THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

NEW JERSEY COAST SECTION

CENTENNIAL JOURNAL

9 MARCH 1984

APPROVED FOR PUBLIC RELEASE

DISTRIBUTION UNLIMITED

CONGRATULATIONS

MITRE C^3I Division

The MITRE Corporation
142 State Highway 35
Suite 105
Eatontown, NJ 07724

NEW JERSEY COAST SECTION

CENTENNIAL JOURNAL

INDEX

THE NEW JERSEY COAST SECTION/CHAPTER OFFICERS

1983-1984

SECTION

Chairperson:	Dave Usechak
Vice Chairperson:	Mike McMahon
Secretary:	David Gunderson
Treasurer:	Derek Morris

SECTION STAFF

M. Hashern Sherif	Membership Chairman
J. Scott Linnell	Asst. Secretary
R. Baechle	Awards Chairman
Debbie Berberian	"Scanner" Editor
Seymour Krevsky	Centennial Journal Editor
Dr. Gabriel Novick	Monmouth College Liaison
Mari Campanella	Student Activity Chairman
Don Heirman	JR Past Section Chairman
Joseph A. Keilin	SR Past Section Chairman

AES (AEROSPACE AND ELECTRONIC SYSTEMS) CHAPTER

Chairperson:	Ed Kardauskas
Vice Chairperson:	John F. Van Savage
Secretary:	Hayden Evans
Treasurer:	George Hessel

COMMUNICATION CHAPTER

Chairperson:	Pat Trischitta
Vice Chairperson:	John Domiter
Secretary:	Elliot Liebman
Treasurer:	Carol Armitage

COMPUTER CHAPTER

Current Chairman:	Nicholas Larocca
Secretary:	Satya Chakrabarti

CS/CSS (CONTROL SYSTEMS/CIRCUITS AND SYSTEMS) CHAPTER

Chairperson:	Shah Shakoohi
Vice Chairperson:	Paul Fleischer
Secretary:	Santanu Basu
Treasurer:	David Lin

EMC/VT (ELECTROMAGNETIC COMPATIBILITY/ VEHICULAR TECHNOLOGY) CHAPTER

Chairperson:	Seymour Krevsky
Vice Chairperson:	Charles Joly
Secretary/Treasurer:	John Mumbauer

MIT/ED/QEA (MICROWAVE THEORY AND TECHNIQUES/ELECTRON DEVICES/QUANTUM ELECTRONICS AND APPLICATIONS) CHAPTER

Chairperson:	Russell A. Gilson
Vice Chairperson:	Neil J. Wilson
Secretary/Treasurer:	John L. Zyskind

NJ COAST SECTION PAST CHAIRMEN AND EDITORS

Past Chairmen	Past "Scanner" Editors	Dates
Don N. Heirman	Pat Trischitta	1982-1983
Joseph A. Keilin	Mike McMahon	1981-1982
Miguel A. Carrio	Joseph G. Kneuer	1980-1982
Joseph Chislow	Don Heirman 1979-1980	
Sidney Marshall	Nicholas LaRocca	1978-1979
Ramu Ramaswamy	Seungtaik Yang	1977-1978
David Haratz	William Montgomery	1976-1977
Victor Ransom	Joseph Keilin	1975-1976
Bruce C. Miller	William Stirrat	1974-1975
Vasant K. Prabhu	J. Gielchinsky	1973-1974
Seymour Krevsky	Ramu Ramaswamy	1972-1973
Detlef C. Gloge	Salomon Lederman	1971-1972
Anthony J. Kazules	John. A. Soboleski	1970-1971
Martin V. Schneider	John F. Prorok	1969-1970
John J. O'Neil	Bruce C. Miller	1968-1969
Louis H. Enloe	Warren Kesselman	1967-1968
Robert Roullette	Martin V. Schneider	1966-1967
Herbert S. Bennett (lst NJ Coast Chairman)	John J. O'Neil	1965-1966

