BOSTON UNIVERSITY

Department of Electrical and Computer Engineering

2001 - 2002

Annual Report

July 1, 2001 - June 30, 2002

www.bu.edu/ece

Contents

1. Highlights

This report provides a detailed description of the instructional and research activities of the faculty, staff, and students of the Department of Electrical and Computer Engineering (ECE) at Boston University during the 2001-2002 academic year. Instructional activities are reported for Fall 2001, Spring 2002, and Summer 2002 semesters. Publications and scholarly activities, as well as budget information, are reported for the 2002 fiscal year (July 1, 2001 to June 30, 2002). Key data for this year are also compared to previous years to show progress and identify trends. More information on ECE's recent activities is reported at the department website, *http://www.bu.edu/ece*.

Faculty

Three new full-time faculty joined the ECE Department this year: Martin Herbordt, Saligrama Venkatesh, and Alexander Taubin. **Martin Herbordt** was appointed Associate Professor with tenure beginning September 1, 2001. He received his Ph.D. from the University of Massachusetts, Amherst in 1994. His research interests include web cache architecture, design of switches for multicomputer networks, architectures for computer vision, and architecture-level design automation. *(See sidebar.)* **Saligrama Venkatesh** was appointed Assistant Professor (tenure-track) beginning September 1, 2001. He received a Ph.D. from the Massachusetts Institute of Technology in 1997. His recent research work includes sensor array processing for acoustic imaging, and design of adaptive echo-cancellation in a controlled environment. *(See sidebar on page 1-2.)* **Alexander Taubin** was appointed Associate Professor beginning January 1, 2002. He received his Ph.D. in 1981 from the Electrotechnical University of St. Petersburg, Russia. His recent research work includes asynchronous circuits, logic design, computer architecture, CAD, and methods of formal verification. *(See sidebar on page 1-2.)*

Martin Herbordt received his Ph.D. in 1994 from the Department of Computer Science at the University of Massachusetts, Amherst, and subsequently became an Assistant Professor in the Department of Electrical and Computer Engineering at the University of Houston, and an Associate Director of Operations at the University's Texas Center for Computation and Information Sciences. In September 2000, he was promoted to Associate Professor with tenure, and subsequently joined Boston University's ECE Department at the same rank in Fall 2001.

Dr. Herbordt's general specialty is computer systems engineering. His current research projects include web cache architecture, design of switches for multi-computer networks, architectures for computer vision, and architecture-level design automation. His emphasis is a blend of hardware and software systems. His research has been funded by an NSF CAREER award, as well as a grant from Compaq Computer Corp.

The Department continued its vigorous efforts to recruit new faculty in selected strategic areas. Two new faculty members will join the ECE faculty in AY 02/03, Murat Alanyali and Maja Bystrom. **Murat Alanyali's** appointment is at the rank of Assistant Professor, tenure track. He received a Ph.D. in 1996 from the Department of Electrical and Computer Engineering at the University of Illinois, Urbana-Champaign. He spent a year as a post-doctoral fellow at Lucent, and subsequently joined the faculty of Bilkent University, Turkey. His research interests include high-speed networks and algorithms for WDM optical networks. **Maja Bystrom** was appointed Associate Professor, tenure track. She received her Ph.D. in 1997 from the Department of Electrical, Computer and Systems Engineering at the Rensselaer Polytechnic Institute, and joined the faculty of the ECE Department at Drexel University. She is an expert in signal processing and telecommunications, and her research has mainly been focused on channel modeling and network design. She received an NSF CAREER award, and was named "Best Professor" at Drexel.

This year Professor **Charles Eddy** has formally left the ECE Department to join the Laboratory for Advanced Materials Synthesis at the Naval Research Laboratory.

Professor **William Oliver** finished a 4-year appointment as Associate Chair for the Graduate Programs. He will be replaced by Professor **Selim Ünlü**. Oliver will have a sabbatical leave in AY 2002/2003.

Professor **Theodore Moustakas** spent a sabbatical year at M.I.T.

Staff

Aaron Caine, formerly the Systems Administrator for the ECE VLSI and Signals/Networks laboratories was promoted in February, 2002 to Systems Administrator III (Systems Manager), a new ECE Department technical

Saligrama Venkatesh received his M.S. and Ph.D. degrees from the Massachusetts Institute of Technology, in 1993 and 1997, respectively. He was a member of the research staff at United Techonologies Research Center from 1997 to January 2000. He will be joining Boston University's Department of Electrical and Computer Engineering as an Assitant Professor in the Fall of 2001. Currently, Dr. Venkatesh is a Visiting Scientist at M.I.T. His research area is statistical signal processing and reliable learning and control. His research at United Technologies involved applications such as sensor array processing for acoustic imaging and design of adaptive echo-cancellation in a controlled environment.

staff position. In this new position Aaron is responsible for the planning, directing, and management of the computer support for the ECE instructional laboratories, the infrastructure, the faculty/staff, and the research laboratories. **Rosemarie Reigadas** joined the ECE Department in October 2001 as the Senior Administrative Secretary supporting the ECE faculty and staff. She is a recent graduate of Wells College, Aurora, NY where she received a BA degree. Also joining the ECE Department this summer will be **Jeremy Goodman** as the ECE Administrative Assistant supporting the Chair and Department Director. He was most recently on staff with the Biology Department and received a BA degree from Clark University, Worcester, MA in 1998.

Awards and Honors

Special Grants:

Professor **Ari Trachtenberg** received an NSF CAREER Award for his research entitled, "Practical Data Synchronization: Minimizing Communication."

Professor **Saligrama Venkatesh** received the ONR Young Investigator Program award for research entitled, "Intelligent Sensor and Relay Platforms."

Professors **Jeffrey Carruthers** and **David Starobinski** won the Provost's SPRInG award (Special Program for Research Initiation Grants) for their proposal entitled "Inter-Layer Modeling and Design of Wireless Communication Networks."

Teaching Awards:

Professor **Selim Ünlü** received the 2001/02 ECE Faculty Teaching Excellence Award from the Department. (See page 3-6).

Professor **Allyn Hubbard** received the 2002 College of Engineering Professor of the Year Award.

Other Faculty Awards and Honors:

Professor **Irving Bigio** was inducted into the College of Fellows of the American Institute for Medical and Biological Engineering.

Professor **David Castañon** was elected Vice President of Finance, IEEE Control Systems Society.

Professor **Janusz Konrad** received the 2001 IEEE Signal Processing Society Magazine Award for his paper "Estimating Motion in Image Sequences," which appeared in the July 1999 issue of IEEE Signal Processing Magazine (co-authored with Christoph Stiller).

Professor **Fred Schubert** was elected Fellow of the American Physical Society for "pioneering contributions to the doping of semiconductors including delta doping, doping of compositionally graded structures resulting in the elimination of band discontinuities, and superlattice doping to enhance acceptor activation."

Professor **Selim Ünlü** was appointed Associate Editor of the IEEE Journal of Quantum Electronics.

Graduate Student Awards:

Graduate student **Marianne Nourzad** received the 2001/02 ECE Graduate Teaching Fellow of the Year Award.

Graduate student **Stephen Ippolito** received the Photonics Technology Award, presented at the 2002 Boston University Graduate Science and Technology Day, for his presentation entitled "High Spatial Resolution Subsurface Microscopy." Ippolito is a graduate student of Professor **Selim Ünlü**.

Undergraduate Program

Enrollment in the BS program has been steady in recent years. A total of 405 students enrolled in the Electrical Engineering (EE) and the Computer Systems Engineering (CSE) programs, with CSE enrollment now making up roughly 64% of the total Undergraduate enrollment. The number of EE and CSE BS degrees awarded this year were

Alexander Taubin was appointed as Associate Professor in January 2002. He received his Ph.D. degree in Computer Science and Engineering from Electrotechnical University of St.Petersburg, Russia. From 1993 to 1999 he was a professor of the Department of Computer Hardware at the University of Aizu, Japan. From 1999 to 2001 he was with Theseus Logic, Inc. as Senior Scientist. His research interests include design of asynchronous systems (analysis, synthesis, testing, formal verification and architectural design) and computer-aided design methodology. Dr. Taubin coauthored two books in asynchronous design and has published more than 40 journal and conference papers. He has served on the technical committees of several international conferences in his field. He was a program co-chair of Async'96 Symposium. He is IEEE Senior Member since 1996.

50 and 51, respectively. *(See details in Section 3.3 and enrollment history in Section 6.1.)*

High-quality instruction continues to be of paramount importance to the ECE Department. The curriculum has been continuously updated to meet the needs of tomorrow's engineers. A process of continual program improvement has been established with the goal of meeting our program educational objectives. Specific expected outcomes have been defined, and mechanisms for assessing their achievement include review of the core courses by a faculty committee, graduation surveys, review by the ECE Industrial Advisory Council, and meetings with student representatives to obtain their feedback. The program objectives are also assessed through alumni surveys. *(See Section 3 for a detailed description of our continual program improvement process.)*

Efforts to enhance the undergraduate laboratories are successfully ongoing, and new equipment has been added this year at a total cost of $164k. In both classrooms and laboratories, emphasis is placed on design, laboratory practice, and applications. Successful ideas that were initiated in previous years, such as the Teaching Workshop, the ECE Project Conference Day, ECE Advising Day, and the ECE Teaching Excellence Award, continued this past year. *(See Sections 3 and 4 for further information.)*

Graduate Program

Recruitment of graduate students remains a key challenge for the department. This year we participated in a seniors name swap consortium together with eight ranking engineering schools. Domestic applications rose by 81%. The rate of acceptance of our Teaching Fellow offers rose from 24% to 65%, but acceptance of our full scholarship offers dropped from 5 out of 6 in Spring 2001 to 2 out of 6 in Spring 2002. Two other applicants accepted Research Assistantships. A new ECE Fellowship carrying the same lifetime-support guarantee as the full scholarship was created. All in all, 30 new MS students and 20 new Ph.D. students entered the program in AY2001-02.

Enrollment in the MS program dropped by 19% (from 67 to 54). Driving the decrease last year has been the good job market for BS students in previous years, ECE's emphasis on research-oriented Ph.D. students, and an increasing tendency for students to apply to the Post-BS Ph.D. program (because we seek Ph.D. students) with greater intent on stopping at the MS level. The number of Ph.D. students decreased by 18% (from 83 to 68) after a 15% increase last year. While we have experienced recent stabilization in this number, it is noted that the ECE doctoral program had very rapid growth since its relatively recent initiation. *(See Section 4 for further information.)*

A total of 41 MS degrees and 9 Ph.D. degrees were awarded this year.

A new **Master of Science in Photonics degree** has been formally approved by the Board of Trustees this year. This new degree program recognizes the growing presence of photonics in the department and the demand for engineers trained in this discipline at a national level. Seven new photonics courses have been approved, and marketing plans are underway. *(See Section 4 for additional information.)*

Twelve new graduate courses were added to the program, including seven in photonics. In Spring 2001 we initiated a plan to offer courses on a two-year cycle, with advanced graduate courses offered once every two years, required undergraduate courses offered every semester, and other courses offered at intermediate frequency based on past enrollment statistics. This new system has helped graduate-student course planning and systematized the faculty teaching expectations.

ECE graduate students had a good presence at the Boston University Science and Technology Day. Twelve posters were presented and the Photonics Technology Award was received by an ECE student, **Stephen Ippolito.**

Research

New research funding this year totaled approximately $5.2M. The average annual research funding in the 1996-02 period is $5.1M, as compared to an average of $2.4M in the 1990-95 period. These figures include only grants for which the Principal Investigators (PI) were ECE faculty. Including the shares of grants for which ECE faculty were Co-PI's, the total of new research funds this year is $6M. (See Section 5.5 for details on research funding)

This year, the ECE faculty and graduate students have published 89 research papers in archival journals, authored or co-authored 11 book chapters, and made 113 conference contributions (papers, abstracts, and presentations). They have also filed 9 patents or patent disclosures. *(See Section 5.2 for a complete listing of faculty publications.)*

Special Events

ECE Day 2002

Initiated in 1997, the ECE Day is a forum for presentation of the students' senior design projects. Held at the end of the Spring term, ECE Day 2002 included 27 presentations on different projects conducted by groups of 2 to 4 students. The presentations were attended by students, faculty, alumni, company representatives, and members of the ECE Industrial Advisory Council. This was the first year that the Senior Design Project course was offered as a two-semester sequence, and marked improvement in the level of project completion and the quality of the presentation has been noted. *(For more information on ECE Day 2001 see Section 3.7.)*

Teaching Workshop

Offered formally as part of a 2-credit course, SC850, the teaching workshop is required for all ECE graduate students who are serving as teaching fellows for the first time. Besides being a valuable educational experience for these graduate students, this workshop also ensures that our undergraduates are served by better trained teaching fellows in their ECE courses. The workshop included panel and discussions, as well as role-playing scenarios on such topics as teaching methodology; presentation techniques; pedagogy; and an outline of teaching policies, procedures, and ethics. *(See Section 3 for more details on Teaching Workshops.)*

ECE Advising Day

The ECE advising day is held each semester to enhance the advising system for ECE undergraduates. Held on the Friday before telephone/web registration begins for the following term, it involves pre-registration advising by faculty volunteers. In the spring this year, it also included guided tours of various research and instructional laboratories, a presentation on the new senior design courses, and a panel discussion on Careers in Electrical and Computer Engineering.

ECE Retreat

The ECE Department held its annual Faculty Retreat on May 3, 2001. This year, the emphasis was on enhancement of the Senior Design Project course, the process of continual program improvement and preparation for the ABET evaluation, and discussion of findings from the Industrial Advisory Council's meeting.

Industrial Advisory Council

The IAC held its annual meeting on May 2, 2002. Curricular issues were discussed with a particular emphasis on the Senior Deisgn Project courses. *(See photo below.)*

Industrial Advisory Council Members

Hassan Ahmed
President
Sonus Networks, Inc.

Jihad Boura
Chief Architect
Avian Communications

Julie M. Cubino
Manager, ASIC Design Kit
IBM Microelectronics

D. George Gata
Mixed Signal Custom Products Department
Texas Instruments

Katie Hall
Founder, CTO, Director
PhotonEx

Micah Knapp
Staff Engineer
SGI

Christina Knopp
Marketing Manager
DUSA Pharmaceuticals Inc.

Kevin Knopp
VCSEL Development Manager
Nortel Networks

David Kukulinsky
President
SIR, Inc.

Ben H. Mbugua
Front Line Application Manager, DSP Division
Analog Devices, Inc.,

Hank McGlynn
Vice President
BAE Systems. North America

Rich Molnar
Technical Staff
MIT Lincoln Laboratory

Anthony Palmieri
Marketing Applications
Applied Micro Circuits Corp.

John Reinke
Sr. Dir. eBusiness Solutions Grp.
Siebel Systems Inc.

Gary Smith
Principal Engineer
Corning Lasertron, Inc.

2. Faculty and Staff

ECE Faculty at the main entrance to the Photonics Building

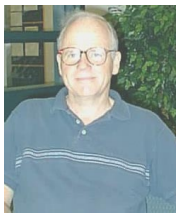
2.1 Faculty

Enrico Bellotti, *Assistant Professor*

- Ph.D ., Georgia Institute of Technology, 1999
- Computational electronics; semiconductor materials and device simulations; power electronics; parallel computing

Irving Bigio, *Professor*

- Ph.D., University of Michigan, 1974
- Medical application of optics, lasers, and spectroscopy; biophotonics; applied spectroscopy; nonlinear optics, quantum electronics, and laser physics
- Fellow - Optical Society of America and American Society for Lasers in Medicine and Surgery



Richard Brower, *Professor*

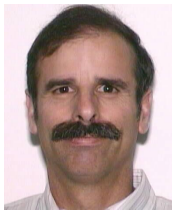
- Ph.D. Physics, University of California, 1969
- Quantum field theory of Strings and Particles, Lattice methods for QCD and statistical mechanics, molecular dynamics simulation for biomolecules

David Campbell, *Professor, Dean, College of Engineering*

- Ph.D., Cambridge University, 1970
- General nonlinear phenomena and complex sys tems; novel electronic materials, including conducting polymers and organic and high tc superconductors; electron transport in semiconductor superlattices
- Fellow - American Physical Society and American Association for the Advancement of Science; Editor-in-Chief, *Chaos;* Editor, *Physics Reports*

Jeffrey Carruthers, *Assistant Professor*

- Ph.D., University of California, Berkeley, 1997
- Wireless infrared communications; broadband communications; mobile and wireless networks
- NSF CAREER Award
- 2000/01 ECE Faculty Award for Excellence in Teaching



David Castañon, *Professor*

- Ph.D., Massachusetts Institute of Technology, 1976
- Stochastic control; estimation optimization; im age understanding and parallel computation
- Associate Editor, *Computational Optimization and Applications*; Associate Director, Center for Subsurface Sensing and Imaging Systems

Charles Eddy, *Assistant Professor*

- Ph.D., Johns Hopkins University, 1998
- Semiconductor device processing and process characterization; electronic and optoelectronic device fabrication and characterization; novel III-V, especially III-V nitride, devices
- Associate Editor, Internet Journal of Nitride Semiconductor Research Steering Committee;
- Naval Research Laboratory Alan Berman Research Publication Award, 1994

Azza Fahim, *Assistant Professor*

- Ph.D., Cairo University, 1984
- Electric machines; computations in electromagnetics

Roscoe Giles, *Professor*

- Ph.D., Stanford University, 1975
- Advanced computer architectures; distributed and parallel computing; computational science
- NSF Partnerships for Advanced Computational Infrastructure (PACI): Co-Chair, National Educational Outreach and Training Coordinating Committee; Co-Chair, Alliance Collaborative and Data Storage Team
- 1996 College of Engineering Award for Excellence in Teaching

Martin Herbordt, *Associate Professor*

- Ph.D., University of Massachusetts, 1994
- NSF CAREER Award; 1995 Outstanding Paper Award, International Conference on Computer Design

Mark Horenstein, *Professor, Associate Dean for Graduate Programs*

- Ph.D., Massachusetts Institute of Technology, 1978
- Applied electromagnetics; electrostatics, micro-electromechanical systems (MEMS)
- President Electrostatics Society of America
- Registered Professional Engineer

Allyn Hubbard, *Professor*

- Ph.D., University of Wisconsin-Madison, 1977
- VLSI circuit design; digital, analog, subthresh old analog, biCMOS, CMOS; information processing in neurons, neural net chips, synthetic aperture radar (SAR) processing chips, sonar processing chips; auditory models and experiments

• 2002 College of Engineering teaching award

Floyd Humphrey, *Research Professor*

- Ph.D., California Institute of Technology, 1956
- Computer simulations of magnetic materials and storage devices; magnetic sensors
- Life Fellow, IEEE; IEEE - 100th Anniversary Gold Medal for Service; Magnetics Society 1988 Achievement Award; Millenium Medal

W. Clement Karl, *Associate Professor*

- Ph.D., Massachusetts Institute of Technology, 1991
- Multidimensional and multiscale signal and image processing and estimation, particularly applied to geometrically and medically oriented problems
- 1999/00 ECE Faculty Award for Excellence in Teaching

Mark Karpovsky, *Professor*

- Ph.D., Leningrad Electrotechnical Institute, 1967
- Testing and diagnosis of computer hardware; fault-tolerant computing; error correcting codes
- Fellow, IEEE

Thomas Kincaid, *Professor*

- Ph.D., Massachusetts Institute of Technology, 1965
- Signal and image processing; neurodynamics; non-destructive testing

Ronald Knepper, *Professor*

- Ph.D., Carnegie Mellon University, 1969
- VLSI integrated circuit technology; silicon CMOS & bipolar devices; numerical device simulation; SiGe BICMOS device and circuit modeling
- Fellow, IEEE

Janusz Konrad, *Associate Professor*

- Ph.D., McGill University, 1989
- Multimedia communications; image and video processing; stereoscopic and 3-D imaging; digital signal processing
- Associate Editor, *IEEE Trans. on Image Processing,* 1996-2000; Associate Technical Editor, *IEEE Communications Magazine*
- IEEE Signal Processing Magazine Award

Robert Kotiuga, *Associate Professor*

- Ph.D., McGill University, 1985
- Electromagnetics; numerical methods for three-dimensional vector field problems; Whitney forms and the Finite Element Method; Geometric inverse problems
- Member, Electromagnetics Academy

Min-Chang Lee, *Professor*

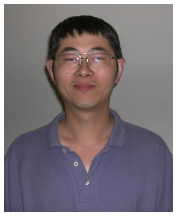
- Ph.D., University of California, San Diego, 1977
- Radio communications; experimental plasma physics; ionospheric plasma physics

Lev Levitin, *Distinguished Professor*

- Ph.D., USSR Academy of Sciences, Gorky University, 1969
- Information theory; physics of communication and computing; quantum theory of measurements; complex and organized systems; reliable computing
- Fellow, IEEE; Member, New York Academy of Sciences governing body of Dielectric Division of the Electrochemical Society;

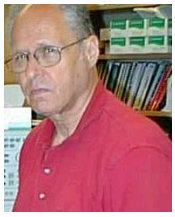
Thomas Little, *Associate Professor*

- Ph.D., Syracuse University, 1991
- Multimedia computing, computer networking, software engineering
- Editorial Board Member, *IEEE Multimedia, Multimedia Systems*
- Member, Executive Committee for the IEEE Computer Society Technical Committee on Multimedia Computing



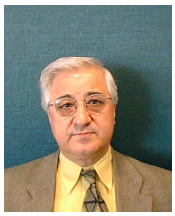
Fei Luo, *Research Associate Professor*

- Ph.D., Chongqing University, 1991
- Distributed fiber optic sensors and systems; optical fiber grating sensors; interferometric sensors and fiber optic smart structures



Theodore Morse, *Professor*

- Ph.D., Northwestern Univeristy, 1961
- Photonic material processing; optical fiber fabrication, lasers, and sensors
- Fulbright Fellow, Germany



Theodore Moustakas, *Professor*

- Ph.D., Columbia University, 1974
- III-Nitrides, growth by molecular beam epitaxy, vapor phase epitaxy and ion-beam cluster deposition methods; study of semiconductor properties and devices (blue-UV VCSELs, optical modulators, detectors, transistors and MEMS)
- Fellow - American Physical Society and Electrochemical Society; Member - Advisory Board, North American MBE; Governing Body, Dielectric Science and Technology Division of the Electrochemical Society
- 1997/98 ECE Faculty Award for Excellence in Teaching

S. Hamid Nawab, *Associate Professor, Associate Chairman for Undergraduate Studies*

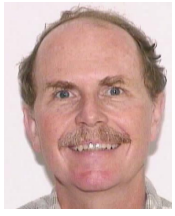
- Ph.D., Massachusetts Institute of Technology, 1982
- Digital signal processing, real-time, low-power, and distributed signal processing; image processing; communication and biomedical applications; integrated DSP environments and architectures, knowledge-based signal processing, and applications in auditory scene interpretation, music and EMG signal analysis.
- 1988 Best Paper Award, *IEEE Signal Processing Society;* 1993 Metcalf Award for Excellence in Teaching; 1998 College of Engineering Award for Excellence in Teaching

William Oliver, *Associate Professor, Associate Chairman for Graduate Studies*

- Ph.D., University of Illinois, 1973
- Radar studies of the upper atmosphere and ionosphere; geophysical modeling and simulation;global change in the upper atmosphere

