

GREAT  
ENGINEERING  
EDUCATORS



Electrical and Computer Engineering

**Carnegie Mellon**



{OUR ALUMNI}

CARNEGIE MELLON CELEBRATED ITS CENTENNIAL IN THE FALL OF 2000. SINCE **"ENGINEERING PRACTICE"** WAS ONE OF THE ORIGINAL DISCIPLINES TO BE TAUGHT IN CARNEGIE'S TECHNICAL SCHOOLS, OUR DEPARTMENT SHARED THIS MILESTONE.



THE VERY FIRST STUDENTS TO ENTER CARNEGIE'S SCHOOL OF APPLIED SCIENCE AND TECHNOLOGY IN 1905 ATTENDED CLASSES IN WHAT IS NOW PORTER HALL 100. AN ENTIRE CAMPUS WAS BEING CONSTRUCTED AT ONCE. SCAFFOLDING STILL COVERED THE OUTSIDE OF THE FEW CLASSROOM BUILDINGS. THE TOWER ATOP MACHINERY (LATER HAMERSCHLAG) HALL – THE HOME OF ECE TODAY – WAS STILL ON THE DRAWING BOARD. THE DIN OF STEAM SHOVELS ECHOED IN THE HALLS – AND EVERYWHERE THERE WAS MUD.

THERE WERE NO DORMS, NO STUDENT CENTERS OR GYMS, NO CAFETERIAS.





AND YET THEY CAME BY THE THOUSANDS. 1,723 STUDENTS APPLIED FOR ADMISSION TO THE FIRST CLASS OF THE SCHOOL OF APPLIED SCIENCE AND TECHNOLOGY IN 1905; 120 WERE ENROLLED. FIVE YEARS LATER, TOTAL ENROLLMENT HAD INCREASED TO 2,224.

THESE FIRST STUDENTS OF “ENGINEERING PRACTICE” WERE THE SONS OF PITTSBURGH’S MILLWORKERS. THEY CAME TO PURSUE A THREE-YEAR DIPLOMA OR A TWO-YEAR CERTIFICATE. MANY DID NOT HAVE HIGH SCHOOL DIPLOMAS.

NO MATTER. ARTHUR ARTON HAMERSCHLAG, WHO SERVED AS THE FIRST DIRECTOR OF CARNEGIE TECHNICAL SCHOOLS FROM 1903-1922 HAD NO COLLEGE DEGREE.

NOW, OUR UNDERGRADUATE AND GRADUATE PROGRAMS **RANK** CONSISTENTLY AMONG THE **TOP TEN**, AND OFTEN AMONG THE **TOP FIVE**, UNIVERSITIES IN THE UNITED STATES.

WE HAVE ESTABLISHED OURSELVES AS ONE OF THE BEST, AND WE HAVE DONE SO WITHIN 100 YEARS – FAR LESS TIME THAN ANY OF OUR PEER INSTITUTIONS.

1912

Tech becomes a four-year, degree-granting college. Tuition is \$50 a year.



THOSE FIRST STUDENTS IN 1905 WERE NOT SO VERY DIFFERENT FROM OUR STUDENTS TODAY. THEY MAY HAVE HAD NO IDEA WHAT THEY WERE STARTING, BUT THEY HAD SEVERAL FUNDAMENTAL CHARACTERISTICS THAT WOULD LAY A FOUNDATION FOR TODAY’S STUDENTS.

IT DIDN’T MATTER WHAT THEIR SOCIOECONOMIC STATUS WAS; **THEY WANTED TO LEARN**, AND THEY WERE WILLING TO WORK VERY HARD TO GAIN THEIR EDUCATION. MANY OF THE FIRST STUDENTS ATTENDED EVENING SCHOOL, CATCHING A STREETCAR OUT TO OAKLAND AFTER A HARD DAY WORKING AS AN APPRENTICE OR JOURNEYMAN IN A STEEL MILL.

STUDENTS IN THE SCHOOL OF APPLIED SCIENCE AND TECHNOLOGY WERE SUBJECT TO STRINGENT ADMISSION EXAMS AND A MORE DEMANDING CURRICULUM THAN MOST OTHER CARNEGIE TECHNICAL SCHOOLS. THE RAPIDLY DEVELOPING CURRICULUM WAS CONSTANTLY CHANGING IN ORDER TO PROVIDE THEM WITH THE BEST TECHNICAL EDUCATION AVAILABLE.