MONMOUTH COUNTY SUBSECTION PAST CHAIRMEN AND EDITORS

Past Chairmen	Past "Scanner" Editors	Dates
David C. Hogg		1964-1965
	Irving Reingold/Nathan Lipetz	1960-1961
Arthur H. Ross		1956-1957
George F. Senn		1955-1956
William M. Goodall	Carl A. Borgeson	1954-1955
O. D. Perkins		1953-1954
Sloan D. Robertson	Archie P. King	1952-1953
		1951-1952
		1950-1951
First Issue of "SCANNER"		Sept. 1950

I

EDITORIALS

FROM THE CHAIRMAN

DAVID USECHAK

May 13, 1984 marks the centennial of the founding of the world's largest engineering and scientific society. That event, the founding of the IEEE under the original name of AIEE, signaled the emergence of electrical engineering as a recognized profession.

In celebration of the 100th anniversary of the Institute, the New Jersey Coast Section has prepared this journal which delineates the past 100 years in the Section. This journal contains discussions of significant outstanding achievements within the Section by the various companies and government agencies. In addition to the Section's most significant technological accomplishments, the reader will find a list of the Section IEEE Fellows, major award winners and past Section officers who have made valuable contributions to the electrical and electronics engineering profession.

As part of its 100th anniversary celebration the IEEE will award centennial medals to persons who have been selected as having made outstanding contributions in their respective areas of activity. The individuals who were selected by the NJ Coast Section and are recipients of the centennial medal are presented along with a short description of their individual accomplishments.

On behalf of the NJ Coast Section I want to congratulate all the engineers and scientists who have made the 100 years so very exciting and we all are looking forward to many more years of accomplishments in the art of communications.

SEYMOUR KREVSKY

FROM THE EDITOR

We thank ATT-Bell Laboratories of Short Hills and Holmdel, NJ, the U.S. Army Communications Electronics Command (DRSEL-IO), Dr. Hans K. Ziegler, Dr. Douglas O. Reudink, Mr. Irving Reingold, Joseph Ryan, Mr. Robert Kulinyi and the MITRE Corporation for their courtesies, time and material contributions to this journal.

The ATT-Bell accomplishments noted herein are those of the Crawford Hill and Holmdel Laboratories and specifically are germane to the NJ Coast Section's annals.

We owe a special thanks to our industrial supporters who helped make this journal possible and to Ms. Nancy Cross of MITRE Corporation for her dedication at the word processor.

More words here would not add to those golden statements presented by the IRE's founder, Alfred N. Goldsmith nor to those given by Ian M. Ross, President of ATT-Bell Laboratories nor those of that illustrious teller of chronicles, Dr. Harold A. Zahl.

Finally, to the current 2469 members of the NJ Coast Section - may your next 100 years be as fruitful!

Shortening Shadows

ALFRED N. GOLDSMITH
Anniversary Editor

THE LIFE of a man or an organization has been aptly compared to the sequence of lights and shades during one day on earth. In the early morning, long shadows lie to the West as the sun rises. Then these shadows shorten as the day advances until no shadows are visible in the noonday blaze of light. And later, the shadows lengthen as the sunlight wanes, and twilight and night approach.

The Institute of Radio Engineers is fortunate in that it is still in its early morning amid the slowly shortening shadows. Its career is young and promising. Its hopes and accomplishments, while great and inspiring, are as yet only partly fulfilled. It has the cheerful stimulus of still being far even from the noon of its life, not to mention the evening.

Yet even at this early stage of the career of the Institute, an assessment of its accomplishments and an estimate of its future may be attempted. To this end, let us return in imagination to 1912, the year of the Institute's formation. It was a very different world from that of today. Knowledge of the communications and electronics field was limited. Vistas now clear were then dim or obscure. Professional standing and cooperation were not at today's encouraging levels. And the number of persons skilled in the electronics field was small indeed.