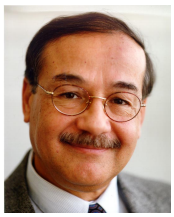
Tatyana Roziner, *Associate Professor*

- Ph.D., Moscow Scientific Research Institute, 1975
- Digital design; testing and diagnostics of computer hardware; fault-tolerant computing



Michael Ruane, *Associate Professor*

- Ph.D., Massachusetts Institute of Technology, 1980
- Magneto-optical materials; optical data storage; optical systems; communications
- 1998/99 ECE Faculty Award for Excellence in Teaching



Bahaa E.A. Saleh, *Professor and Chair*

- Ph.D., Johns Hopkins University, 1971
- Quantum optics; statistical optics; optical processing; image Processing; liquid crystal displays
- Fellow – IEEE, Optical Society of America, and John Simon Guggenheim Foundation; Editor in Chief, *Journal of the Optical Society of America A* (1991-1997); Deputy Director, Center for Subsurface Sensing and Imaging Systems
- Optical Society of America Beller Award (1999)

E. Fred Schubert, *Professor*

- Ph.D., University of Stuttgart, 1986
- Technology and physics of lasers and light-emitting diodes; semiconductor devices research
- Fellow, IEEE, SPIE, 1999; Literature Prize of the German Engineering Society, 1993; Alexander von Humboldt Senior Research Award, 1999; RD100 Award, 2000; Discover Magazine Award for Technological Innovation, 2000

Alexander Sergienko, *Associate Professor*

- Ph.D., Moscow State University, 1987
- Quantum optics, including quantum radiometry and metrology; laser physics; nonlinear optics; quantum communications; remote laser sensing; correlation spectroscopy, field optical microscopy and spectroscopy of semiconductor materials and devices
- NSF CAREER Award
- 2001 College of Engineering Award for Excellence in Teaching

Thomas Skinner, *Associate Professor*

- Ph.D., Boston University, 1982
- Microprocessors; computer networks; operating systems; distributed systems
- 1997 College of Engineering Award for Excellence in Teaching

David Starobinski, *Assistant Professor*

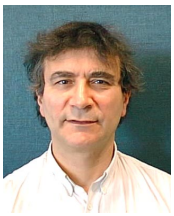
- Ph.D., Technion, Israel Institute of Technology, 1999
- High-speed communication networks; wireless cellular networks

Anna Swan, *Research Assistant Professor*

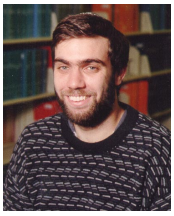
- Ph.D., Boston University, 1993
- Material characterization and spectroscopy of low dimensional systems, semiconductors and de vices; Development of nanoscale optical self-in terference microscopy

Alexander Taubin, *Associate Professor*
- Ph.D., Electrotechnical University of St. Peters burg, 1981
- Asynchronous circuit, logic design; computer ar chitecture; CAD; methods of format verification

Malvin C. Teich, *Professor*
- Ph.D., Cornell University, 1966
- Quantum optics and imaging; photonics; fractal stochastic processes; information transmission in biological sensory systems
- Fellow – IEEE, Optical Society of America, American Physical Society, Acoustical Society of America, American Association for the Advance ment of Science, and John Simon Guggenheim Foundation; IEEE Browder J. Thompson Memorial Prize; IEEE Morris E. Leeds Award; Palacky University Memorial Gold Medal



Tommaso Toffoli, *Associate Professor*
- Ph.D., University of Michigan, 1977
- Fundamental connections between physics and computation; fine-grained modeling of physics-like systems technology (cellular automata machines) and methodology (programmable matter); personal knowledge structuring
- Editorial Board Member, *Complex Systems; The Interjournal*



Ari Trachtenberg, *Assistant Professor*
- Ph.D., University of Illinois, Urbana-Champaign, 2000
- Error correcting codes, cryptography; algorithms, approximations, computation, visualization
- NSF CAREER Award

Selim Ünlü, *Associate Professor*
- Ph.D., University of Illinois, Urbana-Champaign, 1992
- Design, processing, characterization and simula tion of semiconductor optoelectronic devices; near-field optical microscopy and spectroscopy of semiconductor materials and devices
- NSF CAREER Award; ONR Young Investigator Award

Saligrama Venkatesh, *Associate Professor*
- Ph.D., Massachusetts Institute of Technology, 1997
- Statistical signal processing and its applications to communications and information control theory

Affiliated Faculty

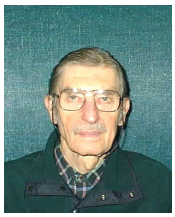
John Baillieul, *Professor (primary appointment with the Department of Aerospace and Mechanical Engineering)*
- Ph.D., Harvard University, 1975
- Robotics; control of mechanical systems; math ematical system theory
- Chairman, Department of Aerospace and Mechanical Engineering; past Editor-inChief, IEEE Transactions on Automatic Control;

Director, Boston Univeristy, Center for Control and Dynamics of Smart Structures and Center for Communicating Networked Control Systemr; IEEE Fellow, IEEE Control Systems Society Distinguished Member, and Vice-President Technical Activities

Christos Cassandras, *Professor (primary appointment with the Department of Manufacturing Engineering)*
- Ph.D., Harvard University, 1982
- Analysis and control of discrete event dynamic systems; stochastic control and optimization; dynamic control of computer and communica tion networks
- Editor-in-Chief, *IEEE Transactions on Autonomic Control*; Member, IEEE Control Systems Society Board of Governors; Fellow, IEEE; 1991 Lilly Fellow

Supriya Chakrabarti, *Professor (primary appointment with the Department of Astronomy and the Center for Space Physics)*
- Ph.D., University of California, Berkeley, 1982
- Planetary atmospheres; ultraviolet spectroscopy, rocket and ground based experiments
- Director, Center for Space Physics; Professor

Solomon Eisenberg, *Associate Professor, Associate Dean for Undergraduate Programs (primary appointment with the Department of Biomedical Engineering)*
- Sc.D., Massachusetts Institute of Technology, 1983
- Electrically mediated phenomena in tissues and biopolymers
- NSF Presidential Young Investigator (1987-1993)
- 1990 Metcalf Award for Excellence in Teaching



Leopold Felsen, *Professor (primary appointment with the Department of Aerospace and Mechanical Engineering)*
- D.E.E., Polytechnic Institute of Brooklyn, 1952
- Wave propagation and diffraction in various disciplines; high-frequency and time domain asymptotics; wave-oriented data-processing and imaging
- Member, National Academy of Engineering; Fellow – IEEE, Optical Society of America, Acoustical Society of America, John Simon Guggenheim Foundation; IEEE Medals: Heinrich Hertz Gold Medal, 1991, Centennial, 1984, 3rd Millenium, 2000; Humboldt Foundation, Senior Scientist Award, 1980; Honorary Doctorate, Technical University of Denmark, 1979; URSI Balthasar Van der Pol Gold Medal, 1975

Theodore Fritz, *Professor (primary appointment with the Department of Astronomy and the Center for Space Physics)*

- Ph.D., University of Iowa, 1967
- Space plasma and magnetospheric physics; magneto sphere-ionosphere coupling; substorms; charged particles and compositions; rocket and satellite experiments

Bennett Goldberg, *Professor (primary appointment with the Department of Physics)*

- Ph.D., Brown University, 1987
- Room-and low-temperature, near-field microscopy of semiconductors and biological systems; magneto-optics and magneto-transport of two- and one-dimensional electron fields
- Alfred P. Sloan Fellow, NSF Presidential Young Investigator

Michael Mendillo, *Professor (primary appointment with the Department of Astronomy and the Center for Space Physics)*

- Ph.D., Boston University, 1971
- Signal processing in Space Physics; Low-light-level CCD instrumentation; atmospheric emission tomography; GPS satellite communi cations; space plasmas in the solar system
- Fellow, American Geophysical Union

Eric Schwartz, *Professor (primary appointment with Department of Cognitive and Neural Systems)*

- Ph.D., Columbia University, 1973
- Computational neural science; machine vision, neuroanatomy; neural modeling

William Skocpol, *Professor (primary appointment with Department of Physics)*

- Ph.D., Harvard University, 1974
- Nanofabrication; device processing; transport experiments in materials
- Fellow, American Physical Society

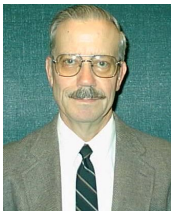
Emeritus Faculty

John Brackett, *Professor Emertius*

- Ph.D., Purdue University, 1963
- Software engineering; software requirements definition; object-oriented testing; rapid prototyping of embedded systems

David Perreault, *Professor Emeritus*

- Ph.D., Purdue University, 1968
- Nonlinear networks; computer-aided design; microprocessors; distributed digital networks



Richard Vidale, *Professor Emeritus*

- Ph.D., University of Wisconsin-Madison, 1964
- Modeling and simulation, software engineering

Moe Wasserman, *Professor Emeritus*

- Ph.D., University of Michigan, 1955
- Semiconductor processing, electronic circuits

NSF PYI/CAREER Awards

Jeffrey Carruthers
Thomas Little
Alexander Sergienko
Ari Trachtenberg
Selim Ünlü

IEEE Fellows

Christos Cassandras
Leopold Felsen
Floyd Humphrey
Mark Karpovsky
Ronald Knepper
Lev Levitin
Bahaa E.A. Saleh
E. Fred Schubert
Malvin C. Teich

2.2 Adjunct Faculty

The ECE Department looks outside the department and university for individuals to teach a few specific courses, as the need arises. These individuals bring a vast amount of engineering expertise, in both academic and industrial capacities, to the classroom. To the right is a list of people who have helped the Department meet its teaching needs over the past year.

Alan Pisano, *SC402 Control Systems (Spring 2002)*
- Ph.D., Northeastern University, 1974

James Sullivan, *EK130 Introduction to Engineering (Fall 2001)*
SC463 Design Project I (Fall 2001/Spring 2002)
- Ph.D., University of Chicago, 1970

Anna Swan, *SC471 Physics of Semiconductor Devices (Fall 2001/Spring 2002)*
- Ph.D, Boston University, 1993

2.3 Scientists

Name	Title	Sponsor
Agniel, Philippe*	Visiting Scholar	**Januz Konrad**
Bertazzi, Francisco	Research Assistant	**Enrico Bellotti**
Boura, Jihad	Senior Research Associate	**Allyn Hubbard**
Carlson, Erica	Research Associate	**David Campbell**
Carmachia, Vittario	Research Assistant	**Enrico Bellotti**
Cohen, Howard	Research Assistant	**Allyn Hubbard**
Daniell, Matthew*	Research Associate	**Alexander Sergienko**
Di Giuseppe, Giovanni	Research Associate	**Alexander Sergienko**
Galdi, Vincenzo	Research Associate	**David Castañon**
Gessmann, Thomas	Research Associate	**Fred Schubert**
Hendrych, Martin*	Visiting Scholar	**Malvin Teich**
Jaeger, Gregg	Senior Research Associate	**Alexander Sergienko**
Kakay, Attila*	Visiting Scholar	**Floyd Humphrey**
Kwon, Oh-Hyun	Research Assistant	**Behaa Saleh**
Redjdal, Makhlouf	Research Associate	**Floyd Humphrey**
Sandler, Nancy	Visiting Scholar	**David Campbell**
Shubochkin, Roman	Research Assistant	**Theodore Morse**
Sang, Sangyup*	Visiting Scientist	**Theodore Morse**
Thomidis, Christos	Research Assistant	**Theodore Moustakas**
Wylangowski, George	Senior Research Associate	**Theodore Morse**

**Completed Appointment during 2001/2002*

2.4 Staff

Technical Staff

Caine, Aaron	*Systems Administrator III*
Fedyunin, Yuri	*Wide Band Gap Semiconductors Laboratory Manager*
Kleptsyn, Vladimir	*Distributed Semiconductor Processing Lab Engineer*
Levin, Yefim	*Microprocessor Laboratory Manager*
Rodriguez, Raul	*Electronics Laboratory Manager*
"Open"	*Systems Administrator I*

Administrative Staff

Barbieri, Joe	*Financial Manager*
Field, Joy* "Open"	*Academic Programs Administrator*
Kachmarsky, Erik* "Open"	*Administrative Assistant*
Kim, Jae	*Grants Administrator*
Reigadas, Rosemarie	*Senior Administrative Secretary*
Rennie, Wayne	*Department Director*

**Resigned during 2001/2002*

2.5 Department Administration & Committees

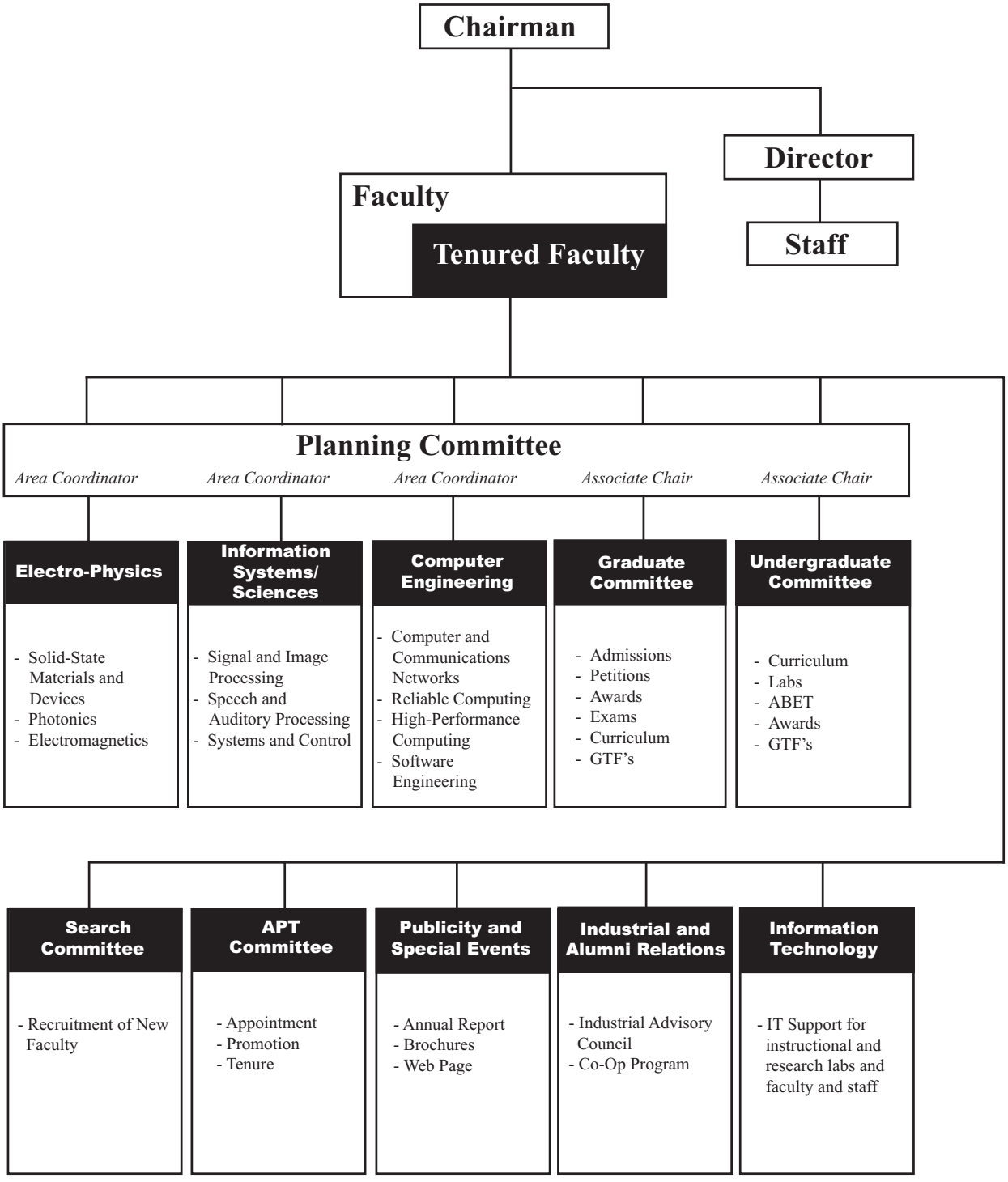
Saleh, Bahaa	*Department Chair*
Nawab, Hamid	*Associate Chair for Undergraduate Studies*
Oliver, William	*Associate Chair for Graduate Studies*
Rennie, Wayne	*Department Director*

Faculty committees direct the academic operations and planning for the ECE Department. The Undergraduate and Graduate Committees are responsible for curricular and student affairs. The Planning Committee comprises the coordinators of the three areas of research and instruction (electro-physics, information systems & sciences, and computer engineering), the Chairman, Director, and the two Associate Chairs, and is responsible for strategic initiatives.

Planning Committee	Graduate Committee	Undergraduate Committee	Search Committee	APT Committee
Saleh (Chair)	**Oliver (Chair)**	**Nawab (Chair)**	**Saleh (Chair)**	**Saleh (Chair)**
Oliver (Assoc. Chair)	Bellotti	Fahim	Carruthers	Brower
Nawab (Assoc. Chair)	Giles	Horenstein	Castañon	Castañon
Herbordt (Comp. Eng.)	Konrad	Kincaid	Giles	Herbordt
Karl (Signals)	Lee	Knepper	Karpovsky	Hubbard
Ruane (Electro-Phys.)	Levitin	Roziner	Lee	Levitin
Rennie (ex-officio)	Toffoli	Sergienko	Ünlü	Schubert
	Trachtenberg	Starobinski	Trachtenberg	Teich
		Venkatesh	Rennie (ex-officio)	Rennie (ex-officio)

Publicity and Special Events	Industrial and Alumni Relations	Information Technology	EK100 Advisors
Saleh (Chair)	**Saleh (Chair)**	Caine	Bellotti
Kachmarsky	Brackett	Carruthers	Brackett
Konrad	Hubbard	Giles (Spring)	Brower
Kotiuga	Kincaid	Herbordt	Carruthers
Ruane	Knepper	Hubbard	lee
Toffoli	Morse	Karl	Levitin
Unlu	Pisano	Konrad	Nawab
Rennie	Ruane	Rennie	Ruane
	Skinner		Trachtenberg
	Rennie		Unlu

2.6 Organizational Chart



2.7 ECE Representation in the College of Engineering and the University

College of Engineering Committee	Faculty
APT Committee	Hubbard, Schubert
Graduate Committee	Oliver
Scholarship Exam Committee	Ünlü
Undergraduate Committee	Nawab
Student Conduct Committee	Kincaid
Professional Practice Advisory Group	Knepper
Distance Education Committee	Horenstein, Ünlü

University Committee	Faculty
APT	Oliver
Committee on Research Activities and Libraries	Ünlü
Faculty Council	Giles, Ünlü
Patent Policy Committee	Moustakas
Undergraduate Research Opportunity Program	Ünlü
Student Conduct Committee	Ünlü

Advisory Group	Faculty
IEEE	Nawab
Minority Engineers' Society (MES)	Giles
Student Association of Graduate Engineers (SAGE)	Ruane
Society of Hispanic Professional Engineers (SHPE)	Castañon
Society of Women Engineers (SWE)	Fahim
Tau Beta Pi	Nawab
Engineering House	Nawab

3. Undergraduate Programs

3.1 Academic Programs

The undergraduate programs in the Electrical Engineering (EE) and Computer Systems Engineering (CSE) are designed to serve our departmental mission.

Department Mission Statement

1. Educate our students to meet high standards of excellence in electrical and computer engineering in preparation for professional careers and advanced studies.
1. Create and disseminate knowledge through basic and applied research in electrical and computer engineering.
2. Serve as a resource of electrical and computer engineering expertise at the local, regional, and national levels.

Consistent with the department mission, the undergraduate programs have a set of basic educational objectives.

Program Educational Objectives

Two to five years after graduation, students are expected to:

1. Build a career path with informed choices about its EE/CSE aspects.
2. Be competitive in the EE/CSE job market.
3. Contribute to the well-being of profession/community.

In addition, our graduates are expected to pursue *one or more* of the following:

1. Graduate education in engineering or allied fields.
2. Breadth of responsibilities in a small company environment.
3. Specialized expertise within a large company environment.
4. Sales/Marketing positions in technology companies.
5. Basic and applied research
6. Applications in other professions, such as medicine, business, and law.

In order to achieve the program educational objectives, the EE and CSE programs are geared to produce measurable outcomes on or before graduation. The three main objectives have been used to define five outcome themes. These themes were subsequently translated into eight principal outcomes, each with detailed specific basic outcomes. The principal and basic outcomes are described in a later section. The five outcome themes are as follows:

Outcome Themes

To demonstrate that our graduates have:

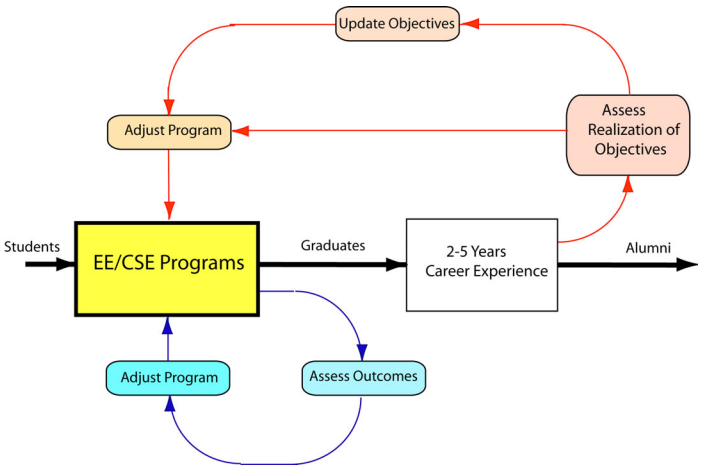
- a strong foundation in EE/CSE with an appropriate balance between theory and application.
- a wide repertoire of techniques and skills for the effective practice of modern EE/CSE.
- an integrated view of the subfields of EE/CSE.
- a broad education and ethical awareness to serve as responsible professionals.
- an ability to expand their knowledge to adapt to changes in technology.

Process for Continual Program Improvement

Over the last several years, we have been developing and institutionalizing a Continual Program Improvement (CPI) process that continually monitors and aims to improve the quality of our undergraduate programs. A key factor in the CPI process, in accordance with the new ABET (Accreditation Board of Engineering and Technology) accreditation criteria, is that it utilizes input from all our major "constituencies" with a vested interest in the ECE undergraduate programs: the department's faculty, undergraduates, and alumni.

The diagram on page 3-2 depicts the CPI process. The "outcomes feedback loop" involves the assessment of program outcomes and the subsequent adjustment of a program with the aim of improving program quality. The "objectives feedback loop" involves the evaluation of program outcomes and the subsequent adjustment of a program with the aim of improving program quality.

The "outcomes feedback loop" involves the assessment of program outcomes and the subsequent adjustment of a program with the aim of improving program quality. The ECE Undergraduate Committee conducts the assessment of outcomes using data/reports from student surveys, faculty surveys, the ECE Core Review Committee, ECE faculty meetings, the department chairman, the three department areas, and the ECE Industrial Advisory Council. Recommendations for program adjustment are then presented by the Chairman of the ECE Undergraduate Committee to the entire ECE faculty for discussion and a vote (if necessary).



