Nanotechnology

[Retired Faculty]

John A. Buck
Professor,
Electromagnetics and Optics and Photonics
Years of Service to ECE: 1982-2015

[Faculty Awards]

Georgia Tech ECE faculty members were honored in many venues for their excellence in teaching, research, educational innovation, mentoring, and lifelong learning. Nine faculty members received external awards, including election to the National Academy of Engineering and the Draper Prize for Engineering. Two junior faculty won government agency funding awards for promising research, and five faculty members received Georgia Tech honors.

External Awards

Deepak Divan | Member, National Academy of Engineering

Russell D. Dupuis | Draper Prize for Engineering and Fellow, National Academy of Inventors

Ayanna Howard | A. Richard Newton Educator ABIE Award

Geoffrey Ye Li | IEEE Jack Neubauer Memorial Award

Morris B. Cohen | Office of Naval Research Young Investigator Award

Hua Wang | National Science Foundation Career Award

Christopher J. Rozell | James S. McDonnell Foundation 21st Century Science Initiative Scholar Award in Studying Complex Systems

Abdallah Ougazzaden | Medal of the City of Metz (located in the Lorraine Region of France)

Madhavan Swaminathan | Distinguished Alumni Award from the National Institute of Technology Tiruchirappalli (India)

Georgia Tech Awards

Magnus Egerstedt | Outstanding Doctoral Thesis Advisor Award and Outstanding Professional Education Award

Mark A. Davenport and **Hua Wang |** 2015 Lockheed Dean's Excellence in Teaching Awards

Raghupathy Sivakumar | Outstanding Achievement in Research Innovation Award

Douglas B. Williams | Outstanding Service Award

Left to right: Douglas B. Williams, Magnus Egerstedt, and Raghupathy Sivakumar received awards at the 2015 Georgia Tech Faculty/ Staff Honors Luncheon.

[+] DEVELOPMENT

The ECE Development Office cultivates and coordinates the School's fundraising efforts with industry, alumni, and other interested individuals and organizations. They manage the Corporate Affiliates Partnership Program, and they plan the James R. Carreker Distinguished Lecture, the ECE Career Fair, and other activities to promote alumni and corporate involvement.

For more information, contact Martina Emmerson Hubbarth, director of ECE Alumni Development, at 404.894.0274; Etta Pittman, director of ECE Corporate Development, at 404.894.6888; or Anna Walker, manager of ECE Corporate Relations, at 404.894.2273.

ECE Exceeds Fundraising Goal for Campaign Georgia Tech

As of June 30, 2015, ECE raised a total of $166,051,162, surpassing its $165 million goal for Campaign Georgia Tech, the largest fundraising target of any school or department on campus. We are incredibly thankful to the thousands of individuals and corporations that have supported the School during this campaign. Special thanks go to Texas Instruments, Allen Ecker, the Leona M. and Harry B. Helmsley Charitable Trust, Christopher Klaus, and Steve Chaddick, whose gifts pushed ECE past its goal.

We would like to thank the following corporations, non-profit organizations, and individual donors for contributing $16,699,819 to the School and its affiliates during FY 15.

[FY 15 Donors]

COMPANIES | AirWatch • Alpha Imaging Technology Corporation • Applied Materials, Inc. • Asahi Glass Co., Ltd. • AT&T • Atotech Deutschland GmbH • Boeing Company • CableLabs • Caterpillar, Inc. • Ciena Communications, Inc. • Cisco Systems, Inc. • ClassOne Equipment, Inc. • ConocoPhillips Corporation • Corning, Inc. • Deere & Company • EPCOS AG • Ericsson, Inc. • EV Group, Inc. • ExxonMobil Corporation • Georgia Power Company • HESM&A, Inc. • Huawei Technologies Canada Company, Ltd. • IBM Corporation • Intel Corporation • IvySys Technologies, LLC • Jiangsu Changjiang Electronics Technology Company • Keysight Technologies • Kulicke & Soffa Industries, Inc. • Linear Technology Corporation • Lockheed Martin • MathWorks • Mentor Graphics Corporation • Microsoft Corporation • Mitsubishi Electric Corporation • Namics Corporation • National Instruments • NEC Laboratories America, Inc. • Nominet • Northrop Grumman • OPE, LLC • Oracle Corporation • Peach State Labs, Inc. • Phillips 66 • Price Waterhouse Coopers, LLP • Qualcomm, Inc. • Quanta Computer, Inc. • Quest Renewables • Raith America, Inc. • Raytheon Company • Robert Bosch Corporation • Silicon Standard Corporation • Solid State Equipment, LLC • Southern Company Services, Inc. • Taiwan Semiconductor Manufacturing • Tango Systems, Inc. • Texas Instruments, Inc. • The Aerospace Corporation • Tokyo Tekko Company, Ltd. • UNID Corporate R&D Center • Unimicron Technology Corporation • Union Pacific Railroad Company • Williams Benator & Libby, LLP • Zeon Corporation • ZTE USA, Inc.