It was our privilege to be associated at that time with the other two founders of The Institute of Radio Engineers. Great tribute should be paid to these farsighted pioneers. Robert H. Marriott, President of the Wireless Institute (one of the merged societies which formed our Institute of Radio Engineers) was ever resourceful, determined, questioning, and analytic. And above all, he was an indefatigable worker and a thoughtful planner. John V. L. Hogan was a highly skilled, inventive, and forceful pioneer. He was that rare combination: a man both human in his reactions and humane in his instincts. Without the broad understanding and generosity of these men, our Institute might never have come into being.

The original builders of the IRE were certainly no example of squatting on their hunkers.

They were strong exponents of a much more logical creed that work conquers all. And work they did, over the passing years, and in the face of many obstacles.

Yet they were fortunate as the years went on in encountering an ever more favorable and respected environment. There were numerous fortuitous helpful events, and there were also many planned and logical campaigns. The founders and their many associates were able to function partly because of three major factors. One factor was the dependable and increasing devotion and effort of the membership. It would be impossible to exaggerate the sacrifices and labor which the membership readily gave the succession of officers of the Institute over the years. The second factor was the continued and friendly cooperation of the communications and electronics industry. Industry fully understood the work of the Institute and enthusiastically backed its efforts and expansion. And the third factor was the truly explosive growth of electronics, which provided an opportunity and a challenge which were gladly accepted and turned to the advantage of the Institute. And the Institute in turn contributed greatly to that expansion over the years. Thus the membership, industry, and the expansion of the electronics field offered the Institute its opportunities. Nor should it be forgotten that governments showed a clear understanding of the worth of the activities of the Institute and encouraged their officials, scientists, and engineers to affiliate with the Institute and to aid in its upbuilding. To all of these forces recognition must be given and gratitude expressed.

Yet growth itself, from a numerical viewpoint, is not enough to ensure the basic success of any professional organization or learned society. It must retain its personality. It must maintain its ideas and ideals. It must display continuing vitality. It must avoid entangling alliances or deviations from its true purpose. Accordingly it became necessary for the IRE carefully to plan its growth along statesmanlike lines to the end that it would remain as youthful and vigorous as in its earliest days. It would be too lengthy a recital to go into the details of the appropriate measures adopted by the Institute to accomplish its aims. Some of these measures have become classic and have blazed the trail for other engineering organizations which have wisely seen fit to adopt them. The IRE established its Sections to meet the needs of members in a city and its environs. It established subsections to fulfill the needs of smaller numbers of members in suburban sections or in smaller population centers. It coordinated the activities of Sections and subsections over large territories through the formation of Regional administrations. It coordinated Regional activities through National divisions or their equivalent.

And, in addition to these "horizontal organizations," the Institute established vertical organizations of all persons among its membership interested in a particular specialty. This led to the formation of Professional Groups and of their local Chapters. Undoubtedly the end is not yet. Additional organizations or administrations, and new forms of publication may in time be needed to meet the ever-increasing desires of the membership. And, if the past is any index to the future, the necessary statesmanship will be found to meet any current needs.

The IRE has carefully avoided such measures as would lead to its grounding on the shoals of disaster which often lie in the path of learned societies as they expand toward maturity. These pitfalls include insufficient interest in the organization by the individual member, of local geographic groups of members, of larger or regional groups of members, and of members imbued with a sense of the national dignity of their compatriot members. Also avoided was the development of insufficient interest resulting from the diverse activities of individual members of the Institute—a situation which was well met by the Professional Groups. More broadly, the Institute has also avoided the dangers of involvement with political, sectional, partisan, commercial, or personal viewpoints and activities which were not of a definitely engineering and scientific

nature. It is easy for a learned society to forget its basic purpose of a search for truth, or for an engineering institute to forget that the practice of its profession for the benefit of humanity is its basic aim. The membership of the IRE may be proud in reviewing the past of the Institute and noting its complete detachment from purposes alien to its basic aims.