The "objectives feedback loop" involves the evaluation of program objectives and the subsequent adjustment of a program with the aim of improving program quality. The ECE Undergraduate Committee conducts the evaluation of objectives using data/reports from alumni surveys, the ECE Industrial Advisory Council, ECE faculty, the department chairman, and the Career Services Office. Recommendations for program adjustment are then presented by the Chairman of the ECE Undergraduate Committee to the entire ECE faculty for discussion and a vote (if necessary).

AY2001-02 Program Improvement

In AY2001-02, we continued our AY2000-01 implementation of the CPI process and we added new elements to the implementation as the CPI framework evolved. Highlights

Detailed Program Outcomes

The five outcome themes (see above) are expanded into the following eight principal outcomes (we refer to them collectively by the acronym EUCCLIDD):

Educational Breadth & Ethics
Understanding
Communication
Collaboration
Laboratory
Integrated View
Design
Discovery

EUCCLIDD

The Foundation theme is represented in three principal outcomes: Understanding, Laboratory, and Design. The Techniques and Skills theme is represented in four principal outcomes: Design, Laboratory, Communication and Collaboration. The themes for Integrated View and Educational Breadth & Ethics are represented respectively by principal outcomes of the same names. Additionally, the Adaptation to Changes in Technology theme is represented by the principal outcome labeled Discovery. We expanded the principal outcomes to a more detailed set of basic outcomes, which are listed below.

Educational Breadth **(E)**
— Awareness of interrelationships of technology, society & ethics. (ABET **h1**)
— Sense of professional and ethical responsibility. (ABET **f**)
— Knowledge of contemporary issues. (ABET **j**)
— Appreciation for the humanities. (ABET **h2**)

Understanding **(U)**
— Knowledge of scientific laws & their mathematical underpinnings. (ABET **a1**)
— Knowledge of principles of current technology. (ABET **a2**)
— Ability to identify, formulate, and solve diverse EE/CSE problems. (ABET **e**)

Communication **(C)**
— Ability to organize, critique & convey complex tech. information (ABET **g1**)
— Ability to communicate in broad social contexts. (ABET **g2**)

Collaboration **(C)**
— Ability to function as valuable members of multidisciplinary teams. (ABET **d**)

Laboratory **(L)**
—Ability to conduct experiments and analyze and interpret data. (ABET **b**)
—Ability to utilize state-of-the-art hardware and software tools. (ABET **k1**)

Integrated View **(I)**
— A broad knowledge of EE/CSE sub fields. (**m1**)
— Knowledge of interrelationships between sub fields. (**m2**)
— Ability to integrate concepts from different sub fields. (**m3**)

Design **(D)**
—Ability to design and implement systems, components and processes to meet desired needs. (ABET c1)
—Practical experience in design. (ABET **c2**)
—Ability to utilize design tools. (ABET **k2**)

Discovery **(D)**
—Ability to conduct discovery in technical areas. (ABET **i1**)
—Awareness of the importance of life-long learning. (ABET **i2**)
—Knowledge and experience with resources for life-long learning. (ABET **i3**)
—Experience in collaborative learning. (ABET **i4**)

Next to each basic outcome we have also listed in parentheses the closest one of the required "a through k" outcomes as defined by ABET. When two or more of our basic outcomes correspond to parts of one ABET-defined outcome (say outcome a) we use numerals to distinguish the different instances of the ABET-defined outcome for each of the corresponding basic outcomes (e.g. a1, a2, etc.). Our "integrated view" outcomes are not within the ABET-defined outcomes and so we have arbitrarily assigned the letter m to them.

from the implementations of each of the CPI feedback loops are given below.

A. Assessment of Outcomes

1) Core Courses: A key component of the outcome feedback loop is a periodic review of the "core" courses in the EE and CSE programs. The core courses for each program are a subset of the "common experience" for all graduates of that program. The respective cores for the two programs are as follows:

EE Core:

- Entry Gateway: EK307 (Circuit Theory)
- Distribution: SC311 (Logic Design), SC401 (Signals & Systems), SC410 (Electronics), SC455 (Electromagnetic Systems I).
- Capstone Gateway: Senior Project (SC463 & SC464)

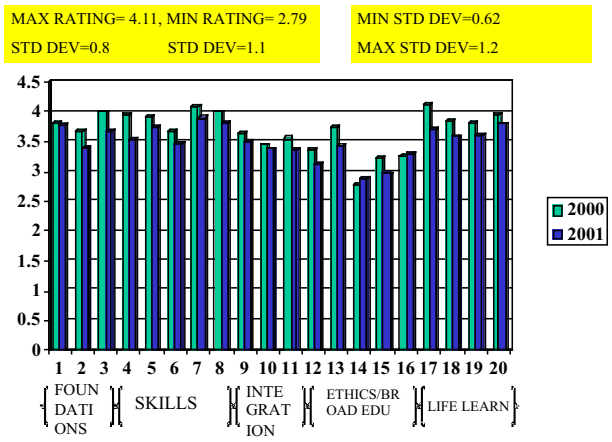
CSE Core:

- Entry Gateway: EK307 (Circuit Theory)
- Distribution: SC311 (Logic Design), SC401 (Signals & Systems), SC410 (Electronics), SC312 (Computer Organization), SC330 (Algorithms).
- Capstone Gateway: Senior Project (SC463 & SC464)

Outcome Assessment in Core

	Understanding	Communication	Collaboration	Laboratory & Tools	Integrated View of ECE	Design	Discovery
ek307	X	x	x	X	x	X	x
sc311	X			X		X	X
sc401	X			x	x	x	X
sc410	X		x	X	x	x	x
sc463	x	X	X	x	X	x	X
sc464		X	X	X	X	X	X
sc312	X	x	X	X		X	x
sc455	X			x	x		x

2) Graduation Survey: Every year for the past three years we have conducted a survey of the graduating seniors on ECE Project Conference Day at the end of the Spring semester. Results from that survey are being used as part of our outcomes assessment process. In each of the three years the response rate on the surveys has been well over 90%. The purpose of the survey is to determine how the graduating seniors rate their program's success with respect to each of the basic outcomes. The survey data for two years is plotted in the following chart. The horizontal axis represents the basic outcomes and the vertical axis represents the average rating given by the seniors, where a score of 1 represents "little or no preparation" for the corresponding outcome and a score of 5 represents excellent preparation for the corresponding outcome.



3) Industrial Advisory Council: Spring 2002 marked the second annual meeting of the Industrial Advisory Committee of the ECE Department. The meeting was held during ECE Senior Project Day. In the morning, the committee was given an overview of the department, its undergraduate programs, and its capstone design project courses. The committee also attended several senior design project presentations. In the afternoon, the committee met with a group of 15-20 ECE undergraduates to assess their opinions and concerns about the ECE Senior Design sequence. They also had a separate half-hour meeting with the Senior Design instructors. Finally they met with a group of ECE faculty to share their impressions about the undergraduate programs in the department. Members of the IAC who attended the meeting were Ms. Christina Knopp, Dr. Jihad Boura, Dr. Katie Hall, Dr. Kevin Knopp, Mr. David Kukulinsky, Mr. Ben Mbugua, Mr. John Reinke, Dr. Rich Molnar, and Mr. Anthony Palmieri.

Here are some key excerpts from the IAC's report:

"It was a pleasure to attend this year's presentations of the senior design project. We felt that the quality of work far surpassed that of previous years due to the restructure of the course to span two semesters as opposed to one. After viewing the presentations and meeting with a group of seniors to learn of their experiences during the course, the Council has several recommendations that we feel will further improve an already strong course syllabus. The current curriculum dedicates much of the first semester to classroom lecture; the bulk of the design work is done in the second semester. This does not give the students much more time to work on the design of their project than they would have had with a one-semester course. The Council recommends that the students are assigned their projects early in the first semester, and that the course work is dovetailed into the design work. This approach will place the lectures in context, and will give the students more time to devote to the planning and design of their project It is also recommended that milestones are set at the beginning of the course, and that the students track their progress against these

milestones. An example of milestones that might be appropriate for the first semester are a project plan, due early in the semester, and an alpha prototype, due by semester's end. A final recommendation is that "modules" be created where the students can learn hands-on skills, such as machining and soldering, that will assist them both in completing their senior project and in becoming valuable engineers. To further stress the importance of hands-on activities, it would be advantageous to complement technical classes such as Logic Design with laboratory experience. The IAC views these skills as a key trait of any accomplished engineer, thus providing a balance of theoretical and experimental skills."

"The Council has several recommendations related to the computer systems engineering (CSE) and electrical engineering (BE) curricula. During last year's IAC meeting, the Council recommended that PY313 (Modem Physics) be removed from the CSE curriculum. It is the Council's opinion that this course is not instrumental in preparing a CSE student for post-graduate work or for work in industry as a computer engineer. We were disheartened to find that PY3l3 remains as part of the CSE curriculum. We believe that this valuable course time would be better spent on more pertinent subject matter."

"One area that the Council feels is lacking in the CSE curriculum is hardware description language (HDL) coding, used for the design of application specific integrated circuits (ASICs), field programmable gate arrays (FPGAs), and complex programmable logic devices (CPLDs). The recommended placement for coursework in HDL coding is SC312, as students would have already covered the foundation in SC311. There are two languages used for HDL coding: VERILOG and VHDL. VERILOG is the more commonly used language and the Council recommends that the students learn VERILOG and have some exposure to VHDL. Expansion of the HDL concepts could be achieved through exposure to Synthesis. Synthesis should be part of the HDL education either as a separate course or as part of coursework covering HDL. If coupled with coursework on HDL, a lab might be included which would allow the students to implement their design into a FPGA or CPLD. It is also important that CSE students learn how to design for optimal signal integrity. Students should be exposed to issues related to signal transmission and signal termination, and should understand how to minimize crosstalk and electromagnetic interference (EMI). A tool such as SPECTRAQUEST would be required for coursework on signal integrity. As technology has evolved, embedded systems have become more common in designs. It would be advantageous to require that some portion of an embedded system be included in coursework, or as part of the senior design project."

"Introduction to Linear Algebra (EKI02 or MA 142) is currently a required course for the CSE and EE curricula. The Council believes that this material would be better addressed by incorporating it into another course, such as MA226 (Differential Equations), or EK307 (Electric Circuit Theory), where the material would be put into context. A final recommendation on the EE curriculum is that students be exposed to statistical analysis. Electrical engineering students learn probability in MA381 (Elementary Probability); however the coverage of statistics in this course is minimal. It is important that students learn the fundamentals of statistics as they relate to measurement uncertainly, yield analysis, error propagation, and statistical process control (SPC)."

"Finally, the Council would like to stress the importance of a fabrication laboratory in differentiating Boston University and its graduating engineers from other engineering programs across the country. Although most companies outsource the fabrication of their devices, it is crucial that the engineer is familiar with the process so that he or she is able to understand fabrication-related limitations to his or her design. It is also important that the engineer is capable of interfacing with the fabrication house. Speaking as one who completed this course during my tenure as an EE student at Boston University, I can attest to the value of the course material as a culmination of the EE curriculum. It is the Council's recommendation that the ECE department strongly consider providing the funding required for a fabrication laboratory. Many universities have approached this task jointly with industry, thus it is advisable that the University take the action to explore this opportunity with Alumni and local companies."

The Department is scheduled to examine these recommendations in detail during Fall 2002.

4) Student Feedback Meeting: During Fall 2001 we also held an open meeting for ECE undergraduates to give their verbal feedback on our programs. Present at the meeting were the Department Chair and the Associate Chair for Undergraduate Studies. In addition, several ECE faculty members came to hear the students' views. There were approximately 25 students present, most of them either seniors or juniors. The students present approved of the department's program objectives and the outcome criteria. They expressed some dismay about a perceived inflexibility in the CSE program. In particular, they cited the fact that there was only one general technical elective. There was a consensus that such flexibility may be obtained by no longer requiring students in the CSE program to take CAS PY 313 (Waves and Modern Physics) and replacing it by a general technical elective. Some suggested CAS CH131 (Chemistry) and EK301 (Engineering Mechanics) should not be required in the CSE program either. However, a number of students opposed

dropping these requirements. In particular, Engineering Mechanics was defended as the first really hands-on engineering course that the students have to take. Seniors strongly expressed the need for a technical writing course. They generally felt that they were ill prepared for the writing requirements in the Senior Design sequence. Finally, many of the students expressed strong support for the Co-op program since many of those present at the meeting felt that they had benefited immensely from their Co-op experiences. They alluded to the fact that the Co-op experiences convinced them of the importance of technical writing.

5) Program Changes: In response to the feedback from faculty, students, and the IAC, the Department initiated/ implemented two major changes in our programs

1) We implemented the new two-semester Senior Design sequence. By all accounts, the new two-semester format has produced a superior quality of projects from the students. Certain implementation issues (such as the best time for the students to begin working on their projects) have arisen, and the course instructors are currently addressing these. Currently, the Department is also discussing ways of promoting greater involvement in Senior Design of ECE faculty other than the Senior Design instructors.

2) We initiated a major change in the CSE program to create more elective courses. In particular, the Department has approved that the required course SC447 (Software Design) be replaced by a "track elective" in which the students would have a choice between SC447, SC446 (Computer Networks), and SC571 (VLSI Design). The ECE Department also approved the replacement of the restricted "Electrical Elective" by a general technical elective. The Department also voted to drop PY313 as a required course. These changes are subject to approval by the entire faculty of the College of Engineering before they can be implemented in our CSE program.

B. Evaluation of Objectives

During Spring 2002, we designed the ECE alumni survey with the specific aim of using it as an instrument for helping the Undergraduate Committee evaluate the program educational objectives. The survey has been placed on the ECE web site and alumni are being contacted to encourage them to fill out and submit the questionnaire.

ECE Alumni Survey

Boston University

Name:
Home Address:

Email Address:

1. My BS Degree is in: Electrical Engineering
   If other...please specify:
2. Graduation year for my BS degree was 2001
3. In my opinion, my current (or intended) career path and the knowledge/skills gained during my BS education are Strongly Related
4. In my opinion, my position in the job market for my chosen career is Competitive

Questions 5,6,7, and 8 relate to your current full-time employment (if any)

5. I am currently employed full-time in a field that is (please click on the answer applicable to you):
   - ENGINEERING related
   - NOT engineering related
6. I am currently employed full-time and my job description includes (keep control key pressed down when clicking on multiple answers):
   - a research/development function
   - an engineering design function
   - a management function
   - a technical support function
   - a sales/marketing function
   - an education/training function
   - none of the above

   My job includes a function, not among the above choices.
7. I am currently employed full-time in a company whose number of employees in my best estimate is more than 5000
8. I am currently employed full-time in a company that belongs to the following sectors (keep control key pressed down when clicking on multiple answers):
   - technology
   - manufacturing
   - consulting
   - financial services
   - medical/health
   - legal
   - media
   - human services
   - defense
   - education
   - none of the above

   Other:
9. I am currently attending **full-time** (keep control key pressed down when clicking multiple answers):
   - GRADUATE SCHOOL in engineering
   - GRADUATE SCHOOL in science
   - MEDICAL SCHOOL
   - BUSINESS/MANAGEMENT SCHOOL
   - LAW SCHOOL
   - NOT ATTENDING

   Other:
10. I am currently attending **part-time** (keep control key pressed down when clicking multiple answers):
    - GRADUATE SCHOOL in engineering
    - GRADUATE SCHOOL in science
    - MEDICAL SCHOOL
    - BUSINESS/MANAGEMENT SCHOOL
    - LAW SCHOOL
    - NOT ATTENDING

    Other:
11. My commitment to graduate education includes (keep control key pressed down when clicking multiple answers):
    - I have already earned a graduate degree
    - I plan to attend a graduate school in the near future
    - I have not attended nor do I plan to attend graduate school

    Graduate degree obtained (if any):
12. My membership status in the IEEE is (keep control key pressed down when clicking multiple answers):
    - I am currently a member
    - I am currently not a member but I have been a member in the past
    - I have never been a member
    - I plan to become a member in the future

    I am a member of another professional organization:
13. My involvement with community includes (keep control key pressed down when clicking multiple answers):
    - volunteering
    - cultural/social activities
    - civic activities
    - mentorship
    - sports
    - charity

    Other:

Submit Form --- or --- Reset

3.2 Other Highlights

ECE Advising Day

Continuing a tradition initiated in 1998, each semester an ECE Advising Day was held just prior to the commencement of the telephone registration period for the next term. On these days many ECE professors volunteered up to four hours of pre-registration advising time for their students. In the fall semester, ECE Advising Day also included a meeting with ECE undergraduates to discuss the strengths and weaknesses of the ECE undergraduate programs. About 25 students attended the session.

Teaching Workshops

The ECE tradition of holding teaching workshops every semester continued this year. Now a requirement (as course SC850) for all new graduate teaching fellows in the College, six 1-hour workshops were held each semester. These workshops included panel and solo discussions and role-playing scenarios on teaching methodology, presentation techniques, pedagogy, ethics etc.

2002 ECE Teaching Award

During the 1997-98 academic year, the ECE Department instituted an award to recognize innovation and excellence in teaching in the department. The award, based on nominations from College students, faculty, and staff, carries with it a $1000 prize to be used towards instructional activities. A committee of ECE professors and students evaluated the nominees. They looked at teaching statements and classroom material, sat in on classes, and collected comments from students.

This year's winner was Professor Selim Ünlü. *(See sidebar)*

2002 ECE Project Conference Day

The ECE Project Conference Day, an annual feature at the end of the spring term, once again was successful in showcasing the work of our seniors and graduate students to other students, faculty, alumni, and company representatives. Senior Project presentations were held in two parallel sessions from 9am to 1pm.

This was the first year that Senior Project course was offered as a two-semester sequence.

Professors M. Ruane and R. Knepper, the two Senior Design instructors for Spring 2002, chaired the two sessions. An awards luncheon was held from 12:30pm to 1:30pm to recognize outstanding project presentations and to announce the ECE Faculty and GTF teaching awards.

P.T. HSU Award

The P.T. Hsu Award is given annually to the best senior design project.

ECE Teaching Award

Professor Selim Ünlü is the winner of the 2002 ECE Award for Excellence and Innovation in Teaching. The 2001 ECE Teaching Award Committee, chaired by Professor Nawab, recommended this award. The committee also included the two most recent winners of the award, Professors Karl and Carruthers. The committee recognized Professor Ünlü's teaching accomplishments in regards to:

1. His key role in the development of the MS in Photonics program, including the establishment of the Photonics Education Laboratory.
2. His use of tools to improve the learning environment, including ef fective use of the web, presentation materials, and videotaped lectures.
3. His commitment to extending the educational reach of the department, through electronic office hours and distance education programs.
4. His consistently excellent teaching evaluations and his commitment to advising and mentoring.

3.3 Enrollment and Degrees Awarded

Enrollment

Fall 2001

	Electrical	Computer Systems	TOTAL
Freshmen*	30	63	93
Sophomores*	24	60	84
Juniors	43	54	97
Seniors	50	81	131
TOTAL	**147**	**258**	**405**

*Note: ENG students are not required to declare their major until their Junior year.

Degrees Awarded

Degrees Awarded	
Electrical Engineering	50
Computer Systems Engineering	51
TOTAL	**101**

Honors Students	
Summa Cum Laude	10
Magna Cum Laude	13
Cum Laude	16
TOTAL	**49**

3.4 Instructional Labs

Circuits and Electronics Laboratory

The Circuits and Electronics lab includes a full line of Hewlett-Packard bench top instruments linked by HP-VEE software. This continually updated facility, which supports ECE courses in circuits and electronics, enables us to offer traditional lab experiments in circuits in electronics in a modern laboratory setting the emulates those found in industry. The lab also can support more advanced experiments in signals and systems, communications, electromagnetics, and photonics. *Nawab*

Circuits and Electronics Laboratory

Control Systems Laboratory

This laboratory houses four ECP Model 220 Industrial Emulator/Serve Trainers for studying control of practical systems. *Castañon*

High Performance Computing Laboratory

The High Performance Computing Laboratory at Boston University was created with support from the National Science Foundation (NSF) in order to support the development of undergraduate courses in parallel and high performance computing. The courses offered at Boston University serve as a national model for computational science education. The lab features a network of multimedia graphics workstations linked at high speed to the supercomputers at the Center for Computational Science and the Scientific Computing and Visualization Lab. *Giles*

High Tech Tools and Toys Laboratory

HTTTL is the instructional laboratory associated with Boston University's NSF-funded Engineering Research Center for Subsurface Sensing and Imaging Systems (CenSSIS). The laboratory houses a variety of PC-based imaging camera systems, machine vision systems and acoustic imaging systems. Software for imaging includes MATLAB, Image Processing Toolbox, Image Builder, Vision Foundry, ENVI and LabVIEW. The HTTTL supports freshman EK130 modules in imaging and subsurface imaging, senior design capstone projects in imaging, and experiments in senior level electives related to imaging. *Ruane*

High Tech Tools and Toys Laboratory

Image and Signal Processing Laboratory

This laboratory serves graduate instructional and research needs by providing advanced computational resources and associated software packages. Equipment includes a Sun Ultra450 computer server with 4 CPU's and 4 Gbytes of RAM, a Sun Ultra450 data server with over 200 gigabytes of RAID storage, 3 Sun Ultra10 workstations, and 4 dual - Pentium 500Mhz personal computers together with color and monochrome printers. This laboratory was developed with funds from the National Science Foundation. *Karl*

Microprocessor and PC Laboratory

This lab features instruction in the programming and interfacing of microcomputers and digital controllers. Higher-level courses emphasize the design of systems using microprocessors. For networking studies, the laboratory contains four PC systems connected in a local loop with access to a larger local loop in the nearby microprocessor lab and to the campus area network. Networking software, various simulators, and analysis packages are available. *Skinner, Toffoli*

Network Computing Laboratory

The Network Computing Laboratory studies interconnection network topologies; routing, network flow control, and deadlocks in multicomputer networks; multicast and broadcast, fault-tolerance in interconnection networks; modules for realization (nodes and routers); performance metrics and scalability; message passing interference, protocols and programming, scalable coherent interfact (SCI), and distributed shared memory; network of workstations (NOW), case studies of high performance scalable networks, and cluster computing. *Carruthers*

Networks Laboratory

This laboratory provides facilities for experiments involving data communication links, local-area networks, and wide-area networks. Powerful computer-based simulation and analysis tools are available to compare and evaluate network designs. Facilities are also provided for experimentation with local-area network switching and routing hardware. *Carruthers*

Photonics Laboratory

The Photonics Laboratory supports the introductory and intermediate level courses in the MS in Photonics program. Four stations each have a vibration isolated optical table, lasers, fiber components and systems, electronic test equipment, and GBIP connected PCs for data logging and instrument control. Shared equipment exists for experiments and demonstrations in interferometry, spectrometry, diffraction, holography, acoustic and electro-optic modulation, and optical spectrum analysis. A secure annex room houses two additional isolated tables, electronics and optical equipment to support thesis and senior design projects that require long-term setup of apparatus. *Ruane, Ünlü, Teich*

Radio Communication Laboratory

The Radio Communication Laboratory supports lab experiments for courses in electrodynamics, waves and antennae, and wireless communication. Equipment includes a transmission line training station, benchtop receiving/transmitting antenna, radio receivers covering the radio spectrum from 1.6 MHz to 440 MHz, and two radio transmitters. Several antennae, including a four element rotating beam, a long-wave trap dipole, and a two-meter vertically polarized directional antenna, are located on the roof of the photonics building. The Radio Communication Laboratory also serves as the home of the ECE-sponsored Boston University Amateur Radio Club. *Horenstein*