THEY HAD AN ENTREPRENEURIAL SPIRIT, ORGANIZING THEMSELVES INTO A NETWORK OF ATHLETICS, PUBLISHING

1913

Machinery Hall (now Hamerschlag Hall) completed. The tower disguises the smokestack for the campus boiler room that operated where the Clean Room is today (Level F).

## ECE Department Heads

Alexander J. Wurtz  
1905 - 1921

William R. Work  
1921 - 1944

Benjamin Richard Teare  
1944 - 1950

E.M. Williams  
1950 - 1969

Angel G. Jordan  
1969 - 1979

Floyd Humphrey  
1978 - 1981

Stanley H. Charap and  
M. Granger Morgan  
(co-acting heads)  
1981 - 1982

Stephen W. Director  
1982 - 1991

Donald E. Thomas  
1991 - 1992 (acting head)

Robert M. White  
1992 - 1999

Pradeep K. Khosla  
1999 - .

GROUPS, TECHNICAL SOCIETIES AND FRATERNITIES THAT WOULD HELP THEM SUCCESSFULLY LAUNCH THEIR CAREERS. THE TARTAN, THE THISTLE AND EVEN THE FIRST FOOTBALL STADIUM WERE ALL STUDENT-FUNDED VENTURES.

AND PERHAPS MOST IMPORTANT, THE TECHNICAL SCHOOLS' FIRST ALUMNI BEGAN TO **INFLUENCE THE WORLD** AROUND THEM. AT FIRST ONLY WESTERN PENNSYLVANIA'S HEAVY INDUSTRY BENEFITED FROM THEIR EDUCATION.

BUT 8,013 ELECTRICAL ENGINEERS HAVE PASSED THROUGH THE HALLS OF HAMERSCHLAG THIS PAST CENTURY – SO MANY THAT IT IS EASY TO SEE WHERE THEIR FOOTSTEPS HAVE WORN A PATHWAY IN THE BLACK SLATE OF THE CENTER STAIRWELL. AND IT IS ALSO EASY TO SEE THEIR INFLUENCE AROUND THE WORLD.



## {OUR EDUCATORS}

THESE 8,013 ALUMNI WERE HELPED ON THEIR WAY BY SOME OF THE GREATEST PIONEERS IN ELECTRICAL ENGINEERING RESEARCH AND EDUCATION – BENJAMIN RICHARD TEARE, EVERARD (ROD) WILLIAMS, GAYLORD PENNEY, LEO FINZI, STANLEY CHARAP, ANGEL JORDAN, AND MORE RECENTLY, STEVE DIRECTOR, MARK KRYDER AND RON ROHRER. SOME OF THESE FACULTY HAVE PASSED ON. SOME HAVE RETIRED AND SOME HAVE MOVED ON TO OTHER CAREERS. BUT NO MATTER WHAT DECADES THEY INFLUENCED, THEIR DEDICATION TO THE PROFESSION IS EVIDENCED BY THE LEGION OF STUDENTS THEY PRODUCED – STUDENTS WHO HAVE DISTINGUISHED THEMSELVES AND OUR DEPARTMENT.

TO COMMEMORATE **A CENTURY OF EXCELLENCE** IN ENGINEERING EDUCATION, THE ECE DEPARTMENT IS HONORING THESE PIONEERS BY CREATING THE **GREAT ENGINEERING EDUCATORS FUND**. THROUGH THIS FUND YOU, THE STUDENTS OF OUR FIRST CENTURY, HAVE AN OPPORTUNITY TO BOTH HONOR OUR GREAT EDUCATORS AND HELP PROVIDE SUPPORT FOR THE STUDENTS OF OUR SECOND CENTURY.

BY OUR BICENTENNIAL YEAR, APPROXIMATELY 21,000 MORE ELECTRICAL AND COMPUTER ENGINEERS WILL GRADUATE FROM OUR DEPARTMENT. THE CONTRIBUTIONS THEY WILL MAKE ARE UNIMAGINABLE BUT WILL, FOR CERTAIN, CHANGE THE COURSE OF TECHNOLOGY AND OUR SOCIETY.