FOUNDATIONS/NON-PROFIT ORGANIZATIONS | American Endowment Foundation • ARCS Foundation, Inc. • AT&T Foundation • Boyce and Gail Dooley Family Foundation • Broadcom Foundation • Community Foundation for Greater Atlanta • ExxonMobil Foundation • Fidelity Investment Charitable Gift Fund • Ford Motor Company Fund • General Motors Foundation • Harris Foundation • Henry M. Jackson Foundation for Military Medicine • James S. McDonnell Foundation • Leona M. & Harry B. Helmsley Charitable Trust • Lockheed Martin Corporation Foundation • Norfolk Southern Foundation • Northrop Grumman Foundation • Renaissance Charitable Foundation, Inc. • SCEEE • SRC Education Alliance • Union Pacific Railroad Company • Vanguard Charitable Endowment • VMWare Foundation • ZTE USA, Inc.

PROFESSIONAL, RESEARCH, & ACADEMIC ORGANIZATIONS | Electric Power Research Institute • ETRI • King Fahd University of Petroleum & Minerals • Massachusetts Institute of Technology

INDIVIDUALS | Charles R. Adams • Rodney C. Adkins • C. Dean Alford • Mr. and Mrs. Charles G. Archibald • Anonymous 160 • Thomas P. Barnwell • Peter G. Barthe • Steve A. Barton • Charles W. Basden • Warren L. Batts • Russell T. Beason • Harry L. Beck • Kevin F. Brennan (posthumous) • Suzy Briggs • Barbara Brown • William C. Brown • H. Austin Brown • John H. Brownlee • F. Sibley Bryan, Jr. • Robert J. Butera, Jr. • Pierce E. Cantrell, Jr. • Mr. and Mrs. James M. Carpenter • Steve W. Chaddick • Melinda Coker • John A. Cole • J. Alvin Connelly • Mary N. Connelly • Leyla S. Conrad • William B. Crane, Jr. • Peter L. Culwell • Todd G. Cutler • James DeBardelaben • Madeline T. Delianides • Jane W. Dickerson • Stephen L. Dickerson • Boyce R. Dooley • H. Allen Ecker • Stanley R. Everett, PE • Stuart Everett • Aldo A. Ferri • Bonnie H. Ferri • Janice L. Gaylord • Thomas K. Gaylord • Zehua Guo • Mr. and Mrs. Edward K. Hagelstein • Sally Hansell • Thanh G. Hoang • Mary Elizabeth Hollingsworth • Martina E. Hubbarth • Tobias Hunt • Christopher W. Klaus • Alan F. Krauss • Frederick G. Krauss • Howard Kuo • Elizabeth B. Logan • Michael H. Logan • Thomas E. Lundy • Mark F. Lytle • Kenneth E. MacKenzie • Norma Jean McLees • Ben R. McRee • Vijay K. Madisetti • Lynn C. Maddox • Theresa A. Maldonado • Henry E. Meadows, Jr. • Toby Morgan • Ragnar-Miguel Myhrer • Kevin A. O'Brien, Esq. • Patricia I. Paulino • John B. Peatman • Andrew F. Peterson • Debra L. Schober-Peterson • Claude A. Petty, Jr. • Etta Pittman • Darrell W. Preble • Sheryl S. Prucka • James M. Reynolds, III • Iris D. Rhodes • Jay H. Schlag (posthumous) • Robert T. Simpson • John T. Slaughter • Paul G. Steffes • Jeffrey Strand • James A. Stratigos, Jr. • Rajagopal Subramanian • Madhavan Swaminathan • Michael T. Tuley • Therese P. Tuley • Kristin Ann Turgeon • Judith Vanderboom • Anita Wathen-Brownlee • Patrick W. Wathen • Roger P. Webb • Michael J. Whalin • Douglas B. Williams • Qi Zhou

Chaddick Estate Gift to Benefit ECE

Steve W. Chaddick (EE '74, MSEE '82) has made gifts and commitments in many different areas at Georgia Tech. But his most recent, an estate gift, pushed ECE past its $165 million goal.