Senior Project Laboratory

This lab is operated as a virtual company, serving real-world customers such as NASA, Analog Devices, Boston and Brookline Public Schools, social service agencies, and faculty and staff across the University. Each team has twenty-four hour access to a permanent bench setup with a networked Pentium PC, benchtop GPIB-based HP test equipment, and software for schematic design, simulation, and PCB layout. Electronics and shop support is provided. Shared tools include high speed scopes, logic analyzers, spectrum analyzers, E-prom, PLA and FPGA burners, and various compilers and cross-compilers for DSP and micro-controller development. *Ruane, Knepper, Horenstein*

Signals Laboratory

This laboratory houses numerous workstations for digital signal processing, image processing, and various real-time applications covering the complete audio frequency spectrum. Equipment includes PC's, microphones, DSP boards, speakers, amplifiers, digital cameras, and software packages such as MATLAB and Hyperception. The courses served by this laboratory include SC401 (Signals and Systems), SC416 (Intro to Digital Signal Processing), SC 512 (Digital Signal Processing), and some ECE modules in EK130 (Introduction to Engineering). *Nawab*

Software Engineering Laboratory

An instructional and research lab, the Software Engineering Laboratory (SEL) supports courses and research on the economical design of reliable software for large-scale, computer-based systems. The lab includes a group of Silicon Graphics and Gateway 2000 networked workstations and provide students with state-of-the-art development tools for the design, implementation, and testing of software systems. *Brackett*

Electronic Design Automation Laboratory

In this lab, students design circuits and systems using state-of-the-art Electronic Design Automation facilities. Hardware includes 32 Sun Workstations, plus chip testing equipment and associated display and software systems. Software tools include ViewLogic, Synopsis, Mentor Graphics, and Cadence. *Hubbard, Knepper, Roziner, Kincaid, Herbordt, Taubin*

Expenditures for Instructional Laboratories 2000/01

FACILITY	EQUIPMENT	APPROXIMATE COST
Electronics Lab	Lab kits, Electric kits, etc.	$ 6,444
Photonics Lab	Workstations, bench top, Hardware, Lasers	$ 10,095
Senior Project Lab	Workstations, Software licenses, Logic analyzer	$ 16,514
Signals/Networks Lab	Software, Server upgrade, Maintenance	$ 20,305
Microprocessing Lab	Workstations, Lab kits, etc.	$ 28,127
Software Eng. Lab	Maintenance, workstations, Software licenses, etc.	$ 24,982
VLSI Lab	Software licenses, Workstations, Memory	$ 57,684
TOTAL		**$ 164,151**

3.5 Undergraduate Courses

Course	Course Title	Fall 2001	Spring 2002	Summer 2002
EK100	Freshmen Seminar	Faculty		
EK130	Intro. to Engineering	Horenstein Morse Kincaid Sullivan	Bigio Morse Ruane	
EK307	Electric Circuit Theory	Fahim Roziner	Lee Roziner Fahim	Lee
EK 317*	Electric Circuit Theory I	Fahim		
EK 318*	Electric Circuit Theory II		Fahim	
EK501	Math Methods I	Kotiuga		
SC311	Intro. to Logic Design	Roziner	Kincaid	Roziner
SC312	Computer Organization	Knepper	Herbordt	
SC330	Applied Algorithms/Data Structures	Brower	Trachtenberg	
SC401	Signals & Systems	Venkatesh	Venkatesh	Nawab
SC402	Control Systems		Pisano	
SC410	Intro. To Electronics	Sergienko Unlu Kotiuga Lee	Lee	Wasserman
SC412	Analog Electronics		Sergienko	
SC415	Communication Systems	Carruthers	Roziner	
SC416	Intro. to Digital Signal Processing	Nawab		
SC440	Intro. to Operating Systems	Skinner	Skinner	Skinner
SC447	Software Design	Skinner	Skinner	Skinner
SC450	Microprocessors	Toffoli	Toffoli	
SC451	Directed Study			Faculty
SC455	Electromagnetic Systems I	Lee	Saleh	Lee
SC456	Electromagnetic Systems II		Kotiuga	
SC463	Senior Design Project	Ruane	Sullivan	
SC 464	Senior Design Project		Ruane Knepper	
SC466	Senior Honors Thesis	Knepper	Knepper	
SC471	Physics of Semiconductor Devices	Swan	Swan	

3.6 Freshman Research Opportunity Program (FROP)

Student Name	Professor
Tejashkumar Patel	Castañon
Adam Weiner	Horenstein
Bethany Farrell	Hubbard
Matt Graham	Lee
Nicole Schofield	Morse
Mary Margaret Froehlich	Ruane
Aspen Sibigtroth	Saleh
Akash Ahuja	Sergienko
Jan Horjus	Teich
Christopher Vermilion	Trachtenberg/Starobinski
Graham Voysey	Ünlü/Goldberg

3.7 Senior Design Projects

All ECE seniors must complete a capstone senior design project in teams of two to four students, designing and prototyping a product, electronic device, or software system for a real-life corporate or social-service client. This year the course adopted a two semester format. In SC463 students learn design methods, project management, team dynamics, communication skills, and legal and ethical standards for design. They form teams, research their project approach, and prepare proposals for their real-world customers. In SC464 teams work on their project in the Senior Project Laboratory, PHO111 and PHO113. Students must make presentations to their customer, write inter- and intra-office memos, design their project to meet customer specifications, manage the project budget, and deliver the working prototype, complete with a detailed instruction manual. The Senior Project Laboratory provides every team with 24-hour access to its own dedicated, fully-equipped laboratory bench, and offers modern CAD and prototyping tools for circuits, embedded systems, and software development. Xebec Technologies is the senior design 'virtual company' used to model the workplace design experience, so students are prepared to contribute quickly upon graduation and entering the profession.

2002 P.T. Hsu Award

Each year a faculty committee chooses the winners of the P.T. Hsu Award for the best overall ECE senior design project by considering degree of success, difficulty, scope, creativity, cost, project communications, and team ef fectiveness. The 2002 winners were Team TechnoWand, working for David Durlach and his Cambridge company, TechnoFrolics. Team members included Michael Biolansky, Jason Booth, Darryn Campbell, and Meagan Gormally. The TechnoWand is a hand-held marketing give-away that will draw users to the TechnoFrolics web site by creating visual art in front of the user. The team prepared a Java applet that flashes a digital code in part of the screen. The TechnoWand reads the flashes with an optical sensor, and decodes the information to control a series of LEDs in the wand. When the user waves the wand at arm's length, a pattern appears in space due to visual persistence. The design team created an explanatory web site, the Java coding, the digital communications scheme, including error detection, and the microprocessor-controlled LED display. Users can choose from sample patterns or create their own pattern on a web page template. The team had three versions before their final design, which was supported by AutoCAD and OrCAD design files for manufacture. Unit price was under $12, well within the customer's target.

Notable 2000-2001 Senior Projects

Team Members	Project and Customer
Sabotage Mark Cross, Pawel Gajkowski, Scott Hastings, Peter Petrovich	Tape Monitor for Homeless Patients Dr. R. Sokolove, BU City Hospital
Illuminati Anthony Aguirre, Jason Brosch, Vi Thuong Duong, Pavan Pant	Acoustic Imaging CenSSIS High Tech Tools & Toys Lab
Random 4 Technologies Francine Lalooses, Aaron Lowenberger, Slanda Arkadiusz, Joshua Zelman	Visual Amplification Art Display Cater School, Boston
The A Team Christophre DiSimone, Markus Raisanen, Ignacio Rodriguez, Eddy St Juste	Wireless Monitor Prof. Carruthers, Networks Laboratory
Top Shelf Engineers Christopher Erickson, Zlatko Kajan, Mead Misic, Dameon Shaw	Laser Safety Power Meter R. Slade, Env. Health & Safety Office
Shire Perfection Andre JosephReid, Brad Schwarz, Kevin Valent, Evan York	Wireless Link for Mimio System Prof. Carruthers, Signals Laboratory

Above: Aaron Lowenberger and Joshua Zelman assembling their 25-panel LED display system for Random 4 Technologies.

Above: Dameon Shaw, Chris Erickson, Zlatko Kajan, and Mead Misic after demonstrating their laser power meter. Note the interchangeable laser heads on the bench.

Above: The A Team, Eddy St. Juste, Ignacio Rodriguez, Markus Raisanen, and Chris DiSimone, holding their five laser IR transmitter unit for the wireless monitor link.

Above: Sabotage team members show their laptop controller, a legacy project for the tape monitor, and the Sabotage design, which fits entirely in the Walkman case in the foreground. Team members are Mark Cross, Pawel Gajkowski, Peter Petrovich, and Scott Hastings.

3.8 IEEE Student Section Activities

The ECE Department supports an active undergraduate IEEE Student Section. This group has held a number of successful events this past year, ranging from lectures and panel presentations to social events for members to educational service activities. Events for 2001-2002 are detailed below.

Lectures/Presentations/Panels

Introduction to Micro-Electromechanical Systems (MEMS)
ECE Professor Mark Horenstein gave an introduction to micro-electromechanical systems (MEMS). The lecture focused on basic fabrication techniques and highlighted several promising applications.

Web-Cast Presentation on JAVA
The group reserved a room and used a video projector to broadcast Sun Microsystem's web-cast entitled "Java Past, Present and Future" by Ron Kleinman.

CANARY Biosensor Lecture
Dr. Todd Rider from MIT's Lincoln Laboratory came to talk about a novel type of biosensor for rapid pathogen identification that is being developed using B cells, or white blood cells, as the sensing elements.

Joint IEEE/ASME Power Engineering Presentation
Jeff Lunde, Vice President at Parsons Brinckerhoff Power, was on hand to talk about the engineering involved with building a power plant. This event was planned with Boston University's American Society of Mechanical Engineers (ASME) Student Chapter.

High-Performance CCD Imagers for Low-Light-Level Applications
Dr. Bernard Kosicki from MIT's Lincoln Laboratory gave a lecture on how CCD imagers works, the improvements they have made in the technology at Lincoln Laboratory as well as the various applications of this technology.

Sun Microsystems / Topcoder Technical Presentation
A group of students attended a technical presentation at MIT presented by the Sun Microsystems on XML, J2EE and Java Controlled Lego Robots.

Local Inventor Presentation on Generalism
Peter Jones, owner of the Boston-based company Tenebraex, was on hand to talk about some of his inventions in the field of optics. He also spoke about technological generalism, being aware of innovations of a variety fields which can inspire unique solutions to seemingly impossible problem. Mr. Jones' latest invention, full-color night vision, was the subject of an article in the November issue of Boston Magazine.

Presentation by GE Capital
Jeff Wehner and Nestor Lopez of GE Capital spoke about the variety of programs that GE has to offer graduating engineers and computer scientists and the interesting work that these programs provide.

Joint Meeting w/ Boston Section of the Robotics & Automation Society
Our chapter had a joint meeting with the local Robotics and Automation Society hosted by iRobot in Somerville. The group had an opportunity to learn about their military reconnaissance robot, PackBot.

IEEE-GOLD Presentation, "Round-Table Discussion on Advanced Degrees"
Our chapter hosted and attended a presentation organized by the Boston IEEE-GOLD Section.

IEEE-GOLD Presentation, "Identifying a Good Business Idea"
Our chapter hosted and attended a presentation organized by the Boston IEEE-GOLD Section.

Tours

Campus Lab Tours
As part of National Engineers Week (E-Week), the group organized tours of two laboratories at Boston University where students had an opportunity to learn about some of the research taking place. These included Professor Schubert's Semiconductor Devices Research Lab and Professor Ünlü's Picosecond Spectroscopy and Near-Field Scanning Microscopy Laboratories.

BAE Systems Tour (Nashua, NH)
The group attended a tour of BAE Systems facilities in Nashua, NH. BAE Systems is the third largest aerospace electronics company in the world. They visited their radar jam lab and anechoic chambers and had lunch with some of their engineers.

Co-op Led Tour of Nextel
This was the first in what will be more 'Co-op Led Tours'. The group visited Daniel MacDonald, a Boston University Co-op student, at his job at the Nextel Facilities. This provided an opportunity to tour a cellular tour and switching network, get some background on electromagnets, and learn about his duties as a Co-op. This was not only a chance for students to tour Nextel, but for potential Co-ops to see what type of work with which they may be involved.

Tour of Bose Corporation
Students had an opportunity to tour the main Bose facilities in Framingham, MA. Various products were demonstrated, including noise-cancellation headsets and their Auditioner Technology, which allows Bose to simulate the sound of any space using a computer model. In addition, students saw their echo-chamber, anechoic chamber and The Bunker, where Bose performs quality tests of its products.

Educational Activities

Fundamentals of Engineering Information Session
A panel of Professional Engineers from several different fields was on hand to talk about the advantages to becoming licensed and encouraging student to take the Fundamentals of Engineering Examination. In addition, the students convinced all engineering departments at Boston University to provide a 100% exam fee reimbursement to seniors who take the exam and report their scores. This event was planned together with the BU ASME student chapter.

Fundamentals of Engineering Review Sessions
Another stipulation that students be reimbursed the fees associated with taking the FE exam was that they attend a review session. Material was covered in two hour blocks, making use of ASME FE Review Videos and materials with professors and graduate students available to do problems and answer questions.

Fundamentals of Engineering Review Book Sale
In conjunction with the FE Info and Review Sessions, the group sold discounted FE Review Books to students planning to take the exam. Although these books were priced well below retail, approximately $50 was raised for IEEE student activities from the sales after all expenses.

Transitioning From Student to Engineer
As another E-Week event, the group hosted a panel of recent BU graduates to discuss their experiences of entering "the Real World." They shared valuable insight, answering questions on a variety of topics, such as job searching, changing careers, and Co-ops and working.

ECE Advising Day
In conjunction with the Electrical and Computer Engineering Department, the students helped plan and promote ECE Advising Day. This event gave students an opportunity to offer feedback on the curriculum offered at Boston University.

Other Activities

Recruiting Booths
Our branch had booths set up at a variety of engineering events on campus to inform students about the group:

- **Student Activities Fair:** Entering freshman were able to learn about the various student organization represented in the College of Engineering.
- **Fall/Spring Engineering Career Fair:** The brach had the opportunity to speak with both students and companies about its activities.
- **National Engineers' Week:** A booth was set up so students could learn about the IEEE and to promote E-Week events.

Web Site Contest
Our branch completely revamped its web site and entered it in the IEEE Worldwide Student Branch Web Site Contest in which it placed first. In addition, the students created a database-driven employment website where after getting an account (for free), employers can post, update and remove job posting as they see fit.

Boston Section Three-Wheeled Car Competition
Boston University had an entry for the Boston Section's Annual 3-Wheeled Car Competition. Although our entry did not win in the speed trials, it did win Most Original Design. With only two wheels, it managed to complete the 60 foot track and stay within the boundaries.

Region 1 Student Paper Contest
Boston University has two teams competing in the Paper Contest. One paper is on GSM Wireless Technology and the other is on a Wireless Monitor, a senior design project.

Gingerbread House-Building Contest
For an event planned by Boston University's ASME Student Chapter, IEEE built a gingerbread house. This house was not only judged on aesthetic appeal, but also its ability to withstand crushing weight. Of all the houses that entered, including ASME, the IEEE group's held the most weight.

Network Gaming Competition
As another event for E-Week, the students organized a competition of the multiplayer network game, Unreal Tournament, with food, fun and prizes.

Evening of Billiards with Other Boston Student Sections
Boston University students attended an evening of billiards at Jillian's organized by members of the MIT IEEE/ACM.

4. Graduate Programs

4.1 Course & Program Development

Curriculum Development

MS In Photonics

A new MS degree program, the MS in Photonics, was developed during the year, and approved at all University levels. ECE will now offer three MS degrees: Electrical Engineering (EE), Computer Systems Engineering (CSE), and Photonics.

The structure of the new MS in Photonics mimics those in EE and CSE, requiring identification of a Concentration area, Breadth courses outside of the Concentration, Advanced-level courses, and a Project or Thesis. Three Concentration areas have been identified for the MS in Photonics: (1) Lasers and Applications, (2) Fiber Optics and Optical Communications, and (3) Photonic Materials and Devices. "Photonics" is still a Concentration under the EE MS program, for those who wish to obtain an MS in EE rather than Photonics.

Seven new Photonics courses have been developed to join our six existing Photonics courses. Six of these seven had been taught previously under the SC500 or SC700 Special Topics rubrics and have now obtained official course numbers. The seventh, SC914, was created to provide the official course registration for the Project in Photonics. These seven courses are listed below:

SC568 Optical Fiber Sensors
SC762 Quantum Optics
SC763 Nonlinear and Ultrafast Optics
SC764 Optical Measurement
SC765 Biomedical Optics and Photonics
SC774 Light Emitting Diodes
SC914 Project in Photonics

Other New Courses

In addition to the new Photonics courses, five other new courses have been developed and were either taught in Spring 2002 or are scheduled to be offered in Fall 2002.

SC500 Digital System Design Automation is planned to be offered in Fall 2002 by Professor Alexander Taubin.

SC500 RF/Analog IC Design Fundamentals for mixed Signal Applications is planned to be offered in Fall 2002 by Professor Ronald Knepper.

SC700 Communication Network Analysis is planned to be offered in Fall 2002 by Professor Murat Alanyali.

SC700 Digital Video Processing was taught in Spring 2002 by Professor Janusz Konrad.

SC700 Quality of Service Networking was taught in Spring 2002 by Professor David Starobinski.

SC700 Modern Information Protocols is planned to be taught in Fall 2002 by Professor Ari Trachtenberg.

Graduate Student Recruitment

ECE had a slim graduate-student recruiting season in Spring 2001, which we attributed to the still-banner employment opportunities for college graduates in Fall 2000. Our expectation of a rebound in Spring 2002 has been fully realized. Domestic applications rose 81% and the rate of acceptance of our Teaching-Fellow offers rose from 24% to 65%. Curiously, acceptance of our full-scholarship offers dropped from five out of six in Spring 2001 to two out or six in Spring 2002. Two other applicants accepted Research Assistantships. The geographic distribution of the new students accepting financial aid was broad, with five coming from the U.S.A., three each from India, the People's Republic of China, and Turkey, and one each from Argentina, Ireland, and Romania.

Because of the previous year's success in recruiting full-scholarship students, and believing that the carrot here was the lifetime-support guarantee that full scholarships offered, we created a new ECE Fellowship, which is a Teaching Fellowship carrying that same lifetime-support guarantee. We offered three ECE Fellowships for Fall 2002, but only one was accepted.

We tried a new tack this year to raise our visibilty to engineering seniors across the nation by asking 70 schools to participate in a seniors name swap. Eight schools joined us [Johns Hopkins, Michigan, Princeton, UC Santa Clara, Villanova, Wake Forest, Washington (Saint Louis), and Yale]. We contacted several hundred seniors from those universities by e-mail, two applied to and visited BU (from Michigan and Princeton), but neither decided to attend.

Teaching-Fellow and RA Stipend

The University raised the base Teaching Fellow and Research Assistant stipend from $13,500 to $14,500 for Fall 2002. We further raise the RA stipend 5% after PhD students pass their Qualifying Exams and another 5% after they pass their Dissertation Prospectus. A first-year bonus of $1000 is added to the stipend of full-scholarship students. Our stipends are higher than most schools', however Boston housing costs are also higher, bringing the after-housing pay in line with other schools'.

Graduate Student Seminars

The weekly or bi-weekly series of ECE Graduate Student Seminars, run in recent years in conjunction with SC850, the Graduate Teaching Fellow Seminar, was not run in Fall 2001 or Spring 2002. The small number of new graduate students reduced the need for the department research orientation that the seminars provide. The single activity run in this seminar series was a "service" talk of interest to all students by Professor Irving Bigio on "Effective Technical Presentations." 66 students attended, with a significant number from the Senior Design class.

ECE Colloquium

The ECE Colloquium series continued for a fourth year. Prominent speakers from both outside and inside the University gave research talks on current issues. We encourage graduate students to attend these talks. A list of speakers for the 2001-2002 Academic year is given on pages 11 through 14 of this section.

Graduate Teaching Fellows (GTFs)

ECE's allocation of the College of Engineering's 53 GTF slots will increase from 20 in Fall 2001 to 22 for Fall 2002. The GTF allocation formula is based strictly on credit-hour enrollments in courses listed in the BU undergraduate catalog, that is, up to the 500 level. ECE also provides an additional GTF (and a professor) to teach the Electric Circuits course in the BU Metropolitan College Science and Engineering Program, most of whose students join the College of Engineering formally in their junior year.

Undergraduate Teaching Fellows (UTFs)

ECE instituted a trial UTF program in AY99-00, partially to give our best undergraduates a higher-level experience in their academic programs, but also to interest them in staying for graduate school. These UTFs have recently taken the courses with which they are assigned to help, and they have been found to form an invaluable resource for the professors and for the GTFs, who often have not had previous student or teaching experience with the specific course material. During Fall 2001 and Spring 2002, ECE awarded 4 UTFs, to Darryn Cambell, Patrick Murphy, Matt Corbo, and Jason Chu. Campbell and Murphy have decided to attend graduate school, Campbell at BU and Murphy at Princeton.