BENJAMIN RICHARD TEARE


Carnegie Mellon, 1939-87  
Department Head, 1944-52  
First Buhl Professor, 1943  
Dean of Graduate Studies,  
1950-53  
Dean of Engineering and  
Science, 1953-65

Benjamin Richard (Dick) Teare was the father of the graduate program in electrical engineering at Carnegie Mellon. His educational philosophy touched every level of student in the engineering college, and his decades of leadership in professional societies and service on early educational and accreditation committees of the IEEE helped gain Carnegie Mellon's programs a national reputation.

Recruited to Tech in 1939 and armed with a \$50,000 grant from the Buhl Foundation, Teare was charged with developing a post-graduate program from scratch. He had eight full-time faculty and faced an impending World War, which would absorb nearly every adult male in the country for the next six years. But, by 1943 the program was successful enough to encourage the Buhl Foundation to endow a professorship, with Teare as its first recipient.

Proving a visionary to our efforts now, Teare was one of the first educators to stress the importance of attracting good students by "establishing competitive levels of financial support by assistantships and fellowships."

Teare served as president of the American Society for Engineering Education (1959-60) and was honored with education awards from the ASEE and the IEEE: one of the first George Westinghouse Medals (ASEE, 1947); the Lamme Medal (ASEE, 1963); and the IEEE Education Medal (1964).



*“Any institution of higher learning which deserves the name has the ambition to be favorably known and respected locally, nationally, and internationally as a center of learning. In the fields of science and engineering, a university attains this ambition in proportion to: 1) the competence of its graduates in their chosen professions; 2) The distinction attained by its faculty through contributions to science and engineering by research and other scholarly pursuits; 3) The extent of leadership assumed by its graduates and its faculty in their professions.”*

*Committee on Post-War Education*

  
 EVERARD M. WILLIAMS  


In his short lifetime – he was 57 when he died – Rod Williams had a great impact on our department and on the Pittsburgh community.

As department head, he recruited many of the faculty who propelled Electrical Engineering to the forefront of research in magnetics and semiconductor devices. His own expertise was called upon by other universities, industry, government and the military.

For his radio and radar research during World War II, and for playing a key role in the development of guided missiles following the war, Williams was awarded the President’s Certificate of Merit for outstanding service to the war effort. In 1946 he was named the Most Outstanding Young Electrical Engineer in the U.S.

Williams was a pioneer in the use of computers in education, and one of the first faculty to recognize the need to provide our students with an understanding of the impact of technology on society. He established an honors program in the department, and was the first to bring students from area high schools to campus to experience laboratory research.

In addition to all of his responsibilities at Carnegie Mellon, Williams found time to put his engineering skills to work reclaiming and renovating derelict housing for the poor and homeless in the East End of the city.

Carnegie Mellon, 1945-72

Department Head, 1952-69

George Westinghouse Professor of Engineering, 1969-72

**Faculty 2003**

The ECE Department has 59 faculty members, counting tenure track, research track and lecturers. Several of our faculty have joint appointments with Computer Science, The Robotics Institute, and the Department of Engineering and Public Policy.

Full Professors (with tenure)	32
(8 with endowed chairs)	
Associate Professors	9
Assistant Professors	8
Research Faculty	9
Lecturers	1
Courtesy Faculty	23
Adjunct Faculty	5
Emeriti	5



**1930**

Goats are grazing on the hillside where Roberts Engineering Hall now stands. Tuition is \$320.

## EDWARD R. SCHATZ

E 1942, '43, '49

Associate Dept. Head, 1952-57

Associate Dean, 1957-61

Dean of Research, 1961-64

Vice President Academic  
Affairs, 1964-72

Acting President, 1972

Senior Vice President,  
1981-96

“A village elder for this university,” said a colleague of Ed Schatz, summing up the bond between Carnegie Mellon and a man who worked tirelessly for five decades for the institution he loved.

After leaving his graduate studies to serve his country during World War II, Schatz returned to Tech in 1946 to join the EE faculty and earn his Ph.D. In 1952 he received Tech's first Carnegie Teaching Award and embarked on his path of academic leadership. After nine years of service to the department and to the college under Dean Teare, Schatz was recruited by President Warner in 1961 to help with an increasingly complex institution.

For the next turbulent decade, Schatz provided academic leadership to a fledgling university with monumental growing pains. In the mid-1960s he played a key role in shepherding the school through its merger with Mellon Institute. Then came social unrest, anti-Vietnam War protests and the many changes brought about by the computer revolution. Add on a new administration and several years of financial difficulties for the school. Through it all, Schatz provided steady guidance.