However, the Institute has not established itself in a guarded ivory tower and without contact or collaboration with others. One of its aims is continued cooperation and even coordinated activity or a suitable degree of integration with other engineering and scientific organizations. Wherever the IRE could help in the organization, operation, or publication activities of conventions, conferences, or symposia in collaboration with other engineering societies of standing, it has done so unhesitatingly and, at times, with considerable sacrifice. Since the establishment of the IRE Professional Groups, this type of cooperation has been greatly broadened. In fact, the roster of joint meetings or the like in which the IRE is engaged is almost startling in its dimensions.

One very important aspect of The Institute of Radio Engineers is its international nature, prescribed by its charter and consistently carried out in its activities. It has been said that science knows no country and that truth is universal. Such fields as communications and electronics are peculiarly adapted to the application of such doctrines, to the utmost practical limits.

Speaking more lightly, the techniques of communications and electronics might even make it logical that the scope of the IRE should ultimately become cosmic. We might look forward to the establishment of lunar and planetary Regions and Sections of the Institute in due course. And after that, who knows? But who would dare place finite limitations on the activities and studies which reach outward with the speed of light toward the infinite?

It may not be amiss also to emphasize that The Institute of Radio Engineers has sought and achieved a unique form of leadership in its dedicated field. In the world there are indeed many types of leadership. Some men, political parties, or nations maintain important positions of power or influence by brute force and iron discipline. Some organizations hold their eminence through guile, subtle persuasion, empty promises, or deceptive practices. But The Institute of Radio Engineers, the mental child and professional expression of its membership, holds its leadership only by service and accomplishment. Its sole aim is ever to give more to humanity and to its members. Its accomplishments require little recital or egotistical praise. They speak for themselves, and win hearty approval of all candid observers.

Thus the Institute will remain as a symbol of an epoch—the age of the approaching welfare, comfort, and health of every man on earth, and of man's conquest of space. And so, in the spirit of selfless aspirations to serve the interests of the people of the world and to express the best professional aims and accomplishments of its membership, The Institute of Radio Engineers looks forward through the decades and centuries toward ever wider, more useful, and more enlightening accomplishments.

Centennial perspective

by Ian M. Ross

The IEEE celebrates its Centennial in a world that has become much smaller in the last 100 years. But the technological revolution responsible for this change has only begun.

Advances in telecommunications have altered society's notions of time and space forever. In 1884, those without service from the fledgling telephone company were quite willing to accept overnight delivery of a telegram, while today we drum our fingers impatiently when faced with a brief delay in getting a dial tone. In 1884, a New Yorker could telephone Boston but could not yet call Philadelphia, whereas today we can dial directly from New York to Tokyo as easily as from Manhattan to Brooklyn.

This remarkable progress has been driven by technology, by the work of dedicated scientists and engineers. Much credit accrues to the contributions of electrical and electronics engineers. They, probably more than any other group, have been the creators and architects of a worldwide system of instantaneous telecommunications.

In the last 100 years, we have come very close to realizing a dream that AT&T's founders had of connecting every city and town in the United States with the rest of the "known world." Given the state of electrical communications technology then, that was a rather ambitious goal—some might say a brazen one. But the goal setters had faith that the intelligence, competence, and drive of the professional engineer would overcome the obstacles.

Now that universal telephone service has been achieved in this and many other nations, we must set our goals even higher. We must plan and work toward those capabilities that will make data and video communication as available and usable as telephone communication.

In doing so, we will redefine the communications industry and its requirements. We must not only transmit enormous amounts of information rapidly, but process and present it in a manner that makes it most useful for people. Also, we must devise the hardware and software to make computers more responsive to humans. We must, for example, develop computers that understand oral instructions with tolerance for individual differences in pronunciation, syntax, and organization. We must use them to free human intelligence and talents to work at optimum levels.