4.2 New Matriculants

New Students Entering 2001-2002

		Male	Female	FT	PT	GTF	RA	Fellow	Other
MS	US	8	2	7	5	1	1	0	6
	Intl.	12	8	20	0	7	0	0	0
Ph.D.	US	8	0	8	0	3	3	1	0
	Intl.	10	2	11	1	3	5	1	0
TOTAL		**40**	**12**	**46**	**6**	**14**	**9**	**2**	**6**

Fall 2001 Mean GRE Scores

		Verbal	%	Quantitative	%	Analytical	%
MS	US	495	57	733	83	663	73
	Intl.	422	37	734	86	614	64
Ph.D.	US	515	61	685	73	590	57
	Intl.	410	35	785	96	675	81
Mean		**461**	**48**	**734**	**85**	**636**	**69**

Spring 2002 Mean GRE Scores

		Verbal	%	Quantitative	%	Analytical	%
MS	US	512	58	700	77	567	53
	Intl.	475	49	773	92	646	71
Ph.D.	US	581	75	738	86	740	90
	Intl.	545	65	778	94	739	89
Mean		**523**	**61**	**749**	**88**	**673**	**76**

4.3 MS Students

Student Name	*Advisor*	*Research Area or Thesis*
Abou-Amarah, Izzat	Nawab	Quantum Optical Imaging
Agarwal, Sachin	Trachtenberg	Fast Data Synchinization in PDAs
Aizikov, Konstantin	Castanon	Computer Systems Engineering
Bach, Edward	Toffoli	Electrical Engineering
Bae, Sunghwan	Skinner	Computer Systems Engineering
Bashar, Fahmida	Brackett	Computer Systems Engineering
Blondin, Archie	Skinner	Computer Systems Engineering
Bozinovic, Nikola	Oliver	Electrical Engineering
Chan, Kin Fan	Nguyen	Electrical Engineering
Chang, Shey-Sheen	Starobinski	Electrical Engineering
Chen, Tai-Chou	Saleh	Electrical Engineering
Chivas, Robert	Morse	"Direct Measurement of Polarization Mode Dispersion in Optical Components"
Ciriello, Sarah	Kincaid	Electrical Engineering
Conery, Joseph	Skinner	Computer Systems Engineering
Dai, Haito	Starobinski	Computer Systems Engineering
Dekow, Gary	Perreault	Electrical Engineering
Dougherty, Paul	Carruthers	Computer Systems Engineering
Evans, Thomas	Bifano	Electrical Engineering
Gali, Srikrishna	Carruthers	Computer Systems Engineering
Gazdeer, Aspiyan	Hubbard	Electrical Engineering
Ghosh, Soma	Starobinski	Computer Systems Engineering
Gunter, Liberty	Eddy	Electrical Engineering
Guo, Ye	Carruthers	Electrical Engineering
Harris, Garrett	Chakrabarti	Computer Systems Engineering
Jow, An-Ching	Starobinski	Electrical Engineering
Kim, Sang-Hoon	Brackett	Computer Systems Engineering
Kim, Soojin	Karl	Electrical Engineering
Kulkarni, Mugdha	Brackett	Computer Systems Engineering
Lander, Todd	Skinner	Computer Systems Engineering
Lane, Keith	Vidale	Electrical Engineering
La Plume, Paul	Ruane	Electrical Engineering

Student Name	*Advisor*	*Research Area or Thesis*
Lee, Dong-Hoon	Carruthers	Communication
Leyfer, Michael	Perreault	Computer Systems Engineering
Liu, Ying-Tsang	Sergienko	Electrical Engineering
Lin, Pei-Chao	Starobinski	Computer Systems Engineering
Liu, Guojing	Oliver	Computer Systems Engineering
Martin, Andrew	Castanon	Electrical Engineering
Mathur, Raman	Carruthers	Electrical Engineering
McKnight, Andrew	Knepper	Computer Systems Engineering
Mc Mahon, Dara	Castanon	Electrical Engineering
Mei, Kao-Chi	Karpovsky	Computer Systems Engineering
Mercurio, Michael	Starobinski	Computer Systems Engineering
Nautiyal, Archana	Karpovsky	Computer Systems Engineering
Nguyen, Nguyen	Kincaid	Electrical Engineering
Nourzad, Marianne	Knepper	Electrical Engineering
Onat, Burak	Skinner	Computer Systems Engineering
Owen, Russell	Moustakas	Electrical Engineering
Pasnoor, Sulakshana	Hubbard	Electrical Engineering
Raman, Supriya	Hubbard	Electrical Engineering
Rykalova, Yelena	Levitin	Computer Systems Engineering
Shah, Jay	Schubert	Electrical Engineering
Silva, Elsa	Vidale	Computer Systems Engineering
Sioufi, Ralph	Karpovsky	Computer Systems Engineering
Tong, Yunjie	Unlu	Electrical Engineering
Ungrangsi, Rachanee	Starobinski	Computer Systems Engineering
Varghese, Joseph	Carruthers	Electrical Engineering
Vellanki, Harshavardhan	Sergienko	Electrical Engineering
Wang, Tong	Morse	Electrical Engineering
Whiting, Andrew	Sergienko	Electrical Engineering
Wu, Jing	Bellotti	Electrical Engineering
Yu, Qingying	Trachtenberg	Computer Systems Engineering
Zhai, Qingtai	Fritz	Electrical Engineering
Zhang, Wei	Carruthers	Computer Systems Engineering

4.4 Ph.D. Students

Student Name	*Research Advisor*	*Research Area or Thesis Title*
Abouraddy, Ayman	Saleh	Quantum Optical Imaging
Abu Ayyash, Salma	Nawab	Signal Processing - Using Knowledge-based Techniques to Perform Signal Decomposition on EMG Signals
Al-Awadhi, Ayman	Carruthers	Computer Engineering
Aleksanyan, Arnak	Karl	Solid State Devices
Arcolano, Nicholas	Venkatesh	Electrical Engineering
Basu, Prithwish	Little	Wireless Ad Hoc Networks, Scalable Video Delivery
Bergstein, David	Eddy	Electrical Engineering
Beriont, Walter	Little	Computer Engineering
Bhattacharyya, Anirban	Moustakas	Electrical Engineering
Bozinovic, Nikola	Konrad	Electrical Engineering
Bycenski, Kenneth	Moustakas	Physics
Bynoe, Wayne	Carruthers	Broadband Wireless LANs
Cabalu, Jasper	Moustakas	Electrical Engineering
Carroll, Sarah	Carruthers	Wireless Communication Networks
Chatterjee, Santanu	Castanon	Computer & Science Engineering
Chauhan, Vikas	Giles	Compuer Engineering
Chen, Fangyi	Hubbard	Electrical Engineering
Chivas, Robert	Morse	Electrical Engineering
Colerico, Marlene	Mendillo	Electrical Engineering
Collier, Charles	Morse	Electrical Engineering
Crager, Joseph	Horenstein	Electrical Engineering
Davis, Brynmor	Karl	Electrical & Computer Engineering
Dobson, Jennifer	Unlu	Electrophysics
Dosunmu, Olufemi	Unlu	Electrical Engineering
Eakman, Gregory	Brackett	A Scalable Approach to Automated Object-Oriented Integration Testing
Emsley, Matthew	Unlu	Electrical Engineering
Feng, Haihua	Castanon	Electrical Engineering
Graff, John	Schubert	Electrical Engineering
Gupta, Shameek	Karpovsky	Computer Engineering
Harris, Garrett	Chakrabarti	Computer Engineering
Hasan, Qadeer-Ul	Levitin	Computer Engineering
Hinck, Todd	Hubbard	Extending the Smart Pixel Paradigm: Integrated Image Acquisition and Imaging Processing Circuitry
Hitchings, Darin	Konrad	Systems Engineering
Hochstein, Lorin	Nawab	Signal Processing
Hock, Robert	Moustakas	Engineering-Physics
Hu, Lan	Toffoli	Computer Engineering
Huang, Chien Chih	Unlu	Electrical Engineering
Iliopoulos, Eleftherios	Moustakas	Growth, Modelling and Optoelectronic Properties of Ordered III-V Nitride Alloys
Ippolito, Stephen	Unlu	Electrical Engineering

Student Name	*Research Advisor*	*Research Area or Thesis Title*
Iyer, Sandeep	Moustakas	GaN Thin Films
Jastrzebski, Piotr	Lee	Trans-hemispheric Propagation of the VLF Signals in the Presence of Ionospheric HF Heating
Jeong, Jonghoon	Teich	Electrical Engineering
Jones, Lawrence W	Carruthers	Computer Engineering
Karl, Christian	Hubbard	Electrical Engineering
Kaur, Parminder	Trachtenberg	Computer Engineering
Ke, Wang	Little	Multimedia Networks, Video-on-Demand Systems
Kim, Duk Joong	Hubbard	Electrical Engineering
Krishnan, Rajesh	Little	Computer Engineering
Laurent, Sophie	Mendillo	Tomography on Auroras
Li, Wei	Moustakas	Microelectronics
Li, Yun-Li	Schubert	Electrical Engineering
Li, Xiaojun	Morse	High Power Fiber Laser
Litvin, Andrey	Karl	Space Physics
Liu, Huajun	Perreault	Networking, Microcomputer systems
Liu, Ying-Tsang	Sergienko	Physics
McNerney, Peter	Konrad	Computer Systems
Mustafa, Mehmet	Karpovsky	Reliable Computing
Nasr, Magued	Schubert	Quantum Optics
Pavlovich, Julia	Karl	Electrical Engineering
Perreault, Julie	Horenstein	MEMS
Polimeni, Jonathan	Schwartz	Computational Neuroscience, Computer Vision, AVLSI
Ray, Saikat	Oliver	Electrical Engineering
Ristivojevic, Mirko	Nawab	Electrical Engineering
Ruan, Dan	Konrad	Electrical Engineering
Sampath, Anand	Moustakas	Solar-blind P-I-n AlGaN Photodetectors
Shapurian, Golnaz	Nguyen	Electrical Engineering
Shaw, Matthew	Sergienko	Quantum Optics
Shi, Yonggang	Karl	Signal Processing
Singh, Rajwinder	Eddy	High Density Plasma Processing of Nitride Semiconductors
Toussaint, Kimani	Ruane	Electrical Engineering
Vamivakis, Anthony	Teich	Electrical Engineering
Walton, Zachary	Toffoli	Computer Engineering
Wang, Meimei	Cassandras	Systems Engineering
Wang, Yang	Bellotti	Physics
Weisenseel, Robert	Karl	Sensor Fusion for Subsurface Object Detection
Williams, Adrian	Oliver Jr	Electrical Engineering
Wotiz, Robert	Nawab	Knowledge Based Signal Processing
Wynne, Rosalind	Sergienko	Physics
Yang, Zibing	Hubbard	VLSI Circuit Design
Yarnall, Timothy	Teich	Electrical Engineering

4.5 Degrees Awarded

MS Degrees Awarded

Electrical Engineering	25
Computer Systems Engineering	16
TOTAL	**41**

Ph.D. Degrees Awarded

Electrical Engineering	7
Computer Engineering	1
Systems Engineering	1
TOTAL	**9**

4.6 Graduate Teaching Fellows

Fall 2001

Student Name	Course
Salma Abu Ayyash	EK317
Nicholas Arcolano	SC401
Fahmida Bashar	SC410
Shey Sheen Chang	SC416
Vikas Chauhan	SC440/447
Robert Chivas	SC455
Jennifer Dobson	SC410
Paul Dougherty	SC311
Aspiyan Gazder	SC410
Shameek Gupta	SC312
Mugdha Kulkarni	SC463/466
Parminder Kaur	SC546
Erick Lin	SC311
Guojing Liu	SC504/511
Raman Mathur	SC410
Archana Nautiyal	SC463/466
Marianne Nourzad	EK307
Sulakshana Pasnoor	SC571
Dan Ruan	SC450
Yunjie Tong	SC560
Joseph Varghese	SC330

Spring 2002

Student Name	Course
Salma Abu Ayyash	SC415
Sachin Agarwal	SC546
Kenneth Bycenski	SC412
Shey Sheen Chang	EK307
Vikas Chauhan	SC440/447
Robert Chivas	SC471
Jennifer Dobson	SC410
Paul Dougherty	SC463/464
Aspiyan Gazder	SC312
Mugdha Kulkarni	SC463/466
Parminder Kaur	EK307
Raman Mathur	EK307
Andrew McKnight	SC311
Alexander Mueller	SC401
Archana Nautiyal	EK307
Marianne Nourzad	EK318
Sulakshana Pasnoor	SC571
Dan Ruan	SC450
Yunjie Tong	SC563/570
Joseph Varghese	SC330
Adrian Williams	EK307

Summer 2002

Student Name	Course
Shey Sheen Chang	SC401
Vikas Chauhan	SC447
Aspiyan Gazder	SC410
Raman Mathur	SC311
Marianne Nourzad	EK307
Anthony Vamivakas	SC455

4.7 Research Assistants

Student	*Advisor*
Abouraddy, Ayman	Saleh
Agarwal, Sachin	Trachtenberg
Arcolano, Nicolas	Venkatesh
Atature, Mete (Physics)	Sergienko
Bach, Edward	Toffoli
Basu, Prithwish	Little
Blasche, Gregory (Physics)	Goldberg
Booth, Mark (BME)	Teich
Bozinovic, Nikola	Konrad
Cabalu, Jasper	Moustakas
Carroll, Sarah	Carruthers
Chen, Fangyi	Hubbard
Chen, Tai-Chou	Moustakas
Colerico, Marlene	Mendillo
Crager, Joseph	Horenstein
Dobson, Jennifer	Bigio
Dosunmu, Olufemi	Unlu
Emsley, Matthew	Unlu
Franzen, Nthan	Oliver
Friel, Ian (Physics)	Moustakas
Graff, John	Schubert
Gunter, Liberty	Eddy
Harris, Garrett	Chakrabarti
Hitchings, Darin	Castanon
Hochstein, Lorin	Nawab
Hu, Lan	Toffoli
Iliopoulos, Eleftherios	Moustakas
Ippolito, Stephen	Unlu
Iyer. Sandeep	Moustakas
Karl, Christian	Hubbard
Ke, Wang	Little
Kim, Duk Joong	Hubbard
Kim, Soojin	Bellotti
Li, Xiaoyun	Morse
Li, Yun-Li	Schubert

Student	*Advisor*
La Plume, Paul	Ruane
Litvin, Andrey	Karl
Liu, Huajin	Perreault
Liu, Ying-Tsang	Sergienko
Laurent, Sophie	Mendillo
McNerney, Peter	Betke/Konrad
Moiseev, Lev (Physics)	Unlu
Nasr, Magued	Teich/Saleh
Pavlovich, Julia	Karl
Perreault, Julie	Horenstein
Polimeni, Jonathan	Schwartz
Raman, Supriya	Nugent
Ray, Saikat	Starobinski
Ristivojevic, Mirko	Konrad
Sampath, Anand	Moustakas
Shah, Jay	Schubert
Shaw, Matthew	Sergienko
Shi, Yonggang	Karl
Siddiqui, Matheen	Sclaroff
Singh, Rajwinder	Eddy
Toussaint, Kimani	Sergienko
Ulu, Gokhan (Physics)	Unlu
Vamivakis, Nick	Saleh
Van Court, Thomas	Herbordt
wang, Yang	Bellotti
Waldron, Erik (Physics)	Schubert
Walton, Zachary	Sergienko
Weisenseel, Robert	Karl
Whiting, Andrew	Teich
Wotiz, Robert	DeLuca
Yang, Zibing	Mountain
Zhai, Qingtai	Fritz
Zhang, Wei	Oliver

Professors Castañon and Saleh congratulate graduating Ph.D. student Haihua Feng

4.8 Graduate Courses

Course Number & Title	*Fall 01*	*Spring 02*	*Summer 02*
SC 500 Special Topics in ECE		Giles	
SC 500 Special Topics in ECE			
SC 501 Dynamic Systems Theory	Castanon	Castanon	
SC 504 Advanced Data Structures	Trachtenberg		
SC 505 Stochastic Processes	Karl	Karl	
SC 509 System Simulation			
SC 511 Software Systems Design	Brackett		
SC 512 Digital Signal Processing			
SC 513 Computer Architecture	Skinner		
SC 514 Simulation for Manufacturing	Vakili		
SC 515 Digital Communication	Ruane		
SC 516 Digital Signal Processing		Nawab	
SC 518 Software Project Management		Brackett	
SC 520 Image Processing and Communication	Konrad		
SC 524 Optimization Theory and Methods	Paschalidis		
SC 533 Introduction to Discrete Mathematics	Levitin		
SC 534 Stochastic Models in Engineering		Levitin	
SC 546 Computer Communications and Networks	Starobinski	Carruthers	
SC 560 Introduction to Photonics	Teich		
SC 561 Error-Control Codes	Karpovsky		
SC 562 Digital Communication			
SC 563 Fiber-Optic Communication Systems		Schubert	
SC 566 Atmostphere and Space Environment	Oliver		
SC 570 Lasers and Applications		Unlu	
SC 571 VLSI Principles and Applications	Hubbard	Knepper	
SC 572 VLSI Design Project	Hubbard		Hubbard
SC 575 Semiconductor Devices	Bellotti		
SC 579 Microelectronic Device Manufacturing		Cole	
SC 700 Advanced Topics in Electrical and Computer Engineering	Bigio	Kotiuga	
SC 700 Advanced Topics in Electrical and Computer Engineering		Starobinski	
SC 700 Advanced Topics in Electrical and Computer Engineering		Little	
SC 700 Advanced Topics in Electrical and Computer Engineering		Konrad	
SC 700 Advanced Topics in Electrical and Computer Engineering		Taubin	
SC 700 Advanced Topics in Electrical and Computer Engineering		Toffoli	
SC 702 RCS EST/ OPT FLT		Castanon	
SC 710 Dynamic Programming and Stochastic Control	Caramanis		
SC 711 Software Architecture			
SC 712 Advanced Software		Skinner	
SC 713 Parallel Computer Architecture	Herbordt		
SC 715 Wireless Communication			
SC 716 Advanced Digital Signal Processing			
SC 717 Image Reconstruction and Restoration			
SC 719 Statistical Pattern Recognition			
SC 730 Informational-Theoretical Design of Algorithms		Levitin	
SC 749 Interconnection Networks for Multicomputers	Karpovsky		
SC 752 Theory of Computer Harware Testing		Karpovsky	
SC 757 Advanced Microprocessor Design			
SC 760 Advanced Topics in Photonics	Saleh		
SC 761 Information Theory and Coding	Levitin		

Course Number & Title	*Fall 01*	*Spring 02*	*Summer 02*
SC 770 Integrated Optoelectronics			
SC 771 Physics of Compound Semiconductors		Bellotti	
SC 772 VLSI Graduate Design Project	Hubbard		Hubbard
SC 850 Graduate Teaching Seminar	Nawab	Nawab	
SC 891 Seminar: Computer Systems Engineering	Faculty		
SC 892 Seminar: Electro-Physics	Unlu	Unlu	
SC 900 Research	Faculty	Faculty	Faculty
SC 901 Thesis	Faculty	Faculty	Faculty
SC 910 Computer Enginnering Design Project	Faculty	Faculty	
SC 911 Systems Enginnering Design Project	Faculty	Faculty	Faculty
SC 912 Software Enginnering Design Project	Brackett	Brackett	Brackett
SC 913 Electrical Engineering Design Project	Faculty	Faculty	
SC 939 Continuing Study	Faculty	Faculty	
SC 951 Independent Study	Faculty	Faculty	Faculty
SC 991 Dissertation	Faculty	Faculty	Faculty

4.9 ECE Colloquium and Seminars

Date	*Speaker*	*Title*
September 19	Ted Morse ECE Department Boston University	Applications of Polarization Mode Beating Effects in Fiber Lasers and Passive Devices
September 26	Saul Youssef Physics/CCS Department Boston University	Physics with Exotic Probabilities
October 3	Mark Horenstein ECE Department Boston University	What You Thought You Knew About the Gold Leaf Electroscope: Can a MEMS Device Push?
October 10	Saul Youssef Physics/CCS Department Boston University	Exotic Probabilities & Quantum Mechanics- Continued
* October 10	Kent D. Choquette ECE Department University of Illinois at Urbana-Champaign	VCSEL's for Optical Interconnect Applications
*October 17	Alexander Taubin Senior Scientist Theseus Logic, Inc.	Synthesis and Verification of Large Asynchronous Circuits Null Convention Logic Approach
October 17	Daniel Cole Manufacturing Department Boston University	Optimal Intergration of Lithographic Patterning Processes and Device/Circuit Design
October 17	Michael Tsuk Compaq Alphaserver Product Development Compaq Computers	The Use of Loop Inductances in Signal Integrity Modeling

Date	*Speaker*	*Title*
*October 23	Helmut Kronmuller Director Max-Planck-Institut fur Metallforschung Stuttgart, Germany	Computational Micromagnetism of Magnetic Structures and Magnetization Processes in Small Particles and Thin Platelets
*October 24	William D. Phillips 1997 Nobel Prize in Physics National Institue of Standards and Techonology	Atom Optics with Coherent deBroglie Waves
October 24	Anna Swan ECE Department Boston University	Beating the Resolution Limit - nm-Scale Resolution in Fluorescence Microscopy Using Self-interference
October 31	Badri Roysam ECE Department Rensselaer Polytechnic Institute	Attention Correction in Confocal Laser Microscopes: A Novel Two-view Approach
October 31	Michael Yeung Manufacturing Department Boston University	Application of EM Scattering to Microchip Manufacturing
November 2	Murat Alanyali Department of Electrical and Electronics Engineering Bilkent University, Ankara, Turkey	Fluid Models for Loss Networks Under Constrained Controls
November 7	Robert Kotiuga ECE Department Boston University	On Causal Passive Linear Time-Invariant Black Boxes with Infinite-Dimensional State Spaces
November 19	Dan Bliss Adaptive Signal Processing Advanced Techniques (Sensor Technology) Group Lincoln Laboratory	MIMO Communication - Capacity, Channel Phenomenology, and Algorithms
November 14	Alexander Polishchuk Math Department Boston University	The Role of Category Theory in Modern Mathematics
November 28	Richard Brower ECE Department Boston University	Gravity/Gauge Theory Duality: The Counter Revolution in String Theory
*November 28	Ibrahim Matta Computer Science Department Boston University	Managing TCP Traffic
January 25	Abraham Katzir School of Physics and Astronomy Tel Aviv University	Infrared Transmitting Fibers and their Applications in Science, Industry and Medicine
February 6	Funda Akelman Electronics and Communications Engineering Department Technical University of Istanbul	Electromagnetic Wave Problems and Numerical Simulation Techniques
February 13	Harry Moses Applied Mathematics	The Wave Function of the Photon and Its Relation to the Electromagnetic Field
*February 13	Raymond L. Boxman Electrical Discharge and Plasma Laboratory Tel Aviv University	Vacuum Arc Deposition of Coating and Thin Films

Date	*Speaker*	*Title*
February 27	Paul Barbone AME Department Boston University	Imaging the Elastic Modulus of Soft Tissue
February 28	Maja Bystrom ECE Department Drexel University	Video and Channel code modeling for Robust Transmission
March 13	Alexander Sergienko ECE & Physics Department Boston University	Quantum Information Processing and Precise Optical Measurement with Hyper-entagled Quantum States
*March 13	PK Aravind Physics Department Worchester Polytechnical University	Bell's Theoren without Inequalities and Quantum Cryptography
March 19	Jeffrey Carruthers ECE Department	S-QMRP: An Internet QoS-aware MUlticast Routing Protocol
February 20	Martin Herbordt ECE Department Boston University	Channel Modeling for Wireless Infrared Communications
*March 20	M. Selim Ünlü ECE Department Boston University	Microscopy Beyond the Diffraction Limit: Guided and Propagating Waves
March 22	Alexis Bernard EE Department University of California, Los Angeles	Source and Channel Coding for Speech Communication and Distributed Speech Recognition
March 22	Tommaso Toffoli ECE Department Boston University	Making a Knowledge Home
March 27	George Zimmerman Physics Department (Emeritus) Boston University	Magnetoresistance: Comparisons and Applications
April 2	Aaron Cohen Research Laboratory for Electronics Masschusetts Institute of Technology	Communication with Side Information: Watermaking and Writing on Dirty Paper
*April 3	S. Hamid Nawab ECE Department Boston University	DSP Structures: Transforms, Filters, and Beyond
April 8	Sekhar Tatikonda Postdoctoral Fellow University of California, Berkeley	Communications Issues in Sensor and Actuator Networks
*April 10	W. Clem Karl ECE Department Boston University	Estimation and Enhancement in an Uncertain World
April 11	Pier Luigu Dragotti Ph.D Candidate Swiss Federal Institute of Technology (Lausanne)	Wavelet Footprints and Frames for Signal Processing and Communication
April 26	Eytan Modiano Laboratory for Information and Decision Systems Massachusetts Institute of Techonology	Algorithms for Resource Allocation and Congestion Control in Next Generation Satellite Networks

Date	*Speaker*	*Title*
April 29	Sergey Rudin U.S. Army Research Laboratory	Exciton Coherence and Low Temperature Optical Spectra of Semiconductors, Semiconductor Quantum Wells, and Quantum Dots
May 1	Cammen Chan ENG SC 951 Project ECE Department Boston University	Electrostatic Discharge Protection for Analog SiGe/SOI Bipolar IC processes with ft=50GHz
May 8	Jim Sullivan AME Department Boston University	Sonification for Experiment Monitoring and Data Analysis
May 15	Bruce Boghosian Math Department Tufts University	Quantum Computational Physics
May 22	Fred Schubert ECE Department Boston University	The Bright Future of LED's
May 29	Laura Giannitrapani SCV Department Boston University	Tools and Toys for 3-D Modeling and Animation
June 5	Robert Kotiuga ECE Department Boston University	Topological Characterization of Solutions to a Geometric Inverse Problem Involving Force-Free Magnetic Fields
June 12	Jonathan Polimeni ECE Student Boston University	Quasiconformal Mapping via Dual Variational Principles and Adaptive Mesh Generation

*ECE Colloquium Series

5. Research

5.1 Areas of Research

Electro-Physics

Coordinator: Michael Ruane

Solid-State Materials and Devices

- Bellotti
- Campbell
- Eddy
- Humphrey
- Knepper
- Moustakas
- Schubert
- Skocpol

Photonics

- Bellotti
- Bigio
- Carruthers
- Eddy
- Goldberg
- Kincaid
- Levitin
- Morse
- Moustakas
- Ruane
- Saleh
- Schubert
- Sergienko
- Teich
- Ünlü

Electromagnetics

- Fahim
- Felsen
- Fritz
- Giles
- Horenstein
- Humphrey
- Kotiuga
- Lee
- Mendillo
- Oliver

Information Systems & Sciences

Coordinator: William Clem Karl

Signal & Image Processing

- Carruthers
- Castañon
- Karl
- Kincaid
- Konrad
- Mendillo
- Nawab
- Oliver
- Teich
- Venkatesh

Systems & Control

- Baillieul
- Castañon
- Karl
- Venkatesh

Computer Engineering

Coordinator: Martin Herbordt

Computer & Communication Networks

- Carruthers
- Cassandras
- Hubbard
- Karpovsky
- Levitin
- Roziner
- Starobinski
- Toffoli
- Trachtenberg

Software Applications

- Brackett
- Brower
- Castañon
- Giles
- Knepper
- Kotiuga
- Levitin
- Little
- Nawab
- Schwartz
- Skinner
- Toffoli
- Trachtenberg

Hardware

- Herbordt
- Hubbard
- Karpovsky
- Knepper
- Taubin
- Toffoli

5.2 Publications

Books

M. N. Horenstein, *Design Concepts for Engineers*, 2nd Ed. Prentice Hall, Upper Saddle River, NJ, 2002.

M. Mendillo, A. Nagy and H. waite, eds., *Atmospheres in the Solar System: Comparative Aeronomy,* American Geophysical Union monograph #130 AGU, Washington, DC, 2002.