In the years immediately preceding his death in 1996, Schatz was once again guiding us through another major change to university life with his management of the \$47M new University Center project.

### 1936

The Electrical Engineering Department has 8 full-time faculty members. Tech's research budget is \$156,000.

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### 1942

Graduate program in Electrical Engineering established with \$50K grant from the Buhl Foundation. It will be ranked number one in the country just 58 years later.

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ANGEL G. JORDAN

A 1959 alumnus of Carnegie Institute of Technology, Angel Jordan has made Carnegie Mellon his life's work.

His pioneering research and technical leadership helped create one of the first university research laboratories in semiconductor devices.

As an administrator, he was one of the leaders in the transformation of Carnegie Mellon into a prominent world-class educational and research institution. He championed the formation of the Robotics Institute, and was instrumental in attracting the Software Engineering Institute to campus.

Jordan was elected to the National Academy of Engineering in 1986 for his contributions to solid-state device research and for innovative leadership in engineering education. He advised 26 Ph.D. students who have all gone on to successful careers.

Emeritus University Professor  
of ECE and Robotics

Carnegie Mellon, 1959 –

Department Head, 1969-79

Dean, College of Engineering,  
1979-83

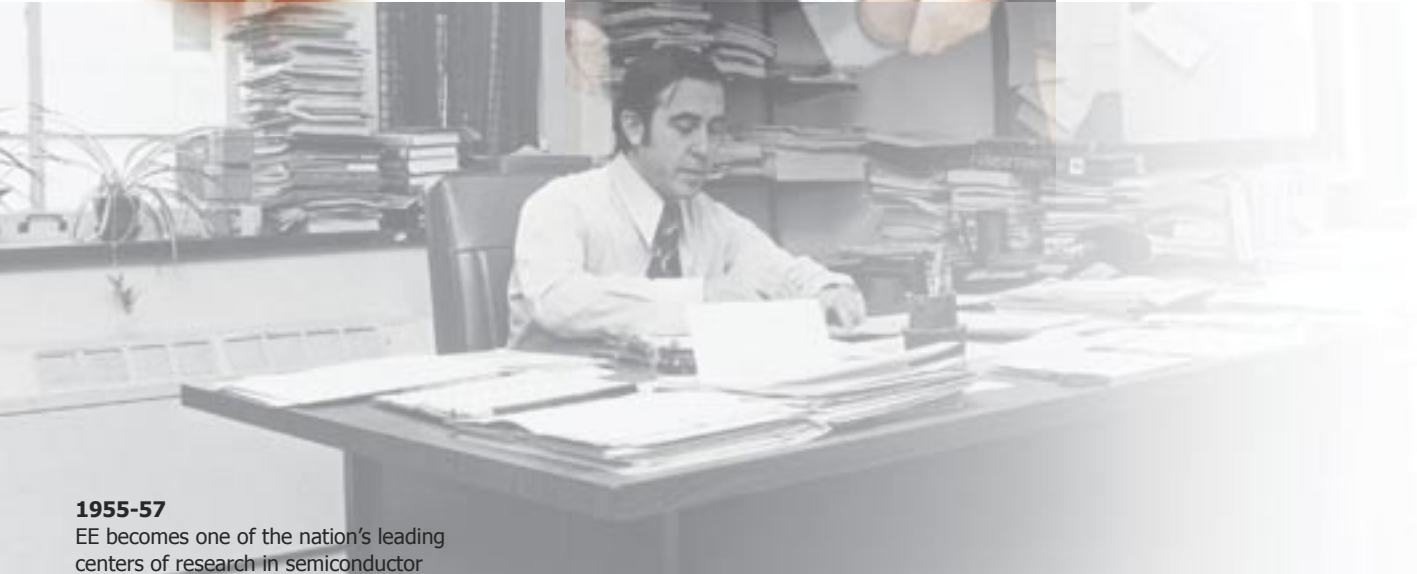
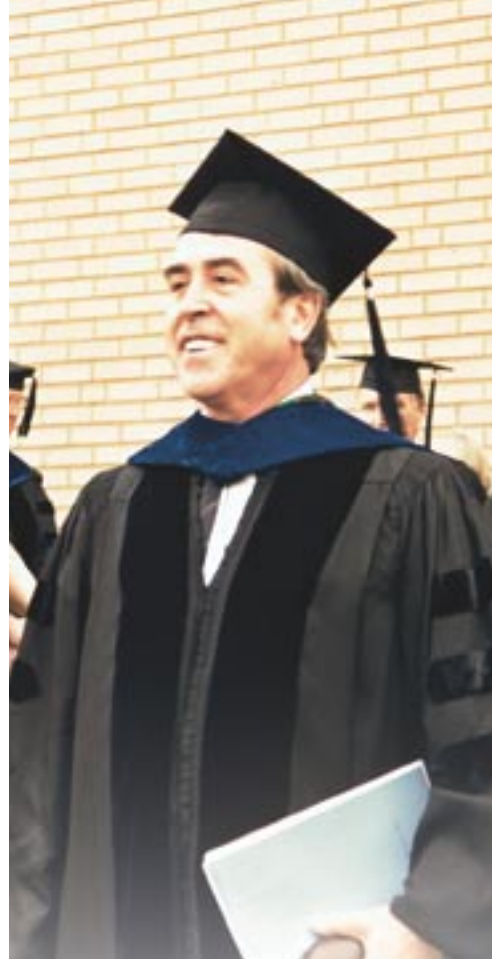
University Provost, 1983-91