Income from the permanent endowment fund, which will bear his name, will provide unrestricted support to the School, ensuring greater resources for future advancements on important initiatives that may otherwise be out of reach. The flexibility of the gift will allow for timely decisions and actions when opportunities present themselves. It will also enhance the already high caliber of teaching and research within ECE.

Chaddick's service to his alma mater has been as expansive as his philanthropy. He is currently on the advisory boards for ECE and the College of Engineering (CoE), the board of the Georgia Tech Foundation, and the Georgia Tech Arts Advisory Board. In past years, he has been on the Georgia Tech Advisory Board, the Georgia Tech Alumni Association (where he served as chair), the Alexander-Tharpe Board, and on his 25th and 40th Reunion Committees.

In addition to funding two chairs within ECE, Chaddick has provided generous support for graduate fellowships, intercollegiate athletics, the Tech Promise Scholarship program, and several facilities initiatives. He was named a CoE Distinguished Alumnus in 1998.

Chaddick is a mentor capitalist with Ridgewood Advisors, a firm that he founded in 2004 as a vehicle for angel investing, nurturing the community of emerging technology companies in the Atlanta area, and facilitating technology commercialization. He was previously a senior executive with CIENA Corporation.

[+] DEVELOPMENT

Texas Instruments Gives $3.2 Million for Student Plaza and Maker Space

Georgia Tech received a $3.2 million gift from Texas Instruments (TI) to support the construction of the Texas Instruments Plaza and Maker Space for the School of ECE. The plaza and the maker space will be located, respectively, adjacent to and in the Van Leer Building on the Tech campus. This gift reinforces TI's commitment to support both research and a hands-on learning environment to educate future engineering innovators.

TI is an enduring partner in Tech's efforts to provide an experiential learning environment for its students, according to Steven W. McLaughlin, Steve W. Chaddick School Chair for ECE.

"Georgia Tech is focused on providing an environment that nurtures project-based learning and professional leadership," said McLaughlin. "Inside the TI Maker Space, ECE students — as well as students from other disciplines across Georgia Tech — will work together to solve technology design challenges that will not only give them the necessary project skills for career success but also provide the experience to address problems facing the industry and the world."

The TI Maker Space will offer a dedicated, project-based lab area for undergraduate courses that cover subjects such as embedded systems, analog devices, and communications, as well as senior design projects. The company will conduct annual reviews to ensure equipment is current, fully leveraged, and meeting the needs of students and faculty.

"We are very excited to be a part of what is happening at Georgia Tech, and have benefited greatly through the years by engaging its faculty and students," said Steve Lyle, TI's director of Engineering Workforce Development and University Marketing programs. "We are hopeful that these spaces will inspire generations of engineers and computer scientists to create innovations that will change the world."

Thank You to Van Leer Renovation Donors

The School is grateful to the following donors for contributing major gift support to the Van Leer renovation project. To learn how to support this effort, contact Martina Hubbarth or Etta Pittman.
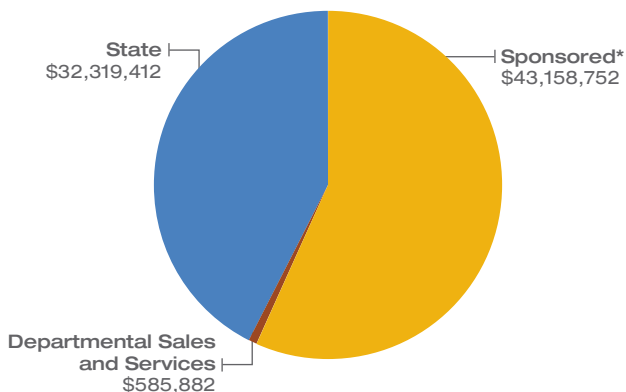
Warren L. Batts	Randall E. Poliner	Aleksander Szlam
Steve W. Chaddick	Gene Sapp, Jr.	Harris Corporation
H. Allen Ecker		