Book Chapters

E. Bellotti et al., "Simulation of Carrier Transport in Wide Band Gap Semiconductors," in *Topics in High Field Transport in Semiconductors*, K. F. Brennan and P. P. Ruden eds., World Scientific Publishing Company Inc., 2001.

J. B. Carruthers, "Wireless Infrared Communications," in *Encyclopedia of Telecommunications*, J. G. Proakis, ed., Wiley, New York, 2002.

P. W. Gross, **P. R. Kotiuga,** "Data Structures for Geometric and Topological Aspects of Finite Element Algorithms," in "Geometric Methods for Computational Electromagnetics," F. L. Teixeira, ed., in *Progress in Electromagnetics* Res., 32, J. A. Kong ed., EMW Publishing, Cambridge MA, pp. 151-169, 2001.

P. W. Gross, **P. R. Kotiuga,** "Finite Element-based Algorithms to Make Cuts for Magnetic Scalar Potentials: Topological Constraints and Computational Complexity," in "Geometric Methods for Computational Electromagnetics," F. L. Teixeira, ed., *Progress in Electromagnetics* Res., 32, J. A. Kong, ed., EMW Publishing, Cambridge MA, pp. 207-245, 2001.

M. Mendillo, F. Roesler, C. Gardner, and M. Sulzer, "The Application of Terrestrial Aeronomy Groundbased Instruments to Planetary Studies," in *Atmospheres in the Solar System: Comparative Aeronomy*, M. Mendillo, A. Nagy, H. eds., American Geophysical Union monograph #130, Washington, DC, pp. 329-337, 2002.

D.Doppalapudi and **T.D. Moustakas** "Epitaxial Growth and Structure of III- V Nitride Thin Films" in *Handbook of Thin Film Materials Vol 4,* H.S. Nalwa, ed., Academic Press, Chapter 2, 2002.

H.M. Ng and **T.D. Moustakas** "Intermetallic Compounds by Molecular Beam Epitaxy" in *Intermetallic Compounds: Principles and Practice Vol. 3* J.H. Westbrook and R.L. Fleischer Eds., John Wiley Ltd., N.Y , Chapter 37, 2002.

N. Martins, **S. R. Venkatesh,** and M. A. Dahleh, "Resource Allocation in Large-Scale Systems," in *Enterprise Information Systems*, Kluwer, 2001.

T. Toffoli, "Symbol Super Colliders," in *Collision Based Computing,* A. Adamatzy, ed., Springer, 2002, pp. 1-23. (Flagship Article)

E. Fredkin and **T. Toffoli,** "Design Principles for Achieving High-Performance Submicron Digital Technologies," in *Collision Based Computing,* A. Adamatzy, ed., Springer, pp. 27-46, 2002.

E. Fredkin and **T. Toffoli,** "Conservative Logic," in *Collision Based Computing,* A. Adamatzy, ed., Springer, pp. 47-81,

Journal Articles

Baldanzi, **E. Bellotti**, and G. Goano, "Optical Properties of III-Nitrides Ternary Compounds," *Stauts Solidi (b)*, 228(2), pp. 425-428, 2001.

V. Camarchia, **E. Bellotti**, M. Goano, and G. Ghione, "Physics Based Modeling of a Submicron GaN Permenable Base Transistor," *IEEE Electron Device Letters*, EDL23, N6, 2002.

E. Ghillino, C. Garetto, M. Goano, G. Ghione, **E. Bellotti**, and K. F. Brennan, "Simplex Algorithm for Band Structure Calculation of Noncubic Symmetry Semiconductors: Application to III-Nitrides Binaries and Alloys," *VLSI Design*, 13, pp. 63-68, 2001.

H. E. Nilsson, E. Ghillino, A. Martinez, U. Sannemo, **E. Bellotti**, and M. Goano, "Numerical Calculation of Hole Band-to-Band Tunneling in Wurtzite GaN and SiC," *J. Appl. Phys.* 90, pp. 2847, 2001.

M. Wraback, H. Shen, **E. Bellotti**, J. C. Carrano, C. J. Collins, J. C. Campbell, R. D. Dupuis, M. J. Schurman, and I. A. Ferguson, "Femtosecond Studies of High-Field Transient Electron Transport in GaN", *Stauts Solidi (b)*, 228(N2), pp. 585-588, 2001. (Invited)

A. C. Lee, C. D. O. Pickard, M. R. S. Keshtgar, S. G. Bown, G. M. Briggs, S. Lakhani, **I. J. Bigio,** and P. J. Ell, "Intra-Operative Assessment By Optical Biopsy for Sentinel Lymph Node Metastasis in Breast Cancer," *British Journal of Cancer* 85, pp. 27-28, 2001.

C. D. O. Pickard, **I. J. Bigio**, S. G. Bown, G. M. Briggs, A. C. Lee, P. M. Ripley, and S. Lakhani, "Optical Biopsy for the Di-

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E. L. Waldron, J. W. Graff, and **E. F. Schubert,** "Improved Mobilities and Resistivities in Modulation Doped p-type AlGaN/GaN Superlattices," Fourth International Conference on Nitride Semiconductors, (Denver, July16-20, 2001).

E. L. Waldron, J. W. Graff, and **E. F. Schubert,** "Improved Mobilities in Modulation Doped p-type AlGaN / GaN Superlattices," Fall meeting of the Materials Research Society (MRS) (Boston, November 26-30 2001).

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5.3 Research Labs

Applied Electromagnetics Laboratory

This laboratory is devoted to problems in experimental electromagnetics with a primary focus on industrial electrostatics, sensors, and micro-electromechanical systems (MEMS). Current projects include a study of spark energies from insulating surfaces, studies of the electrostatic properties of insulating materials, development of a circular electrode array plasma-torch system, and charge-control systems for MEMS actuators. *Horenstein*

Biological Information Processing Laboratory

Work carried out in this laboratory is principally concerned with the wavelet analysis of biological signals. Particular examples include the analysis of fractal behavior of neural spike trains in hearing and vision; the analysis of the human heart rate and the differentiation of pathological from normal heart rhythms; and information transmission in biological sensory systems. *Teich*

Biomedical Optics and Biophotonics Laboratory

The core theme of biomedical optics/photonics is minimally invasive optical diagnostics and therapeutics. This laboratory focuses on the development of optics-based technologies for clinical applications and biomedical research. Current research topic areas include:

- Advanced spectroscopic technologies for tissue diagnosis
- Noninvasive measurement of drug concentrations in tissue
- Interstitial laser thermotherapy and photodynamic therapy
- Computational methods for modeling optical transport in tissue
- Optical interferometry for imaging nerve activation

Bigio

Broadband Wireless Communications Laboratory

This laboratory supports research projects on the design, theory, and prototyping of broadband wireless communication systems. The major focus is on the use of infrared light as the transmission medium for high-data-rate indoor wireless local-area networks. The laboratory includes facilities for the fabrication and testing of experimental prototypes as well as computing resources for system design and analysis. *Carruthers*

Computer Architecture and Automated Design Laboratory

Work focuses on experimental computer architecture, particularly on the application of emerging technology to computationally intensive application. Projects include developing design tools for application specific coprocessors, designing MPP router switches, vision computers, and the application of configurable computing to bioinformatics. *Herbordt*

Functorial Electromagnetics Laboratory

The Functorial Electromagnetic Analysis Lab considers the difficulties encountered in the finite element analysis of three-dimensional electromagnetic fields that cannot be anticipated through experience with two-dimensional simulations.The lab has focussed its efforts in the development of Whitney form techniques, homology calculations, algorithms for total magnetic scalar potentials in multiply-connected regions, helicity functional techniques, and data structures based on semi-simplicial objects. Torsion invariants of complexes and rational homotopy theory are currently being exploited in the context of direct and inverse three-dimensional problems such as impedance tomography and magnetic field synthesis. *Kotiuga*

Imaging Science Laboratory (ISL)

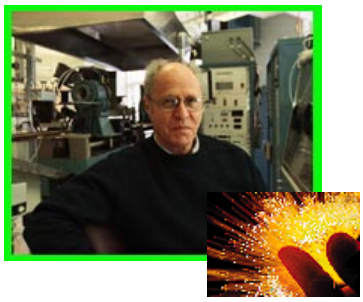
Affiliated with the Boston University Center for Space Physics, the ISL applies state-of-the-art optical imaging technology to the study of the Earth, Moon, planets and comets. Activities include equipment design and fabrication, field campaigns to observing sites world-wide, and digital signal processing. *Mendillo*

Integrated DSP Environments and Architectures Laboratory (IDEA)

This laboratory conducts research in digital signal processing and its integration into application systems. Issues of interest include DSP algorithms, knowledge-based systems, software architectures for integrated DSP, software environments for the development of integrated DSP systems, integration of numeric and symbolic processing, statistical signal processing, and multidimensional signal processing. This research is carried out in the context of many applications, ranging from the interpretation of musical signals to the analysis of spread spectrum signals and the knowledge-based decomposition of electromyographic (EMG) signals. *Nawab*

Lightwave Technology Laboratory

This lab is one of the few university laboratories capable of designing, fabricating, and characterizing silica optical fibers. The research activities of this laboratory focus on new



processing techniques for optical fibers and planar waveguides, high power optical fiber lasers, and a variety of optical fiber sensors. The components of this facility consist of a fabrication laboratory with three glass lathes including a new state-of-the-art Nextrom MCVD system, an optical laboratory with numerous pump lasers for fiber lasers, five isolation tables, and an 8m optical fiber draw tower, newly outfitted with Nextrom widing and control equipment. In addition, there is a CVD laboratory for studies of thin films. *Morse*

Magnetic and Optical Devices Laboratory (MODL)

Properties and applications of magnetic and magneto-optical materials are studied using optical, electrical, and computational methods in the MODL. Recent work has included micromagnetics modeling, using supercomputer facilities, for commercial read/write heads, GMR memory devices, and nana-structured magnetic materials. Kerr and Faraday effect imaging are used to measure the structure and dynamics of magnetic thin films and hard magnetic wires. *Ruane, Humphrey*

Multi-Dimensional Signal Processing (MDSP) Laboratory

The MDSP Lab conducts research in the areas of multidimensional and multiresolution signal and image processing and estimation, and geometric-based estimation. The applications that motivate this research include, but are not limited to, problems arising in automatic target detection and recognition, geophysical inverse problems (such as finding oil and analyzing the atmosphere), and medical estimation problems (such as tomography and MRI). The general goal is to develop efficient methods for the extraction of information from diverse data sources in the presence of uncertainty. The lab's approach is based on the development of statistical models for both observations, prior knowledge, and the subsequent use of these models for optimal or near-optimal processing. *Karl*

Multimedia Communications Laboratory

The focus of this laboratory is the enabling technology for multimedia applications. Research includes investigation of distributed modes of group interaction; communication systems for continuous media; conceptual and physical database organizations; indexing schemes to support content specific queries and fast browsing; user interfaces; and applications. The laboratory is equipped with tools for real-time digital video capture, storage, conversion and playback. *Little*

Near-Field Spectroscopy Laboratory

Near-Field Microscopy/Spectroscopy is being developed as a new technique to extend the resolution of optical imaging beyond the diffraction limit, bringing a new level of optical characterization. Near-field optical microscopy has application to many areas of materials and device development, and this laboratory will serve as a resource for researchers throughout Boston University as well as industry partners. Emphasis is currently placed on the optical characterization of semiconductor devices and biological materials. In particular, this includes imaging laser diode emission and material-defect and compositional analysis for semiconductor applications. *Goldberg, Ünlü*

Laboratory of Networking and Information Systems

This lab is involved in providing novel perspectives on modern networking issues, including scalability, heterogeneity, and performance. The lab is equipped with sophisticated hardware and software and promotes research into the fields of network synchronization, mobile computing, Internet traffic engineering, distributed Web caching, and coding theoretic approaches to real-time information reconciliation.
Starobinski, Trachtenberg

Picosecond Spectroscopy Laboratory (PSL)

This state-of-the-art optical characterization facility was recently established. The Picosecond Spectroscopy Laboratory provides excitation sources, spectrometers, and microwave electronic test equipment for the investigation of the linear and non-linear optical properties of materials and devices. The research emphasis in this laboratory is on high-speed photodetectors, particularly time-resolved characterization of photodiodes. *Ünlü*

Quantum Imaging Laboratory

Research in the Quantum Imaging Laboratory focuses on photonic imaging systems that make use of the special properties of nonclassical light. Experiments are conducted on nonlinear optical parametric down-conversion; quantum coherence; quantum imaging; quantum interferometry and microscopy; and quantum communications and cryptography. *Saleh, Sergienko, Teich*

Radio Communications and Plasma Research Laboratories

Field experiments are conducted in this lab using ground-based facilities and spacecraft-borne instruments to investigate radio-wave propagation and interactions with ionospheric plasmas,

with applications to establishing artificial radio communication paths. Laboratory experiments with a large, toroidal plasma device are also conducted to study the microwave interactions with magnetoplasmas, simulating and cross-checking the results obtained in the field experiments. *Lee*

Reliable Computing Laboratory

Members of the Reliable Computing Laboratory conduct research on a broad variety of topics, including the design of computer chips; efficient hardware testing at the chip, board, and system levels; functional software testing; efficient signal processing algorithms; coding and decoding; fault-tolerant message routing for multiprocessor systems; and the design of reliable computer networks. *Karpovsky, Levitin, Roziner*

Semiconductor Device Research Laboratory

This laboratory fabricates prototypes of next-generation optoelectronic devices such as semiconductor lasers and light-emitting diodes. Activities include photolithographic fabrication, optical and electrical characterization, and modeling of device and systems properties. *Schubert*

Software Engineering Laboratory (SEL)

An instructional and research lab, the Software Engineering Laboratory (SEL) supports courses and research on the economical design of reliable software for large-scale and embedded computer-based systems. The lab is comprised of more than twenty-five Silicon Graphics and Gateway 2000 networked workstations, plus four Motorola embedded computer development systems. The SEL provides students with state-of-the-art development tools for the design, implementation, and testing of significant software systems. *Brackett*

Visual Information Processing (VIP) Laboratory

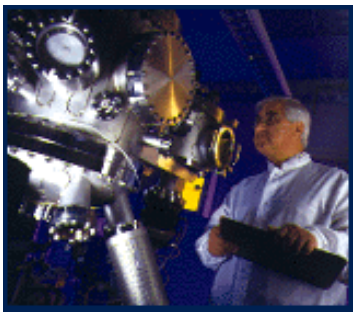
The VIP Laboratory provides computational and visualization infrastructure for research in the area of visual information processing. The particular topics of interest are: manipulation, compression, transmission and retrieval of visual information, whether in the form of still images, video sequences, or multimedia data. In addition to standard monoscopic (2-D) images, also stereoscopic and multiscopic (3-D) images are studied. The primary application of this research is in the next-generation multimedia communications: life-like (3-D), efficient (low bit rate), reliable (error-resilient), and flexible (object-based). The VIP Laboratory is equipped with a network of state-of-the-art workstations to serve computational needs, while its visualization infrastructure includes 2-D and 3-D digital cameras and capture systems, as well as 3-D displays (shuttered and 9-view automultiscopic "Synthagram"). *Konrad*

VLSI and Neural Networks Systems (VNNS) Laboratory

The VNNS group designs, builds, and tests innovative architectures that span a wide variety of VLSI applications in electrical and biological fields. Chips designed using digital, analog, and subthreshold methodologies are realized using CMOS BiCMOS and Bipolar technologies. Applications include neural-net image processing, integrated photonic devices and parallel photonic testing, automatic partial-valued dynamic logic synthesis, single-chip large-molecule and DNA analyzers, and neural tissue interface chips. The group is equipped with a full suite of design tools and testing instrumentation for analog and digital systems. *Hubbard*

Wide Band Gap Semiconductors Laboratory

In this laboratory, we investigate the growth, optoelectronic properties and device applications of III-Nitride semiconductors. The materials are grown by Molecular Beam Epitaxy (MBE), Vapor Phase Epitaxy (VPE) and Ion-Beam Cluster Deposition (IBCD). Device applications include blue-UV VCSELs, optical modulators, UV solar-blind detectors, transistors and MEMS. The laboratory is equipped with clean room facilities for materials growth (MBE, VPE and IBCD) and device fabrication (electron beam evaporator and sputtering units) as well as facilities for material and device characterization. This group collaborates closely with Professor Charles Eddy in the area of device processing and with Professor Enrico Bellotti in the area of device modeling. *Moustakas*



5.4 Centers and Interdisciplinary Activities

Center for Computational Science (CCS)

http://satchmo.bu.edu/

The CCS at Boston University was chartered in 1989 as an interdisciplinary focal point for computational science research and education. In collaboration with the Office of Information Technology's Scientific Computing and Visualization Group (SCV), CCS has made leading edge computational resources available to researchers and students on a university wide basis since the installation of its first massively parallel supercomputer in 1988. The recent installation of the SGI/Cray Origin2000 represents the fourth generation parallel supercomputing technology at the University. Facilities also include an SGI Power Challenge Array, advanced graphics workstations, virtual reality stations and very high speed networking.

The University's support of computational research has been extended to institutions throughout New England by means of the NSF funded MARINER (*http://mariner.bu.edu/*) project, a collaboration between CCS and SCV. MARINER offers education and training programs, access to state-of-the-art computing facilities and opportunities for pilot projects, Internet connectivity and industrial partnerships.

The Center is a cooperative venture in which associated members come from a variety of disciplines in the academic and industrial communities to develop and take advantage of leading-edge computer and communications technologies. Under the auspices of MARINER, CCS takes its place as a leader in developing computational applications in collaboration with regional schools and companies.

Building on MARINER, the University is extending its programs on a national scale as a partner in the National Computational Science Alliance, one of two national Partnerships for Advanced Computational Infrastructure supported by the NSF.

Center for Space Physics

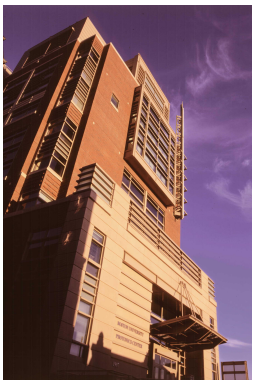
http://www.bu.edu/csp/

The Center for Space Physics provides a focus for research and graduate training in space physics. It is a multidisciplinary center within the Graduate School of Arts and Sciences that includes faculty from the College of Engineering and the College of Arts and Sciences.

The mission of the Center is to promote and foster space physics research and to provide a central base for that research and for the teaching of space physics, especially at the graduate level. The Center seeks to fulfill this mission by creating an intellectual atmosphere conducive to research and to the exchange and exploration of new ideas. The Center organizes a seminar series in space physics as well as internal research discussion groups, and often hosts visits of scholars from the United States and abroad. Although the Center itself offers no degree program, graduate education is a major component of Center activities. Graduate students from programs in Astronomy, Applied Physics, and Engineering conduct their thesis research at the Center. The Center provides a formal link between research groups in the Colleges of Engineering and Arts and Sciences, allowing them to co-locate research students and post-doctoral associates to allow greater interaction to everyone's benefit. The Center also provides administrative support for research projects, particularly in the areas of grant management and proposal development.

Photonics Center

http://www.bu.edu/photonics



To help industry bridge the gap between basic research and practical application, Boston University launched the Photonics Center in 1994 with $29 million in seed funding from the federal government. The Center is now forging true business partnerships in which companies draw on the University's exceptional expertise and resources in engineering, science, medicine, and management to build actual product prototypes and spawn a growing stream of new companies.

The Photonics Center at Boston University is a bold new model for university-industry collaboration. It has been established to work directly with investors and industrial partners to turn emerging concepts in photonics technology into commercial products. The Center is staffed and equipped to help industry partners reduce the technical and financial risk involved in developing new ideas, refining them in the laboratory, building working prototypes, and starting up companies. To date the Center has forged joint ventures with nearly a dozen companies to develop new products in data storage, environmental monitoring, opto-electronics, and biotechnology.

In 1997, the University completed the nine-story, 235,000 square-foot Photonics Building to house this ambitious

initiative. The $80 million facility includes a full complement of state-of-the-art laboratories as well as meeting rooms, lecture halls, and an entire floor devoted to incubator space for start-up companies that complements its existing incubator at 1106 Commonwealth Avenue. Faculty affiliated with the Center have in-depth expertise in all aspects of photonics technology, including the core areas of opto-electronics, photonic materials, data storage, imaging systems, medical applications, and sensors.