**Students (AY 02-03)**

Undergraduate (sophomore thru senior)	500
Integrated Master's/Bachelor's	61
Master's	88
Ph.D.	142

**Degrees Granted in 2002**

Undergraduate (55 with University Honors)	143
Simultaneous M.S./B.S.	22
Master's	90
Ph.D.	25



**1955-57**

EE becomes one of the nation's leading centers of research in semiconductor devices. First Computation Center established and housed in newly built Scaife Hall. First freshman course in computer programming offered. Tuition is \$600 a year.

GAYLORD W. PENNEY

Westinghouse Corporation  
Research, 1923-47

George Westinghouse Professor  
of Electrical Engineering,  
1947-69

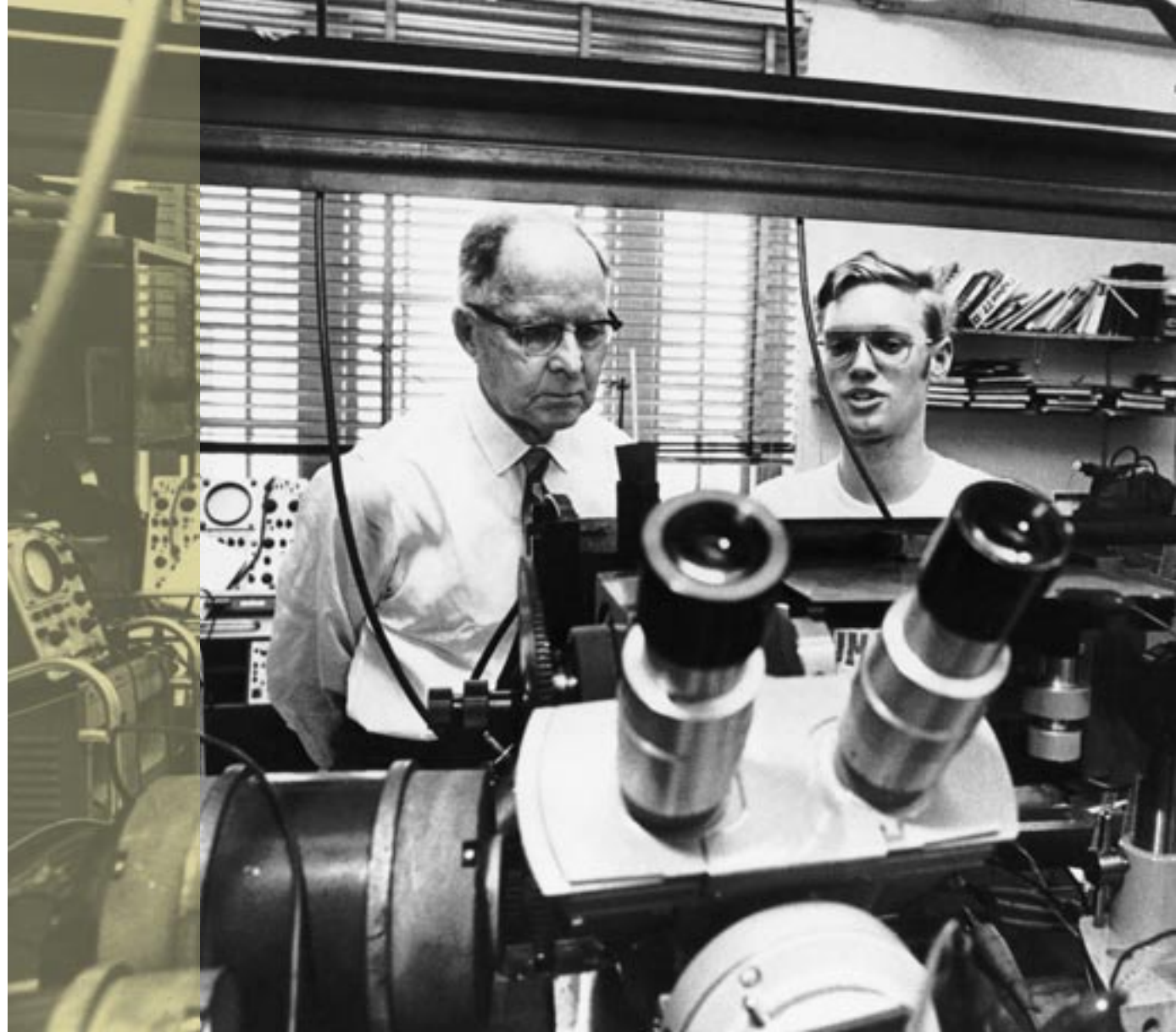
Carnegie Mellon, 1947-93

Gaylord Penney retired from Carnegie Mellon at age 95 after a 70-year career as an engineer, inventor and educator. One of the last of the breed of engineer who spent long happy hours experimenting in a laboratory, Penney's dedication earned him 45 patents during his lifetime, most of them in air pollution control devices with industrial applications.

Pittsburgh was known as the "Smoky City" in 1923 when Penney arrived here from his home in Iowa. Like many other scientists of his day, he was determined to find a way to reduce industrial pollution. He spent the next 24 years in the laboratories of Westinghouse Research inventing devices like the Precipitron, the first two-stage electrostatic precipitator.

In 1947 Penney joined our faculty. Along with his students, he produced a steady stream of papers in technical journals and continued to earn patents on electrostatic air cleaning devices. Long after the usual retirement age, Penney received funding from agencies such as the National Institutes of Health, and honors from his colleagues, among them the Chambers Award from the Air Pollution Control Association and the Award of Merit from the Industry Applications Society.