[+] FINANCES

The School spent $76,064,047 from state, sponsored research, and departmental sales and services sources. A large percentage of this total pays for faculty and staff salaries, while the rest is dedicated to materials and supplies, travel, and equipment in support of our research and educational missions.
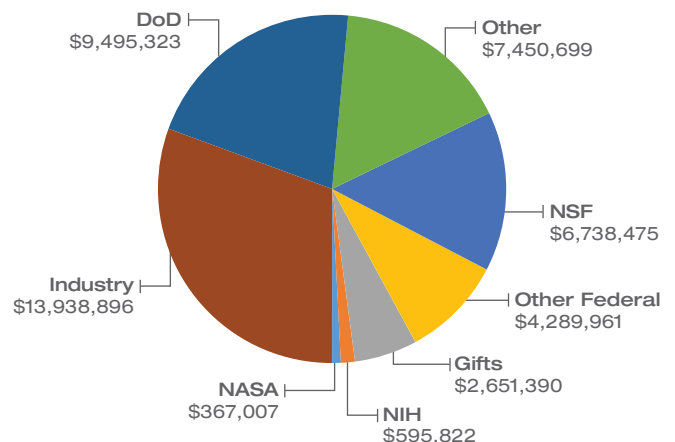
Research funding for FY 15 totaled $45,527,573 from grants and contracts, which includes support received through the Georgia Tech Foundation. Of that total, 31% came from industry, 47% came from federal government sources, 6% came from Georgia Tech Foundation gifts, and 16% came from other sources

FY 15 Expenditures

State $32,319,412
Sponsored* $43,158,752
Departmental Sales and Services $585,882

Includes Georgia Tech Foundation and agency funds.

FY 15 Research Funding

DoD $9,495,323
Other $7,450,699
NSF $6,738,475
Other Federal $4,289,961
Gifts $2,651,390
NIH $595,822
NASA $367,007
Industry $13,938,896

[+] RESEARCH & EDUCATION HIGHLIGHTS

Georgia Tech Launches ECE Degree Program in Shenzhen

The Georgia Tech-Shenzhen Master of Science Degree Program in ECE launched successfully in Shenzhen, China on August 18, 2014. Approved by the Southern Association of Colleges and Schools and the Chinese Ministry of Education, this program allows students from all over the world to receive a high quality education offered by Georgia Tech faculty, gain experiences studying and living in China, and interact with multinational companies.

Led by ECE Professor G. Tong Zhou, this degree program is identical to its counterpart offered at the Atlanta campus, and admission and degree requirements are also the same. GT-Shenzhen is located in the Shenzhen High Tech Industry Park, making it easy for students to gain internship experiences, and it is less than four miles from the border crossing with Hong Kong.

Researchers Work to Counter a New Class of Coffee Shop Hackers

Not connecting to a shop's Wi-Fi while using your laptop or smart phone might not mean you're safe from hackers. The bad guys may be able to see what you're doing just by analyzing the low-power electronic signals your laptop emits even when it's not connected to the Internet.

Alenka Zajic and Milos Prvulovic, an assistant professor in the School of ECE and an associate professor in the School of Computer Science respectively, are investigating where these information "leaks" originate so they can help hardware and software designers develop strategies to plug them. By studying emissions from multiple computers, the researchers have developed a metric for measuring the strength of the leaks — known as "side-channel signal" — to help prioritize security efforts.
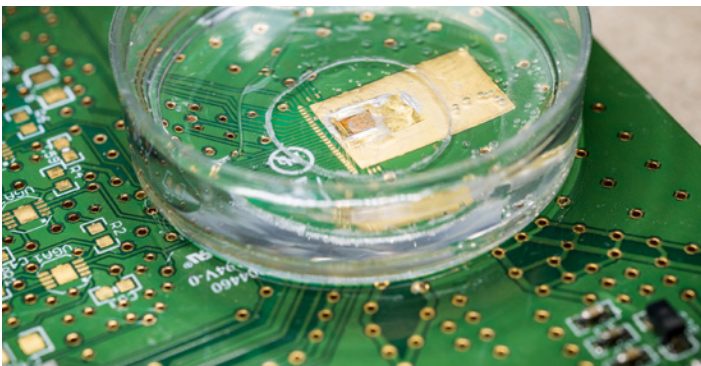
Cellular Sensing Platform Supports Next-Generation Bioscience and Biotech Applications

Hua Wang, the Demetrius T. Paris Junior Professor in ECE, and his team have demonstrated the world's first multi-modality cellular sensor. Each sensor pixel can concurrently monitor multiple different physiological parameters of the same cell and tissue samples to achieve holistic and real-time physiological characterizations. The research is part of the Semiconductor Synthetic Biology program, sponsored and managed by Semiconductor Research Corporation.