Resources available to industry partners, government, faculty, and students through the Photonics Center support development and testing of ideas and products. These resources include several research and development laboratories: Scanning Infrared Near-Field Microscopy Laboratory, Optoelectronic Device Characterization Laboratory, Femtosecond Laser Facility, Photochemical Processes Laboratory, Photonic Systems Engineering Laboratory, Liquid Crystal Display Laboratory, Quantum Imaging Laboratory, Precision Optics Laboratory, Optoelectronic Materials Laboratory, Precison Measurement Laboratory, Optoelectronic Processing Facility, Laser Measurement and Fiber Optic Sensors Laboratory, Magnetic and Optical Devices Laboratory, Near-Field Scanning Optical Microscopy Laboratory, Picosecond Spectroscopy Laboratory, and the Advanced Electronic Materials and Devices Processing Research Laboratory.

Center for Subsurface Sensing and Imaging Systems (CenSSIS)

http://www.censsis.neu.edu/

The Center for Subsurface Sensing and Imaging Systems (CenSSIS) is a National Science Foundation Engineering Research Center (ERC) established in 2000. It seeks to revolutionize the ability to detect and image objects that lie underground or underwater, or are embedded within cells, inside the human body, or within manmade structures. CenSSIS is a collaborative effort of 4 academic institutions: Northeastern University, Boston University, Rensselaer Polytechnic Institute, and the University of Puerto Rico at Mayagüez; and 4 strategic affiliates: Massachusetts General Hospital, Brigham and Women's Hospital, Lawrence Livermore National Laboratory, and the Woods Hole Oceanographic Institution. Together, the CenSSIS partnership works with industrial partners who provide their insight into research challenges.

The Center's primary focus is on detecting, locating, and identifying objects obscured beneath the covering media, such as underground plumes, tumors under the skin or developmental defects in an embryo. Utilizing electromagnetic, photonic, or acoustic probes, CenSSIS will engage biomedical and environmental problems, developing techniques for sensing subsurface conditions. Projects integrate new methods of subsurface sensing and modeling, physics-based signal processing and image-understanding algorithms, and image and data information management methods. Research topics being addressed include: humanitarian de-mining, multilayer hyperspectral oceanography, 3-D subretinal visualization, nonlinear ultrasound medical imaging, subcellular biological imaging, electrical impedance tomography, acoustic diffraction tomography, and multi-sensor civil infrastructure assessment.

Overall, the CenSSIS program is a vehicle enabling substantial leverage of industrial investments because of the substantial level of funding available for basic research. In addition to research, the Center has established programs for education, industry collaboration, and technology transfer.

5.5 Grants and Contracts

The table on the next three pages delineates the new grants awarded over the 2001/02 fiscal year. The funding level for new grants, where an ECE faculty member is the Principal Investigator (PI), is approximately $5,208k. ECE faculty members were also Co-PI's on grants with PI's from other departments, as noted in the table. Their share of the funding for new grants awarded is approximately $769k. The total of new grants is therefore approximately $5,977k. In addition, ECE faculty have received gifts and other awards totaling $39k, as noted in Section 5.7.

New Grants with ECE Principal Investigators

Faculty	*Title of Award*	*Source*	*Begin*	*End*	*Amount*
Bellotti, Enrico	Investigation of the Breakdown Mechanisms in HEMTs (Subcontract via Univ. of Michigan/BAE Systems, Inc.)	DOD/Army	10/01/01	09/30/02	$49,250
Bellotti, Enrico **Moustakas,** Theodore (Co-PI)	GaN-based Permeable Base Transistors (PBT) Fabrication and Evaluation (Subcontract via BAE Systems, Inc.)	DOD/Army	01/30/02	12/31/02	$12,500 (PI) $12,500 (Co-PI)
Brackett, John	Framework for Testing Real-Time Object-Oriented Systems	The Charles Stark Draper Laboratory, Inc.	09/01/01	06/30/02	$40,000
Castanon, David	Center for Subsurface Sensing and Imaging Systems (CenSSIS) -- Research Thrust 2 (Subcontract via Northeastern Univ.)	NSF	07/01/00	08/31/02	$111,045
Castanon, David	Cooperative Control in Adversarial Environments	DOD/Air Force	12/01/01	11/30/02	$164,439
Eddy, Charles **Ludwig,** Karl (Co-PI)	Development of a System for Studies of Surface Structure During Plasma Processing and Student Training	NSF	08/01/01	07/31/03	$42,000 (PI) $42,000 (Co-PI)
Eddy, Charles	Processing of High Performance UV Detector Arrays (Subcontract via BAE Systems)	DOD/DARPA	06/01/00	05/31/02	$35,000
Eddy, Charles	Improved SIC Material for High Power Electronics (Subcontract via Phoenix Innovation, Inc.)	DOD/Navy	07/01/01	01/01/02	$19,000
Hubbard, Allyn	A Biomimetic Smart Acoustic Sensor (in conjunction with Hearing Research Center)	NSF	06/08/00	12/31/02	$685,000
Karl, W. Clement	Anatomic Morphologic Analysis of MR Brain Images (Subcontract via Mass. General Hospital)	HHS/NIH/NINDS	09/01/01	08/31/02	$79,881
Morse, Theodore	ONR HBCU Future Engineering Faculty Fellowship (R. Wynne) (Subcontract via North Carolina Agricultural and Technical State University)	DOD/Navy	07/01/01	12/31/01	$13,250
Morse, Theodore	Photonics Technology Development and Insertion/Task 1: Fiber Laser Technology (in conjunction with Photonics Center)	DOD/Army	09/01/01	08/31/02	$297,055

Faculty	*Title of Award*	*Source*	*Begin*	*End*	*Amount*
Morse, Theodore	Advances in Fiber Lasers (in conjunction with Photonics Center)	DOD/Air Force	10/01/01	12/31/01	$57,500
Morse, Theodore	ONR HBCU Future Engineering Faculty Fellowship (R. Wynne) (Subcontract via North Carolina Agricultural and Technical State University)	DOD/Navy	07/01/01	12/31/02	$13,750
Morse, Theodore	Research in Fiber Lasers	AFOSR	03/01/02	10/31/02	$110,000
Moustakas, Theodore	MEMS Sensor (Subcontract via Boston Micro Systems, Inc.)	NSF	07/01/01	12/31/01	$25,000
Moustakas, Theodore	Novel Heterojunction Diodes for High Power Electronics (Subcontract via Viatronix, Inc.)	DOD/Navy	07/01/01	12/31/01	$25,000
Moustakas, Theodore	Investigation of Piezoelectric III-Nitride Films Grown on SiC Micromachined Devices	Boston MicroSystems, Inc.	10/16/01	04/19/01	$25,000
Moustakas, Theodore	Investigation of Atomic Long-Range Order in AlGaN Films (modification No. P00006 and P00007)	DOD/Navy	12/01/00	09/30/02	$93,767
Moustakas, Theodore	Investigation of Atomic Long-Range Order in AlGaN Films (modification No. P00008)	DOD/Navy	12/01/00	09/30/02	$29,095
Moustakas, Theodore	Photonics Technology Development and Insertion/Task 6: Gallim Nitride Vertical Cavity Surface-Emitting Lasers (GaN VCSEL) Technology (in conjunction with Photonics Center)	DOD/Army	03/01/02	02/28/03	$149,305
Moustakas, Theodore	Novel High Power, Wide Dynamic Range HBT for Use in Analog/Digital Converters (Subcontract via Viatronix, Inc.)	DOD/DARPA	05/01/02	12/01/02	$30,000.00
Moustakas, Theodore	Novel Heterojunction Diodes for High Power Electronics (Subcontract via Viatronix, Inc.)	DOD/Airforce	07/01/02	06/30/03	$30,000.00
Oliver, William	Upper Atmoshpere/Ionosphere Studies with the MU Radar (in conjuction with Center for Space Physics)	NSF	08/01/01	07/31/03	$105,488
Ruane, Michael	Center for Subsurface Sensing and Imaging Systems (CenSSIS) -- Education Program (Subcontract via Northeastern Univ.)	NSF	07/01/00	08/31/02	$63,293
Saleh, Bahaa	Center for Subsurface Sensing and Imaging Systems (CenSSIS) -- Research Thrust 1-Photonics (Subcontract via Northeastern Univ.)	NSF	07/01/00	08/31/02	$111,740
Saleh, Bahaa **Teich,** Malvin (Co-PI) **Sergienko,** Alexander (Co-PI)	REU Supplement: Imaging and Optical Information Processing with Entangled Photons	NSF	05/01/01	04/30/02	$2,000 (PI) $2,000 (Co-PI) $2,000 (Co-PI)

Faculty	*Title of Award*	*Source*	*Begin*	*End*	*Amount*
Saleh, Bahaa **Teich,** Malvin (Co-PI) **Sergienko,** Alexander (Co-PI)	Imaging and Optical Information Processing with Entangled Photons	NSF	05/01/01	04/30/02	$33,334 (PI) $33,333 (Co-PI) $33,333 (Co-PI)
Saleh, Bahaa (PI) **Teich,** Malvin (Co-PI) **Sergienko,** Alexander (Co-PI)	Modeling and Optimization of Ultrafast, Low-Noise Avalanching Photodiodes for Optical Communicatoins (Subcontract via Univ. of New Mexico)	NSF	08/15/01	08/31/04	$45,001 (PI) $45,000 (Co-PI) $45,000 (Co-PI)
Saleh, Bahaa	Scanning Acoustic Microscope for Classification of Vulberable Plaque--Research Thrust 1-Acoustics	Northeastern University/ CenSSIS	01/01/02	07/31/02	$34,555
Saligrama, Venkatesh	Intelligent Sensor and Relay Platforms (InSAR) (Young Investigator Program)	DOD/Navy	05/01/02	04/30/05	$55,052
Sergienko, Alexander **Saleh**, Bahaa (Co-PI) **Teich**, Malvin (Co-PI)	Ultrafast Quantum Optics (in conjunction with Photonics Center) (Subcontract via BBNT Solutions LLC)	DOD/DARPA	08/10/01	07/31/03	$76,000 (PI) $76,000 (Co-PI) $76,000 (Co-PI)
Sergienko, Alexander **Saleh**, Bahaa (Co-PI) **Teich**, Malvin (Co-PI)	Quantum Crystallography with Polarized Entangled Photons (T. Yarnall) (Subcontract via MIT/Lincoln Laboratory)	DOD/Air Force	09/01/01	08/31/03	$883 (PI) $883 (Co-PI) $883 (Co-PI)
Sergienko, Alexander **Saleh**, Bahaa (Co-PI) **Teich**, Malvin (Co-PI)	Ultrafast Quantum Optics (in conjunction with Photonics Center) (Subcontract via BBNT Solutions LLC)	DOD/DARPA	05/01/02	04/30/05	$284,513 (PI) $284,512 (Co-PI) $284,512 (Co-PI)
Schubert, Fred	Improved Nitride-Based NPN HBTs (Subcontract via Univ. of New Mexico)	Dept. of Defense/Navy	05/01/02	10/31/02	$75,700.00
Swan, Ana **Goldberg**, Bennett (Co-PI) **Unlu**, M. Selim (Co-PI) **Karl,** W. Clement (Co-PI)	Nanometer Resolution with Spectral Self-Interference Fluorescence Microscopy	NSF	04/01/02	03/31/04	$77,763 (PI) $77,762 (Co-PI) $77,762 (Co-PI) $77,762 (Co-PI)
Swan, Ana	Photonics Technology Development and Insertion/Task 15: Integrated Optic Telecommunication Devices-Characterization and Gabrication (in conjunction with Photonics Center)	DOD/Army	03/01/02	02/28/03	$95,288
Teich, Malvin	REU Supplement: Entangled-Photon Absorption and Spectroscopy	NSF	06/01/01	05/31/02	$5,000
Teich, Malvin **Saleh,** Bahaa (Co-PI)	XYZ on a Chip: Development and Fabrication of Three-Dimensional Microdevices (Subcontract via Boston College)	NSF	09/01/01	08/31/03	$202,445 (PI) $202,445 (Co-PI)
Toffoli, Tommaso	Programmable Matter Methods (in conjunction with Center for Computational Science)	Dept. of Energy	09/01/01	08/31/02	$113,347
Trachtenberg, Ari	CAREER: Practical Data Synchonization - Minimizing Communication	NSF	02/01/02	01/31/04	$153,883

Faculty	*Title of Award*	*Source*	*Begin*	*End*	*Amount*
Unlu, Selim **Goldberg**, Bennett (Co-PI) **Lutchen**, Kenneth (Co-PI)	Development and Study of Hyper-Polarized Noble Gas System for Magnetic Resonance Imaging (in conjunction with Photonics Center) (Subcontract via Brigham & Women's Hospital)	NSF	09/01/01	08/31/02	$24,923 (PI) $24,923 (Co-PI) $24,922 (Co-PI)
Unlu, Selim **Goldberg**, Bennett (Co-PI)	Spectral Self-Interference Microscopy	Corning, Inc.	01/01/02	09/30/02	$11,000 (PI) $11,000 (Co-PI)
Unlu, Selim	U.S. Switzerland Cooperative Research: Monolithic High-speed Photoreceivers, Wavelength, and Polarization Sensors on Si	NSF	01/01/02	12/31/04	$32,760
Unlu, Selim	Photonics Technology Development and Insertion/Task 2: Optical Communication and Polarization Sensing (in conjunction with Photonics Center)	DOE	08/31/01	08/30/03	$154,500
Total Awards					**$5,208,337**

New Grants with ECE Co-PI's

Faculty	*Title of Award*	*Source*	*Begin*	*End*	*Amount*
Giles, Roscoe (Center for Computational Science)	ITR/EWF: New Approaches to Human Capital Development Through Information Technology Research (Subcontract via Portland State University)	NSF	09/15/01	09/14/02	$107,309
Giles, Roscoe **Rebbi,** Claudio **Porter,** John **Bresnahan.** Glenn	PACI: Education, Outreach and Training (EOT) (Subcontract via Univ. of Illinois) ($220.000)	NSF	10/01/01	09/30/02	$55,000.00
Ludwig, Karl **Eddy,** Charles **Moustakas,** Theodore	MRI: Development of Surface Scattering Spectrometer for Real-Time X-Ray Studies of Growth and Processing ($120.000)	NSF	08/01/01	07/31/02	$80,000
Mountain, David **Hubbard,** Allyn	Models of Whale Auditory Function (in conjunction with Hearing Research Center ($100.000)	DOD/Navy	09/01/00	09/30/03	$30,000
Mountain, David **Hubbard,** Allyn	Models of Whale Auditory Function (in conjunction with Hearing Research Center ($237.736)	DOD/Navy	09/01/00	09/30/03	$71,320
Rebbi, Claudio **Bresnahan,** Glenn **Giles,** Roscoe **Porter,** John	Acquisition of a Power4-Based IBM SP and PC-Based Scalable Display Wall for Multidisciplinary Computational Science Research ($938.316)	NSF	10/01/01	09/30/04	$234,579
Rebbi, Claudio **Bresnahan,** Glenn **Giles,** Roscoe **Porter,** John	PACI: Mariner, A mid-Level Alliance Resource in the Northeast Region (Subcontract via University of Illinois) ($390.000)	NSF	10/01/01	09/30/02	$97,500.00
DeLuca, Carlo **Nawab,** Hamid	Hrnessing MotoNeuron Activity from Lab to Clinic (in conjunction with Neuromuscular Research Center ($604.881)	NIH	06/0101	05/31/02	$92,809
SUBTOTAL	Grants with ECE Co-PI's				$768,517
GRAND TOTAL					**$5,976,854**

Continuing Grants and Contracts

Faculty	*Title of Award*	*Source*	*Begin*	*End*
Bellotti, Eddy, Moustakas, Carruthers	Feasibility Study of GaN-Based Permeable Base Transistors (PBTs)	BAE Systems	05/31/01	12/01/01
Castanon	CAREER: High Bit Rate Wireless Infrared Communications	N.S.F.	04/01/99	03/31/03
Castanon	MURI95	DOD/Air Force	12/01/98	03/31/02
Castanon	Sensor Management and Information	DOD/Army	12/01/99	11/31/01
Karl	Fusion for Detection, Localization and Classification of Mines (Subcontract via Northeastern Univ.)			
Eddy	Fabrication of Ultraviolet P-I-N GaN and AIGaN Photodiode Detector Arrays (Subcontract via Avyd Devices, Inc.)	DOE	02/15/01	01/31/03
Eddy	Processing of Advanced Recessed-Gate GaN HEMT Tech.	DOD/Navy	02/09/01	09/30/01
Hubbard	A MURI Center for Automated Vision and Sensing Systems	ONR/ERA	06/01/98	08/31/01
Karpovsky	REU Supplement: Software Implemented Fault Tolerance in Multiprocessors	N.S.F.	01/01/97	07/31/01
Karpovsky	Software Implemented Fault Tolerance in Multiprocessors	N.S.F.	08/01/96	07/31/01
Little	Rapid Task-Based Self-Organization in Distributed Ad-hoc Spaces	N.S.F	09/01/00	08/31/03
Morse	Miniature Photoacoustic Detector for Trace Chemical and Biological Warfare Agents (in conjunction with Photonics Center)	ONR	09/01/99	10/01/01
Morse	NSF STTR Phase II: A Fiber-Optic Probe for In-situ Measurement of Thin Film Deposition (in conjunction with Photonics Center) (Subcontract via Ion Optics, Inc.)	N.S.F.	09/01/99	09/30/01
Moustakas	III-V nitride UV detector arrays fabricated by combining HVPE lateral epitaxial overgrowth and MBE methods	ONR/ERA	01/01/99	12/31/01
Moustakas	GCIB GaN Growth	Epion Corp	08/05/00	05/05/02
Moustakas	Optoelectronic neural system	Astralux, inc.	03/06/01	08/31/01
Moustakas	Integrated device coolong based on hot electron emission	Astralux, inc.	03/06/01	08/31/01
Nawab	MRI: acquisition of computer facilities to support an interdisciplinary multidata signal and image processing laboratory	N.S.F.	09/01/98	08/31/01
Perreault	Communication reduction study	P&E Microcomputer Systems	01/01/01	12/31/01
Saleh	Quantum Remote Sensing	Veridian Systems	02/05/01	10/31/01
Schubert	Enhancement of Deep Acceptor Activation in Semiconductors by Superlattice Doping	ONR/ERA	12/01/98	12/30/01

Faculty	*Title of Award*	*Source*	*Begin*	*End*
Schubert	Novel Ohmic Contact Technology	N.S.F.	09/01/00	08/31/03
Sergienko	CAREER: Quantum cryptography with entangled photons	N.S.F.	02/15/99	01/31/03
Sergienko, Teich, Saleh	Quantum Ellipsometry	N.S.F.	10/01/00	09/30/01
Teich, Saleh, Sergienko	Entangled-Photon Absorption and Spectroscopy	N.S.F.	06/01/99	05/31/02
Teich, Saleh, Sergienko	Entangled-photon microscopy	Acarl Zeiss Jena Gmbh	07/01/00	12/31/01
Teich, Saleh	Functional Imaging of Synapses by Entangled-Photon Microscopy	The David and Lucile Packard Foundation	08/01/99	08/31/04
Unlu	CAREER: Development in Innovative Optoelectronic Devices and Optical Characterization Techniques	N.S.F.	09/01/97	08/31/01
Unlu	US-Turkey cooperative research: high performance photodetectors for longhaul optical communications			
Unlu	REU supplement: US-Turkey cooperative research: high performance resonant cavity enhanced photodetectors and applications			
Unlu	PRIDE: photonics research in interdisciplinary education -- participant support costs			
Unlu	Photonics Research in Interdisciplinary Education--REU Suppliment			
Unlu	Monolithically Integrated Thermoelectric Coolers for Mid-IR Lasers/High Resolution Thermal Imaging			

Gifts and Other Awards

The following table delineates gifts and other awards received during 2001/2002.

Humphrey, Floyd	Massachusetts Institute of Technology	$14,466
Morse, Theodore	Hope Technologies, Inc.	$15,000
Morse, Theodore	Intelcore Technologies, Inc.	$10,000
Total Awards		**$39,466**

6. Outlook

The last decade has witnessed the maturation of the ECE department from a primarily undergraduate program to a more balanced department with high quality instruction, a substantial research program, and an increasingly distinguished faculty. Key statistics of enrollment, degrees awarded, faculty size, and grant funding in the last 10 years are exhibited in the following tables and charts.

6.1 Enrollment

Fall enrollments in the BS, MS, and Ph.D. programs are listed in Table 6-1 and Chart 6-1. Important undergraduate trends in ECE have tended to mirror national patterns. These include:

- A demographic decline in undergraduate enrollment occurred mid-decade, followed by an increase and subsequent stabilization resulting from college restriction on enrollment, which was implemented to attain a higher quality student body.
- Enrollment shifted from EE to CSE, such that 64% of students now pursue CSE (see Chart 6-2).