We all breathe cleaner air because of this engineer's spirit of invention.



**1960**

Programming courses elected by nearly half the freshman class. The term "computer bum" is coined on this campus. Tuition is \$1,000 a year.

**1966**

The Department of Computer Science is founded. University tuition is \$1,700.



ARTHUR G. MILNES



The London blitz during World War II delayed Art Milnes' undergraduate studies for two years. His master's work, a study of aircraft ignition systems, was influenced by the war as well. But In 1954, while working on his doctorate in magnetics, a Royal National Academy of Sciences Fellowship allowed him a year of study at Carnegie Tech. At this time the EE Department was beginning to earn a reputation for its programs in magnetics and solid state and Milnes seized the opportunity.

Buhl Professor Emeritus  
Carnegie Mellon 1957–.

Three years later Milnes and his wife returned to the U.S. on the maiden voyage of the M.S. Statendam – this time to stay.

Hired as an associate professor by department head E.M. Williams, Milnes expressed an interest in “power transistor circuits.” This seemed to Milnes “a fresh and productive field in which Tech could very well secure a leading role...”

Milnes and his students produced hundreds of papers during his tenure in our department and he is the author of several books. In 1983 his 1972 paper “Heterojunctions and metal-semiconductor junctions” was included in Citation Classics as one of the most cited items in its field.

In 1973 Milnes was appointed to the Buhl Chair in electrical engineering. In 1982 he received the J.J. Ebers Award from the Electron Devices Society for contributions to research and education in heterojunction and deep-impurity device physics. In 1993 he received the van der Ziel Award for outstanding, sustained semiconductor device research.