Wang said the work can have a positive impact on semiconductors used in developing health care applications, including more cost-effective development of pharmaceuticals and point-of-care devices and low-cost, home-based diagnostics and drug testing systems. The research could also benefit defense and environmental monitoring applications for low-cost, field-deployable sensors for hazard detections.
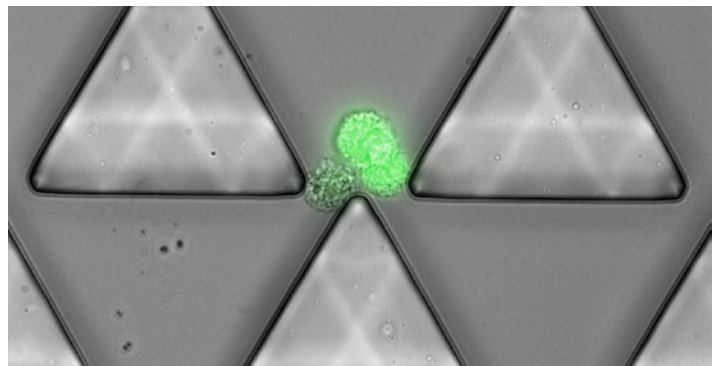

New Device Captures Metastasis-Associated Circulating Tumor Cell Clusters

Researchers have developed a microfluidic device called the Cluster-Chip, which captures clusters of tumor cells circulating in the bloodstream. Once captured, the clusters can be studied to help researchers understand their role in cancer metastasis and perhaps one day give doctors the information they need to tailor treatments to specific patients.

The Cluster-Chip was developed by a Massachusetts General Hospital research team that included Fatih Sarioglu, now an ECE assistant professor, and the research was reported in *Nature Materials*.

The device uses the unique physical properties of the clusters to capture them from blood samples being passed through the chip, which contains rows of triangular microposts. Single cancer cells and ordinary blood cells pass through without being captured. The flow rate is kept low to minimize the possibility that clusters will be broken or distorted.
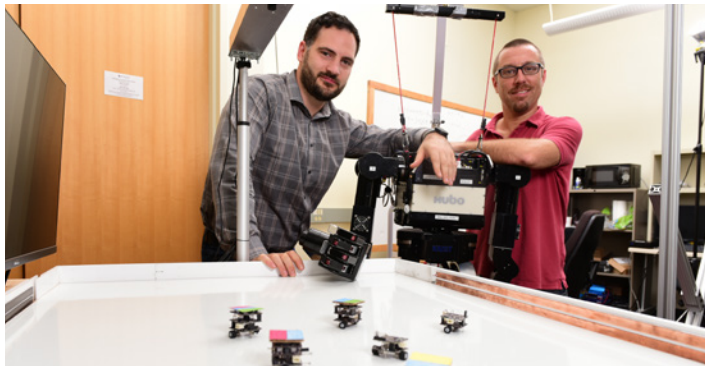
Controlling Swarms of Robots with a Finger

Using a smart tablet and a red beam of light, Magnus Egerstedt, the Schlumberger Professor in ECE, and his team have created a system that allows people to control a fleet of robots. By tapping a tablet to control where the light appears on the floor, swarm robots roll toward it, communicating and deciding how to evenly cover the lit area.

The new algorithm that fuels this system demonstrates the potential of easily controlling large teams of robots, which is relevant in manufacturing, agriculture, and disaster areas.

The Georgia Tech model differs from other robotic coverage algorithms because it's not static. It allows robots to "change their minds" effectively, rather than just performing the single job they're programmed to do.

With $5 Million Grant, VIP Program Will Grow at Georgia Tech and Beyond

The Vertically Integrated Projects (VIP) Program received a $5 million grant from The Leona M. and Harry B. Helmsley Charitable Trust to drive systemic reform of STEM education.

Managed by Edward J. Coyle, the John B. Peatman Distinguished Chair in ECE and a Georgia Research Alliance Eminent Scholar, the VIP Program unites large undergraduate teams with graduate students and faculty to work on long-term research projects. Led by Georgia Tech and co-led by the University of Michigan, this award will expand VIP to institutions across the United States.

Tech will be able to expand its VIP program, whose research teams include undergraduates from more than 20 majors. Each team focuses on one topic and encourages interdisciplinary collaboration.