Once again, it will be the product of the engineer and the scientist that will make these goals achievable. Continuing advances in microelectronics and photonics are beginning to make such Information Age goals economically and technically feasible. Today we can put more than a half-million components on a fingernail-size chip. And the equivalent cost of a transistor is less than one-hundredth of a cent—a thousandfold cheaper than the cost of a quality transistor 20 years ago. There is no question that we will soon surpass a million components on a chip and ultimately reach 100 million. Even a billion-component chip may be a physical possibility within a few decades.

These advances, coupled with the enormous transmission power of lightwave communications, promise to add a new dimension to human communications and the expansion and transfer of knowledge. Both the rate at which information can be sent through light-guide fibers and the distance the information can travel without amplification have increased dramatically. In fact, the product of rate and distance is doubling yearly—and probably will continue for the rest of the decade.

As a result of such advances, the benefits to education, medicine, business, and science of a world girded by the most up-to-date, rapid, and sophisticated communications and information-management systems are innumerable. Certainly they will have a profound influence on political, economic, and social activity. They will just as certainly change society in ways that cannot be foreseen. To some extent we will enter this era on faith, not sure where it will lead, but ready to control it, change it, or adapt it so that the outcome is favorable.

Bringing a new dimension to international communications will be vital to this era. It will also present a new challenge to the engineering profession, perhaps the greatest ever confronted—that of designing an international system of fully compatible networks. To accomplish this, global standards must be set. Unfortunately, standards can be used as barriers, perhaps providing some initial advantages but inhibiting real technological and economic progress. All nations should take an enlightened and positive approach toward achieving a balance between competition and cooperation in advancing telecommunications.

We must also work to maintain an open exchange of scientific and technological information. In view of the increasing convergence of communication and information management in a highly competitive and politically fragmented world, this is going to be a major challenge for us all.

Those of us in the electrical and electronics engineering profession are ultimately the stewards of the Information Age. We must use our understanding of the technological issues and our influence to ensure that the potential benefits of this era are fully realized. We have come too far in these 100 years and done too well to fall short of that objective now.

Ian M. Ross is president of AT&T Bell Laboratories and a member of the IEEE Honorary Centennial Committee.

One Hundred Years of Service

THIS issue of the IRE TRANSACTIONS ON MILITARY ELECTRONICS is devoted entirely to the U. S. Army Signal Corps in recognition of its centennial anniversary of service to the nation. Selected articles within these pages will give the reader an appreciation of some of the Corps' brilliant history as well as its approach to the solution of current scientific problems.

This centennial anniversary brackets a hundred-year segment of colorful and fast-moving military history. It has been a period of singular extensions of science as applied to the battlefield. Notable among them have been advances in all three essential elements of military operations: firepower, mobility, and communications.

The history of progress in military electronics has been a history of cooperative enterprise. In a series of instances, advances by industry have applied directly to the battlefield; in others, military need has sparked creative invention that led to wholly new products in industry. Throughout the century, the progress of one has extended the progress of the other. Today, such joint effort, spanning all aspects of technology, lies at the base of our national military strength.

While the Army Signal Corps' 100th anniversary marks a past period of progress, it also marks the entrance of the Corps into a future of far greater challenge. This future begins in an era when a single advance in technology is exerting more impact on military science than any other event in the history of warfare—the development and control of nuclear reactions that can readily be applied to battlefield weapons. Their impact on tactics, and in turn upon the sciences fitted to their support, is far-reaching, especially in communications-electronics. We see versatile nuclear weapons capable of dominating the battlefield of the future and introducing the greatest firepower increase in history, yet requiring a proportionate increase in mobility for ground combat. As a result of the advances in missile science, we have a new artillery capable of unprecedented destruction at great ranges, with both sides in combat being capable of massive blows delivered with great flexibility.