	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01
BS	376	329	328	344	361	399	398	410	407	406	405
MS	247	201	171	135	103	68	70	83	80	67	54
Ph.D.	44	49	50	55	64	78	83	80	72	83	68
Total	667	579	549	534	528	545	551	573	559	556	527

Table 6-1: Enrollment

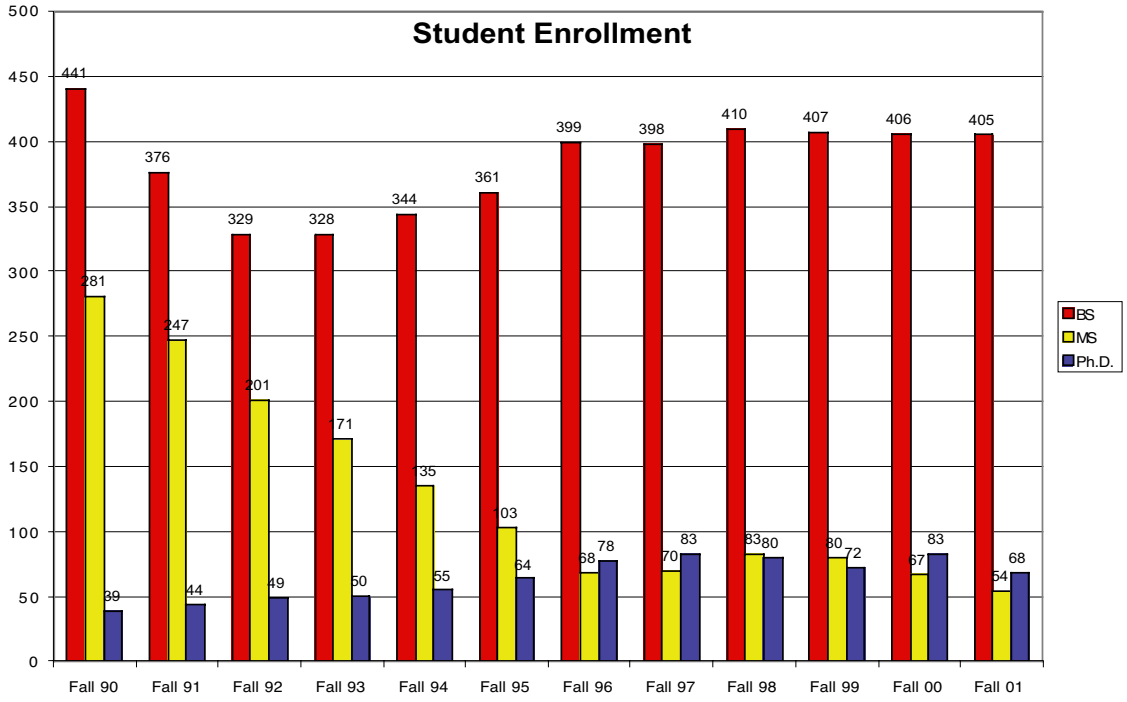


Chart 6-1: Undergraduate and Graduate Student Enrollment

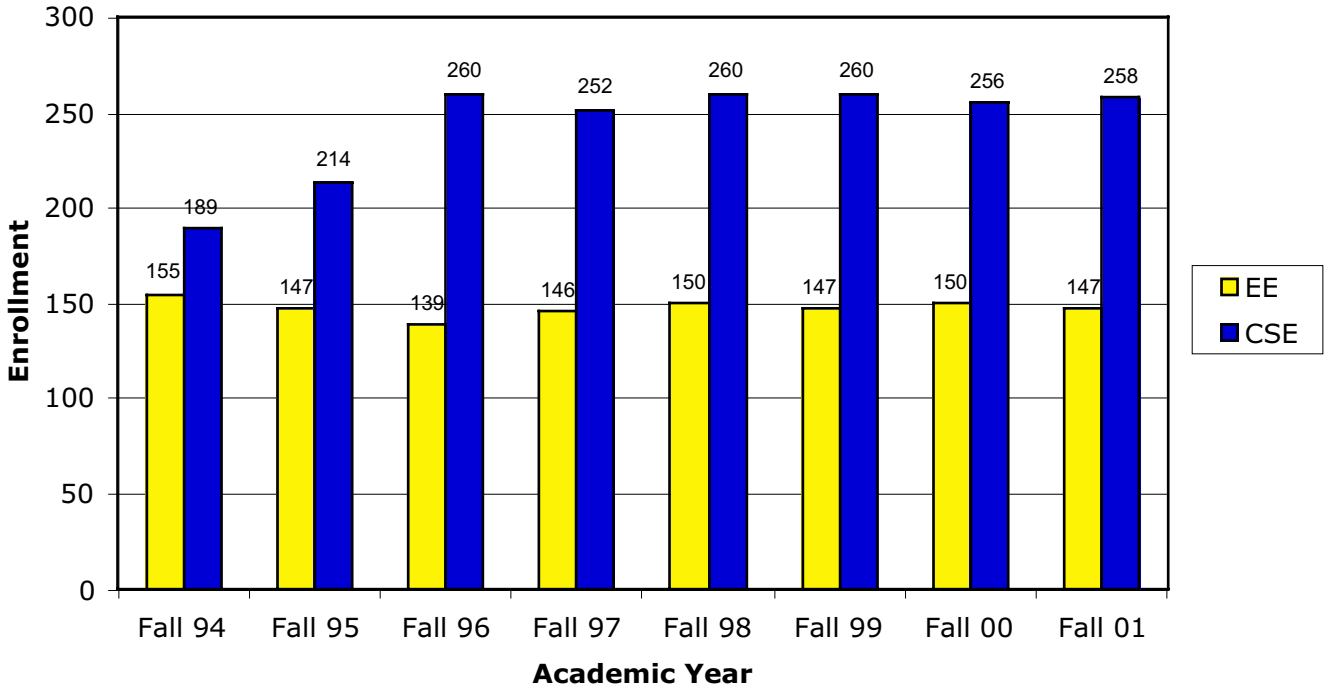


Chart 6-2: EE and CSE Enrollment in BS Program

At the graduate level, the emphasis has shifted from professional MS-oriented students to Ph.D. students:

- MS degree enrollments have been steady over the past five years, but remain much lower when compared to the 1990 to 1994 period, due to the demise of the Corporate Classroom program.
- Ph.D. enrollment has risen, along with the number of applications, but domestic candidates remain difficult to recruit.
- Graduate fellowship resources have remained fixed, while RA support grew modestly with grant funding.

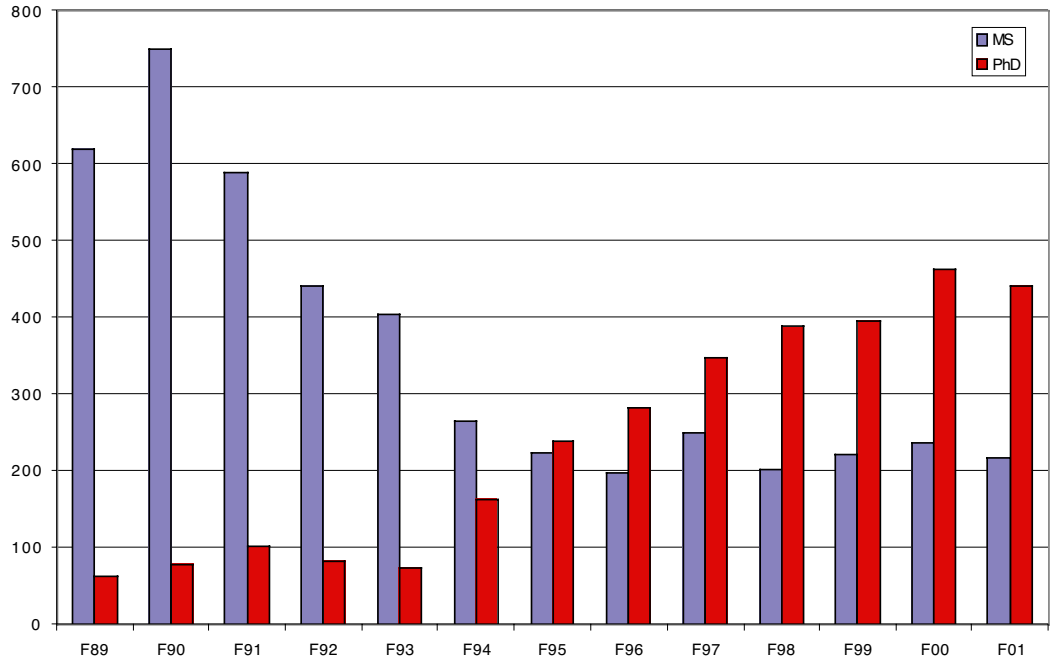


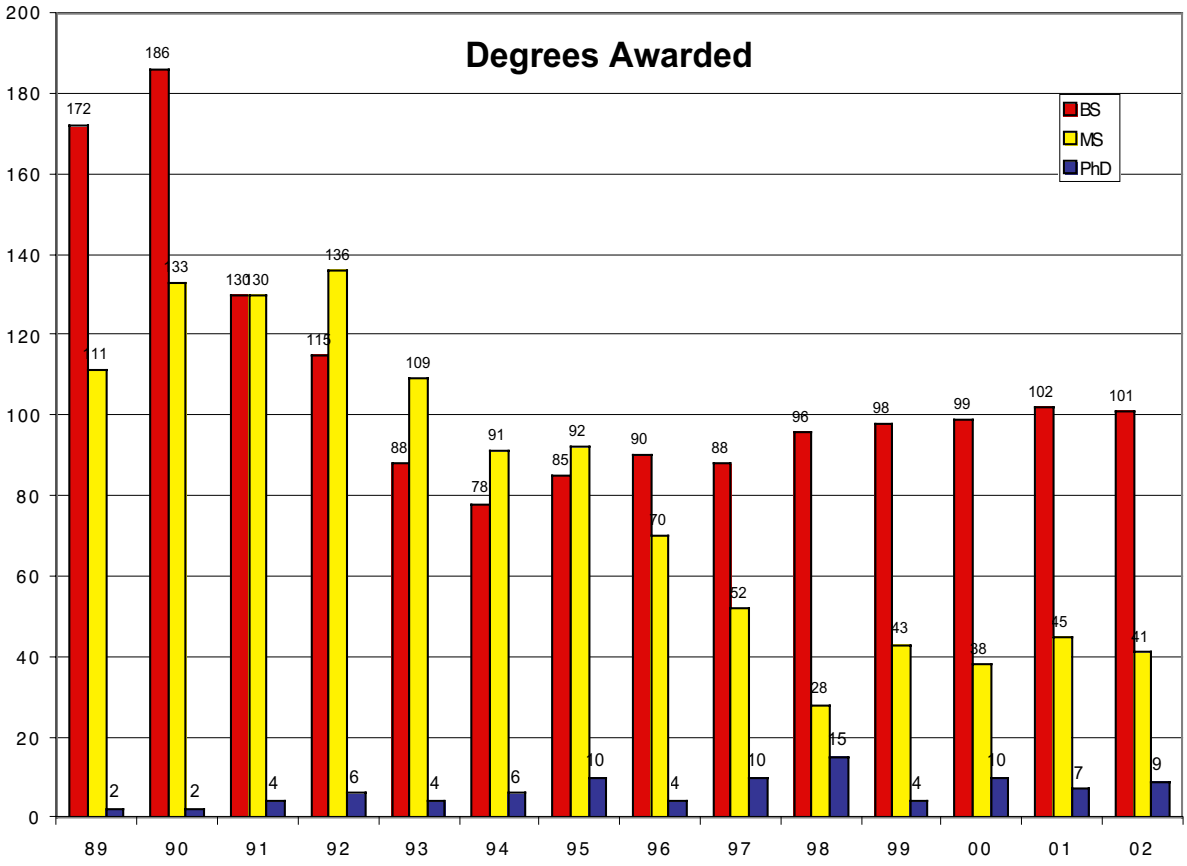
Chart 6-3: Graduate Student Applications

6.2 Degrees Awarded

Data on the degrees granted by the department in the last ten years are shown in Table 6-2 and Charts 6-4 to 6-6. The number of Ph.D. degrees awarded has increased from an average of 6 per year, in 1992-96, to an average of 9.3 per year, in 1997-2002.

	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02
BS	115	88	78	85	90	88	96	98	99	102	101
MS	136	109	91	92	70	52	28	43	38	45	41
Ph.D.	6	4	6	10	4	10	15	4	10	7	9
Total	**257**	**201**	**175**	**187**	**164**	**150**	**139**	**145**	**147**	**154**	**151**

Table 6-2: Degrees Awarded



6.3 Research Funding

Although a slight decline was experienced this year, research funding has grown significantly over the past ten years. After a year of aggressive effort, total new research funding surpassed $6.3M in 2001 and then subsequently fell back to $5.2M in 2002.

- Funding per faculty totaled approximately $145k.
- Annual average over the last seven years (1996-02) is $5.1M., compared to $2.4M over the previous six years (1990-95).

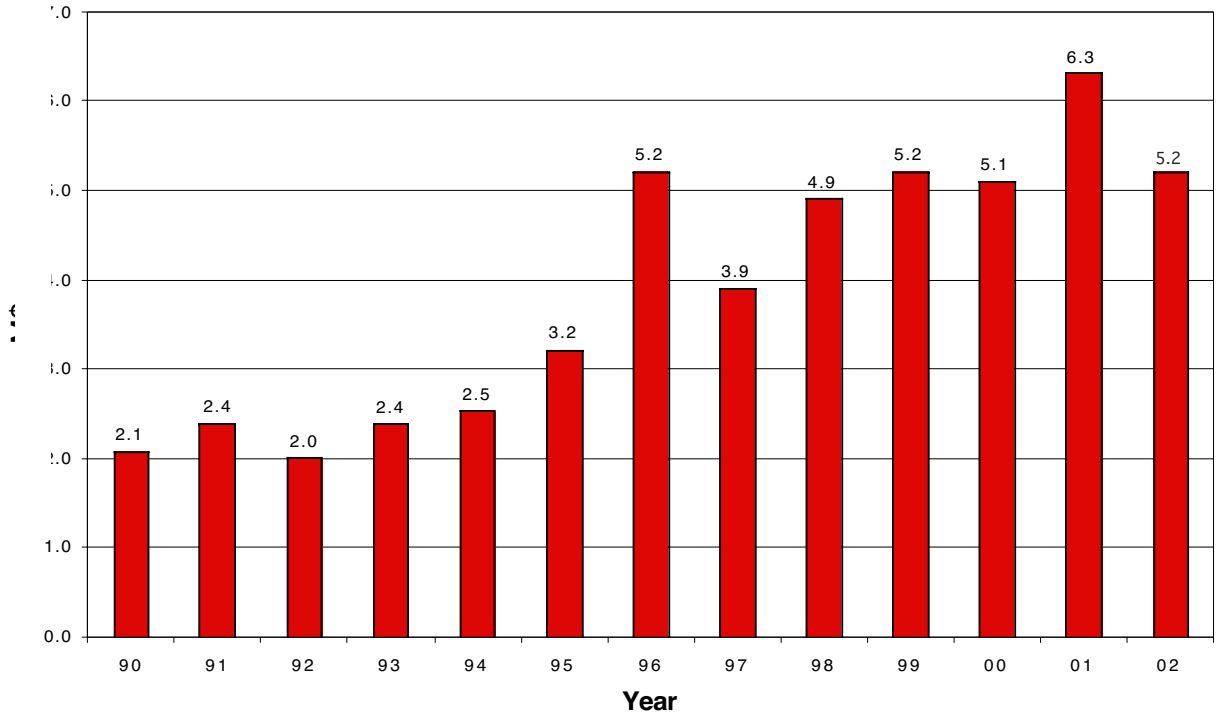


Chart 6-7: New Research Grants and Contracts These figures include only grants and contracts for which the Principal Investigators (PI) were ECE faculty. The share of grants for which ECE faculty were Co-PI's totaled approximately $7.7k in 2001/02, so that the total funding is approximately $6M.

6.4 Faculty and Staff

Faculty hiring has largely replaced departures, with small net growth over the last ten years:

- Department growth has has remained at about the same level over the last five years.
- 13 of the current faculty joined the department in the last five years.
- New hires have been directed both to strategic research thrusts and to address shifting enrollments.

Staff development has lagged behind the faculty and programmatic changes:

- Scientific staff (post docs, visitors) has increased with associated space and administrative demands.
- Teaching lab staff positions have remained at 6.
- Administrative staff has grown much slower than the faculty/scientific staff head count and research volume.

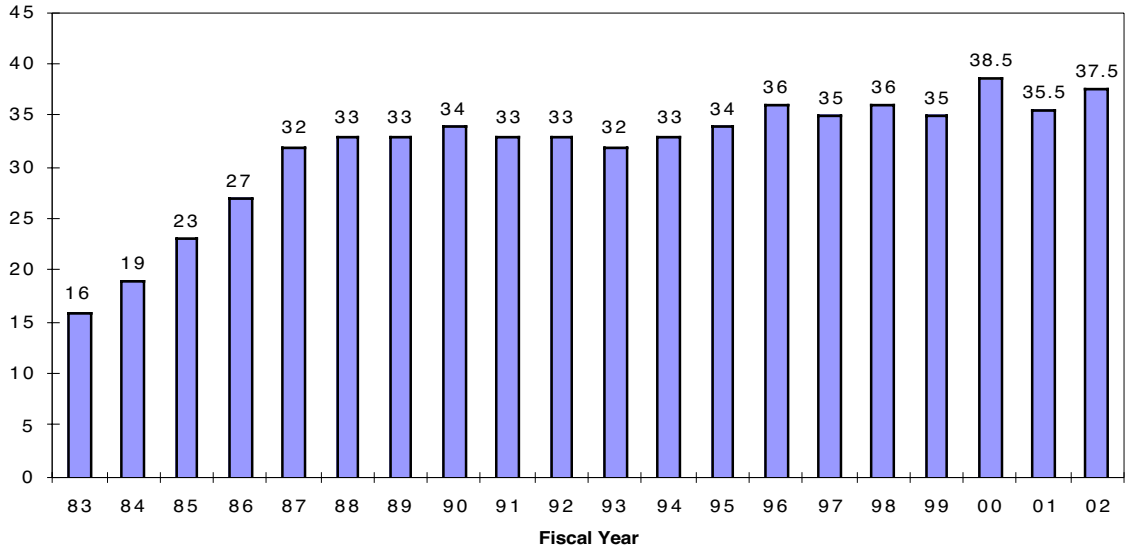


Chart 6-8: Faculty Growth and Turnover Since 1983 Affiliate faculty and research faculty with no teaching responsibilities are not included in this chart.

6.5 Outlook for Future Growth

Plans for faculty growth have been motivated by the need to strengthen existing research areas to become more competitive at a national level, develop expertise in areas of ECE where important new technologies are expected to grow, and respond to shifting and growing student enrollments at both the undergraduate and graduate levels. Our objective has been to keep up with the rapidly-changing face of our profession and to play a leading role in shaping future technological advances. The ECE Department has three main areas of research and instruction: *electrophysics* (which includes photonics, solid state materials and devices, and electromagnetics), *information systems & sciences* (which includes signal and image processing, and control and communication systems), and *computer systems engineering* (which includes hardware, software applications, and computer and communication networks). These areas overlap and are mutually supportive. Planned growth aims at exploiting the synergies between these areas as well as links with other departments and centers at Boston University. *(See Chart on page 6-7.)* The following are the principal areas for expected future growth.

Computer Systems Engineering

Our most urgent need for growth is in computer systems engineering. This is immediately dictated by the size of our undergraduate enrollment in CSE and by the expected future market demands for ECE graduates. Although the enrollment in CSE is much greater than that in EE, the number of faculty capable of teaching computer engineering courses, particularly in software engineering, remains inadequate. Some teaching is done by non-research active faculty. Failure to add new faculty in this area could result in severe course staffing problems and could frustrate research growth. Recruiting in CSE is not easy under the best of circumstances. The scarcity of qualified people and the strong competition with industry and other universities means that most ECE departments in the U.S. are facing the same difficulty, and makes vigorous recruiting in computer engineering a necessity. This effort must be coordinated with the BU Department of Computer Science to benefit from synergies and to enhance our competitiveness in attracting new faculty members. Stronger links with the Center for Computational Science are necessary. Another link offering particularly strong synergistic possibilities is that between the ECE High Performance Computing group and the Center for Space Physics (CSP). CSP is a BU research center with strong links to ECE (40% of its graduate students are from ECE).

Communication and Computer Networks

Telecommunications and computer networking have dramatically changed our society and are expected to continue to have a significant economic impact and to drive much of the electronics and computer technology. The student demand for telecommunication and networking courses has been high and the Department has recently enhanced the curriculum at both the undergraduate and graduate levels. Research in this area has recently increased, but additional faculty are necessary to reach a critical mass. Computer-network specialists would also help us in meeting some of our urgent teaching needs in the general computer systems engineering program. The Computer Science Department at BU has also targeted computer networks for faculty growth, and the Department of Manufacturing Engineering has a strong systems group with a related interest in discrete event systems. Our combined effort will create a strong BU program in this very important area.

Information Systems and Sciences

The ECE Department has a strong group in information systems and sciences with research in digital signal processing, image and video processing, multimedia communication, and mobile and wireless communication. This group has established an excellent reputation and enjoys a strong graduate student interest. Members of the group are active in the NSF Engineering Research Center for Subsurface Imaging and Sensing *(see page 5-19)* and in the Center for Information Systems and Engineering (CISE). The Department must endeavor to maintain the strength of this group and to seek opportunities to enhance it by the addition of new faculty and by enhancing its ties with other BU groups.

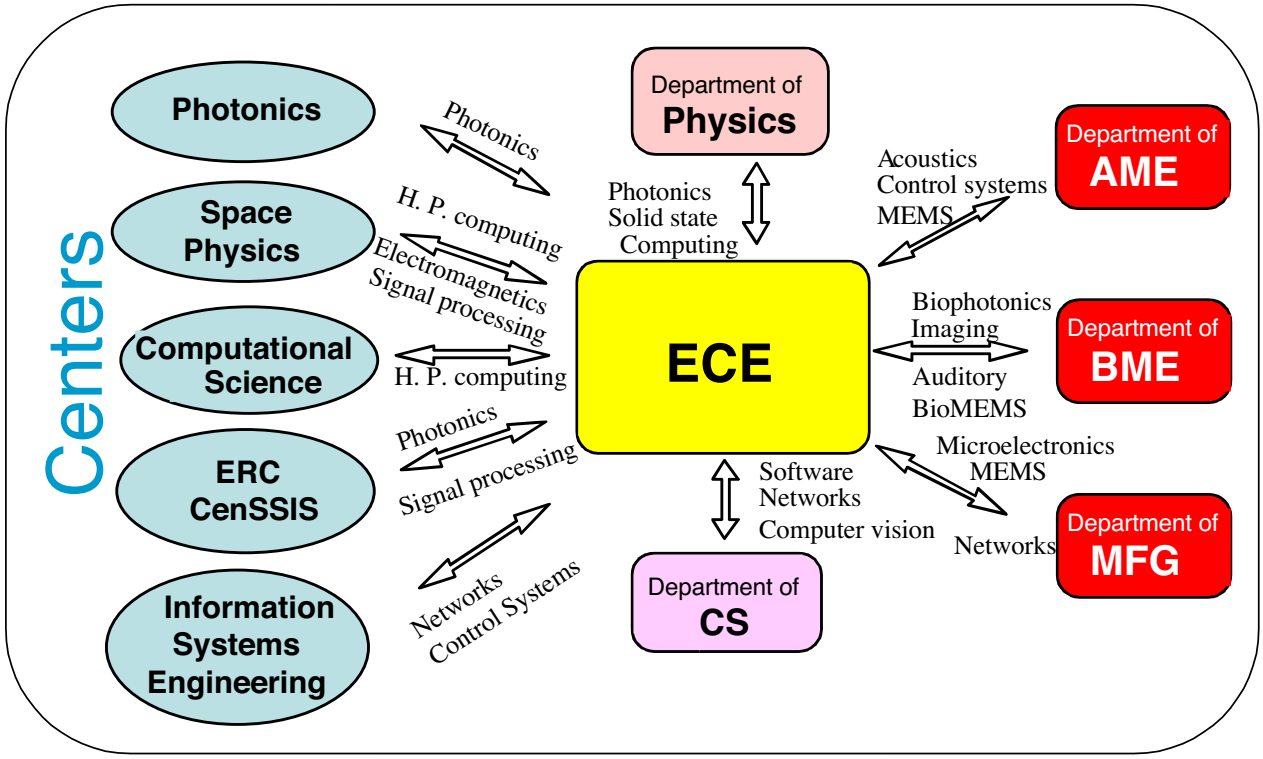
Photonics

When BU established the Photonics Center, it made a strategic commitment to become a national center of excellence in photonics. Senior and junior ECE faculty have been added in photonic materials and devices, quantum optics, and fiber optics. A new MS in Photonics Degree program has been initiated and a large number of new courses have been added to the curriculum. It is imperative to maintain the momentum and to continue to strengthen this program with new faculty. This will of course enrich the scientific base of the Photonics Center and its technical vitality. While we have outstanding research in photonic materials and devices and their applications, we lack strength in the systems area, particularly in high-speed optical communication, switching, and networks. Growth in these areas is synergistic with our effort in communication and computer networks. Another area of importance in photonics, and also solid state devices, is micro-electromechanical systems (MEMS) and nanostructures because of their optical applications in photonic devices and systems. Nanostructures

and MEMS is a thrust area for other engineering departments, and this effort will benefit from a well-coordinated faculty recruiting campaign and a large research group in this important area.

Analog and Digital VLSI Electronics

VLSI electronics continues to be an area of fundamental importance. VLSI circuits constitute the principal hardware for computers and embedded systems. Maintaining a strong instructional program in this area is essential for both our degree programs. Application of VLSI electronics to biological sensors is an area of great potential, and interests both the ECE and the Biomedical Engineering Departments. The addition of more faculty is essential to meet increased teaching needs, to reduce the burden on research active faculty, and to give this research area the critical mass necessary to gain national recognition and competitiveness for research funds.



Links between the ECE Department and other Departments and Centers