CREATE-X Will Build Students' Entrepreneurial Confidence

Thanks to a major gift from alumnus Chris Klaus, Georgia Tech and the College of Engineering formally launched CREATE-X on April 1, 2015. A collective of programs, CREATE-X is designed to boost students' entrepreneurial confidence and give them the tools needed to establish startups. This effort is led by Raghupathy Sivakumar, the Wayne J. Holman Chair in ECE.

Open to all Tech undergraduates, CREATE-X is based on three simple principles: Learn, Make, Launch. Participants will choose from an assortment of programs that correspond with each principle. The signature offerings of CREATE-X that correspond to these principles are the Startup Lab course, the Idea to Prototype Undergraduate Research Experience, and the Startup Summer program.

[+] COMMERCIALIZATION

ECE faculty members and students have founded successful startup companies through the Advanced Technology Development Center and currently have 19 opportunities under evaluation by VentureLab.

This year, our students made quite a splash in the Atlanta entrepreneurship scene, winning awards at the seventh annual InVenture Prize and at the Technology Association of Georgia (TAG) Business Launch Competition.

Haplit Takes People's Choice Award at 2015 InVenture Prize

Haplit was among the six finalists for the 2015 InVenture Prize and won the People's Choice Award, consisting of a $5,000 prize. The event took place April 1 at the Georgia Tech Ferst Center for the Arts and was aired live on Georgia Public Broadcasting.

Haplit is an interactive and responsive learning device for the braille writing system that is targeted at those born blind or with degenerative diseases. Team members were computer engineering major Chandler Matz, computer science major Philip Bale, and business administration major Megan Fechter.

Gimme Wins 2015 TAG Business Launch Competition

Gimme – the developers of a device and software solution that enables vending machines to communicate sales, cash, and inventory data to handheld devices – won the 10th annual TAG Business Launch Competition, held on May 11 at SCADShow.

Gimme's hardware and accompanying analytics and tracking software helps prevent theft, saves labor costs, and improves inventory management. The company, co-founded by Georgia Tech electrical engineering senior Cory Hewett and 2014 Georgia Tech electrical engineering alumnus Evan Jarecki, bested three other startups in the final round of a bracket competition.

Their prize consisted of $50,000; a spot in the Venture Atlanta technology conference; and more than $100,000 in donated services from the Atlanta business community.

[+] STUDENTS & STUDENT GROUPS

ECE student organizations work with the School's faculty, staff, and administrators on issues ranging from everyday student concerns to K-12 outreach to service to the greater community.

[Student Groups]

Eta Kappa Nu • IEEE • ECE Ambassadors •
Women in Electrical and Computer Engineering

[Student Awards]

Our students were honored at ECE's annual Roger P. Webb Awards Program and at several annual Georgia Tech events. Two recent Ph.D. graduates were honored with Sigma Xi doctoral thesis awards, while Donnya Ajdari received the highest accolade given to an undergraduate female engineering student.

Individual Awards

Ahmad Beirami and **Zhixuan Xia** | Georgia Tech Sigma Xi Ph.D. Thesis Awards

Donnya Ajdari | Helen Grenga Outstanding Woman Engineer Award

David Ehrlich and **Philippe Laban** | Henry Ford II Scholar Awards

Jonathan Tuck | ECE Undergraduate Research Award

George Alexopoulos | Outstanding Electrical Engineering Senior Award

Kenneth Marino | Outstanding Computer Engineering Senior Award

Nathan Parrish | ECE Graduate Teaching Assistant Excellence Award

Adam Charles and **Zhixuan Xia** | ECE Graduate Research Assistant Excellence Awards

[+] ALUMNI

ECE Graduates Honored at College of Engineering Alumni Awards

Three ECE alumni were honored at the 2015 Georgia Tech College of Engineering Alumni Awards in two categories. The event was held April 25 at Twelve Atlantic Station in Atlanta.

ACADEMY OF DISTINGUISHED ENGINEERING ALUMNI

William Hand Allen
BSEE '75
Founder and Senior Advisor
Allen & Shariff Corporation
Columbia, Maryland

ACADEMY OF DISTINGUISHED ENGINEERING ALUMNI

Robert N. Stargel, Jr.
BSEE '83
Vice President, Global Nonwovens
Kimberly-Clark Corporation
Roswell, Georgia

ENGINEERING HALL OF FAME

Kenneth G. Byers
BSEE '66, MSEE '68
Chairman
Byers Engineering Company
Atlanta, Georgia

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