STANLEY H. CHARAP

Professor Emeritus  
Carnegie Mellon, 1968 –  
Associate Dept. Head, 1980-85  
Associate Director, DSSC,  
1990-96

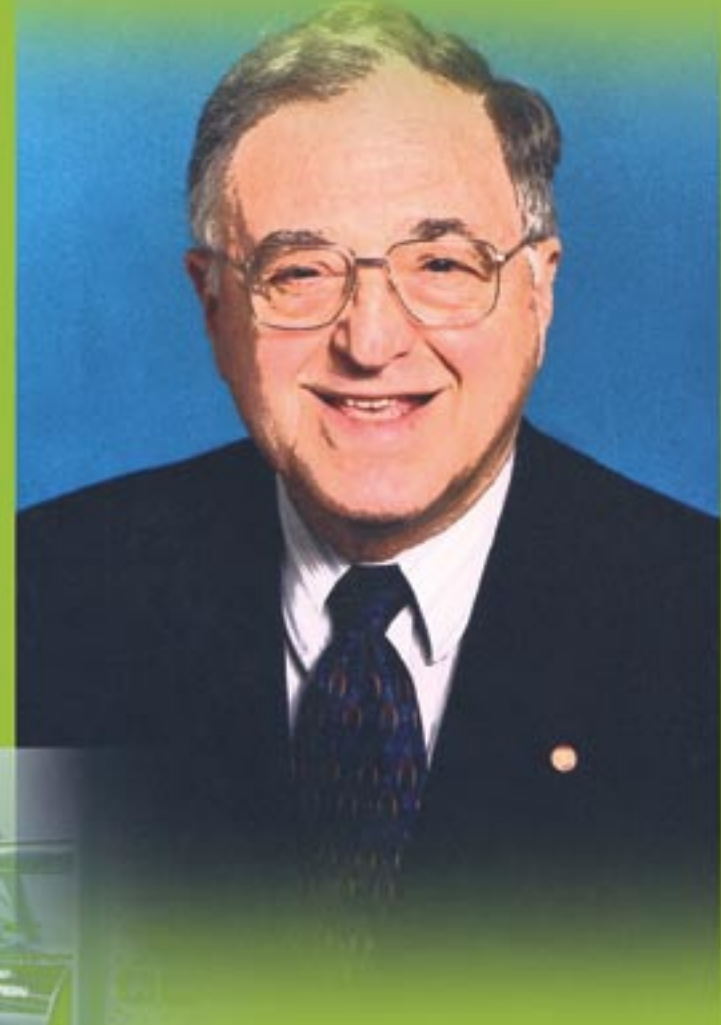
In 1968, Stan Charap was recruited by department head E.M. Williams to maintain the program in magnetics begun by one of the pioneers in the area, Leo Finzi.

As interest in magnetics technology grew in the 1970s, Charap made numerous contributions to the department's research and educational programs through teaching, advising and research. The results of some of his early research has been included in a popular text on solid state physics, and he prepared the English edition of the "Physics of Magnetism" text which has been widely used in the education of a generation of magnetics researchers.

As associate department head, Charap advised the department's undergraduate population from 1980-85 and during that time was also called upon to serve as co-acting department head from 1981-82.

The 1980s ushered in an exciting era for the advancement of magnetics research in the department. Charap was a founding member of the Magnetics Technology Center in 1982 and served as associate director of the Data Storage Systems Center from its formation in 1990 until his retirement at the end of 1996.

Throughout his career and continuing into retirement, Charap has been a leader in the IEEE Magnetics Society, serving in many positions including president of the society. He has served as general chair of both major magnetics conferences and was the Magnetics Society Distinguished Lecturer in 1996. For his service to the profession, Charap received the Society's Achievement Award in 1998.



**1980**  
EE is poised to launch major research centers in computer-aided design, magnetics, semiconductor manufacturing and optical data processing. A Class 100 clean room is constructed. Tuition is \$3,700.

**1985**  
The interdisciplinary Engineering Design Research Center is funded by NSF. Electrical Engineering has become Electrical and Computer Engineering.

STEPHEN W. DIRECTOR

Steve Director was one of a group of young faculty who put Carnegie Mellon on the map in design research in the 1970s. In 1982 he founded the SRC-CMU Research Center for Computer-Aided Design, and since that time a legion of CAD Center (later CEDA) graduate students have gone

on to become successful and influential academic and industrial leaders.