Preparedness in the nuclear field, however, does not necessarily forecast that all engagements of the future will see the use of these weapons. Indeed, many types of military operations may be conducted without them. The decisions as to these matters will be made at the highest levels and will be based on national objectives and national policy for the particular case in hand. The preparation for possible future combat, therefore, demands development of a state of readiness covering a wide variety of situations and circumstances.

Fitted to such varying tactical situations are the Army's new organizational concepts which are keyed to the application of graduated force, and have the dual capability for conventional combat, or for hard-hitting application of nuclear weapons. But their proper functioning in combat presents one of the greatest communications-electronics challenges in history. Consider the necessarily wide dispersal of troops of both sides on the battlefield. When a situation arises that can be exploited, commanders must not only get the facts quickly, and often from a distance, as the situation develops, but must be able to process and disseminate their decisions to all elements in a timely fashion. A rapid and reliable battlefield-information process, together with fast and precise command control over units widely dispersed across the combat area, are indispensable partners to future success in ground combat.

Among the key scientific systems needed for the modern army, therefore, is one of combat area surveillance for information on enemy movement and for the location of timely targets this movement presents. Its system concepts and indeed the development of many of its components are well under way, spanning an array of sensory means including radar, infrared, photographic, visual, acoustic, seismic, radiometric and meteorological devices.

Army communications systems serving the dual needs of conventional or nuclear combat emphasize three characteristics to a greater degree than in the past: they must provide a greatly increased communications capacity per military unit; they must span greater distances; and they must possess a high degree of systems interconnectivity.

To support these greater communications-electronics needs, all of us must probe into extended uses of the science, for example, into space vehicles for communications and combat surveillance purposes, messenger drones as ground-directed relay points, and even into the creation of artificial ionospheres as short-time conveyors of military intelligence. Added to these are perhaps a dozen more approaches toward an increase in communications capacity. As history repeats, their solution will come through the joint imagination and teamwork of industrial and service laboratories; and again this solution will both strengthen the national security, and pay substantial dividends through civilian application to the nation as a whole.

The Army Signal Corps joins with its colleagues of the IRE, industry, and the other military services in attacking the scientific problems of military electronics. It is the Corps' proud hope that its second century of existence will provide even greater opportunities for service to the nation.

COL. HAROLD MCD. BROWN, *Guest Editor*

September 1976 Vol. 64 No.

PROCEEDINGS OF THE IEEE

Scanning the Issue

SPECIAL ISSUE ON TWO CENTURIES IN RETROSPECT

Matters in electrical science and engineering were not always as they are now. Our first sources, batteries and machines, had to be conceived, systems had to be developed in which the sources could operate efficiently, and the ac-dc controversy had to be resolved. The telephone was almost not invented, so eager were the entrepreneurs to expand the capabilities of the telegraph.

Steinmetz, Kennelly, and Pupin had to carry on a lengthy campaign of education in the pages of the *AIEE Transactions*, that the "electricians" of the early days might improve their abilities in mathematical understanding, in order to design and build the components of the advancing and enlarging systems. Analysis of the ac system did not arrive full-feathered—the sine wave was not a fortuitous result of the ac system, since Fourier analysis was not a common skill of the early members of the profession. The intricacies of inductance had to be explored—even the name "reactance" was debated—and the use of complex algebra and j was long fought for before the proponents of the useful but unwieldy vector diagram were overcome.

The hard work that went into the electrical field's early development should be a source of pride to those in the profession today. But to derive that sense of pride we must have knowledge of that early history. Thus we have the IEEE History Committee's mission to seek for and disseminate historical knowledge, exemplified by this Special Bicentennial-Year Issue, devoted to the general theme of the history of electrical science and engineering in the U.S.

However this Special Issue has not been executed in the traditional anniversary-issue style and format. The issue represents, in fact, an unusual—if not unprecedented—experiment by an engineering journal in that over half the papers are contributions from historians rather than from engineers. That this experiment in intercultural collaboration could be undertaken at all was the result of a singular conjunction of circumstances and personalities that itself might someday be studied by historians.