As ECE department head, Director was the driving force behind the revision of our undergraduate curriculum in 1990, which became a bellwether for curriculum reform across the country. As dean of the College of Engineering, he worked with ABET to establish guidelines to accredit these new curriculums and served as a consultant to engineering schools across the country seeking to join this reformation.

Director was elected to the National Academy of Engineering in 1989 for his "pioneering contributions to computer-aided circuit design and leadership in electrical engineering education." In 1996 he was the first recipient of Aristotle Award presented by the Semiconductor Research Corporation for his commitment to graduate education and mentoring. He is the 1998 recipient of the IEEE Education Medal "for contributions to electrical engineering education through innovative textbooks, leadership in undergraduate curriculum reform and inspired graduate teaching."

Carnegie Mellon, 1977-96

Whitaker Professor and ECE Department Head, 1982-91

Founding Director, SRC-CMU Research Center for Computer-Aided Design, 1982-89

Dean, College of Engineering, 1991-96



**1991**  
ECE leads the nation into a decade of undergraduate curriculum reform. Tuition is \$15,250. University's research budget is \$128M.

RONALD A. ROHRER



Ron Rohrer's distinguished, and in many ways unique, 40-year career has made him a legend in electronics design automation community.

Rohrer's early research at Berkeley in the 1960s, coupled with faculty leave spent at Fairchild Semiconductor, resulted, in 1972, in the renowned circuit simulation program, SPICE. Over the next two and a half decades, Rohrer chaired the electrical engineering departments at several universities, making valuable contributions to their undergraduate curricula. In addition, he held consulting, research, marketing and management positions in many successful semiconductor and electronic design automation companies. Today, he continues to pursue innovation as an entrepreneur and venture capitalist.

At Carnegie Mellon, Rohrer brought his vast industrial experience into the classroom and became one of the leaders in the ECE Department's curriculum reform of 1990-91. As the second director of the SRC-CMU Research Center for Computer-Aided Design he successfully led the center into its second decade.

In 1989, Rohrer was elected to the National Academy of Engineering for his "contributions to circuit simulation that have enabled deep submicron IC design and for leadership in electrical engineering education." In 1992 he was awarded the IEEE Education Medal for "innovation in bringing electrical engineering practice into the classroom and merging academic research with industrial needs." In 1996 he was awarded the NEC Computer and Communication Prize, a worldwide honor for pioneering contributions in electronics.

Emeritus University Professor

Carnegie Mellon 1974-75; 1985 -

Director, SRC-CMU Research Center for Computer-Aided Design, 1989-93

Research Centers and Institutes 2003

- Center for Circuits, Systems and Software
- Center for Computer and Communications Security
- Center for Highly Integrated Information Processing and Storage Systems
- Center for Silicon System Implementation
- Center for Wireless and Broadband Networking
- Data Storage Systems Center
- General Motors Collaborative Laboratory at Carnegie Mellon
- Information Networking Institute

1997

Roberts Engineering Hall comes online – the first new engineering building in 42 years. The Institute for Complex Engineered Systems is formed. Tuition is \$20,275. University's research budget is \$166M.

MARK H. KRYDER

Professor of ECE

Founding Director, Magnetics  
Technology Center, 1982-90

Founding Director, Data Storage  
Systems Center, 1990-98

Carnegie Mellon, 1978 –.

Through Mark Kryder's vision, Carnegie Mellon has become home for the largest academic research center in data storage in the United States.

In 1982 Kryder founded the industrially sponsored Magnetics Technology Center (MTC). In 1990 the MTC was granted an Engineering Research Center designation by the National Science Foundation and became the Data Storage Systems Center (DSSC).

Through the efforts of Kryder and other faculty affiliated with these two centers, nearly 300 Ph.D. students have gone on to become an important part of the brain trust of the data storage industry.

In 1998 Seagate, the world's largest manufacturer of disk drives, recruited Kryder to head up their new research facility that would explore new technologies four to 10 years in the future. The \$40M facility was located in Pittsburgh because of the DSSC where Kryder continues to supervise graduate students.

This educator has created a win-win situation for our students, our research programs, for Seagate, and for the aspirations of the city of Pittsburgh to become a high technology center.

In 2003 he was awarded the David L. Lawrence Man of the Year Award from Pittsburgh Vectors for promoting Pittsburgh outside the region.



**Fall 2002**  
\$35.5M Center for Computer  
and Communications Security  
funded by Defense Department.  
Tuition is \$29,190.