In planning the issue, the Guest Editors made a deliberate decision to avoid the chimerical goal of a comprehensive coverage of every facet of electrical history, even in the United States, over the past two hundred years. Instead, we adopted the strategy of inviting some leading electrical historians to write on topics that were in their field of special interest and competence. Somewhat surprisingly, we found that the resulting collection of papers revealed numerous linkages and a relatively broad coverage. From the editors' perspective, the papers in this issue provide a reasonably good summary of the current state of the field in electrical history, showing both its strengths and weaknesses. We believe it should not be surprising to find large gaps of knowledge when one considers the enormous disparity in the numbers of professionally trained historians and professional engineers, and the even greater disparity of support of research in the two fields. This Special Issue should, therefore, be viewed as more of a demonstration of needs and opportunities for historical research than as a definitive work.

The Editors are convinced that more effective communication between humanists and engineers is possible and should be encouraged. Too often historians of technology seem to have communicated mainly with other historians, and engineers with other engineers. Engineers traditionally have been taught to be forward-looking and agents of change rather than to be contemplative, with pride and knowledge of their professional heritage. Yet, as Lynn White pointed out in an essay entitled "Engineers and the Making of a New Humanism," one characteristic of a mature profession is a conscious appreciation of its history. That contemplative historian–engineers can contribute to the writing of engineering history as well as to its appreciation is demonstrated by a number of papers in this issue. These engineers who are authors of these papers have profited from their privileged perspective as participants in the activities described, and their accounts are enriched by personal reminiscences. The professional historians have demonstrated the value of seeking a variety of sources, including unpublished manuscripts and oral interviews. Their contributions in this issue also show that historical "facts" are often difficult to ascertain and do not speak for themselves but require informed interpretation.

Some recent events suggest that electrical history may be approaching the "invisible college" status that seems always to precede the emergence of a new scholarly discipline. Sessions on electrical history were held at the annual meetings

of the Society for the History of Technology (SHOT) in 1970, 1972 and 1974. The "Jovians," a group of members of SHOT who share an interest and enthusiasm for electrical history, have held meetings during the SHOT convention each year since 1971. A number of the Jovians have contributed to this issue. An electrical history archive was established by the Smithsonian Institution in 1973, with some financial support by the IEEE Life Member Fund (LMF) arranged by the IEEE History Committee. An LMF grant also was instrumental in the compilation and publication of a guide to manuscripts relating to electrical history by the Smithsonian's Division of Electricity in 1974. This was compiled by David Hounshell, who is among the contributors to this issue. The LMF and IEEE History Committee have also sponsored development of several slide presentations on electrical history and a forthcoming directory of electrical museums and artifact collections. The artifact directory was compiled by Robert Belfield, also a contributor to this issue. Both the directory and slide collections will be distributed by the Smithsonian Division of Electricity. An archive documenting the growth of physics and electrical engineering in the western United States was established at the Bancroft Library of the University of California, Berkeley, in 1973. The project coordinator at the Bancroft Library is A. L. Norberg, who has written a paper for this issue in which he has drawn on the collections of this important project.

Perhaps the most significant development for the future increase and diffusion of knowledge in electrical history is a recently announced agreement between the IEEE History Committee and the Administrative Committee of the Education Group. This agreement provides for regular publication of electrical history papers in the *IEEE Transactions on Education* and appointment of an Associate Editor for History. All IEEE members who have or who would like to develop an interest in the history of their profession and its founders are encouraged to join the Education Group and to contribute manuscripts for consideration.

J. D. RYDER
J. E. BRITTAIN
Guest Editors

II

CENTENNIAL AWARD WINNERS

IEEE REGION 1 AWARD

JOHN G. NORDAHL

Electrical Engineer/Manager-Retired
40 Riverside Avenue
Red Bank, NJ

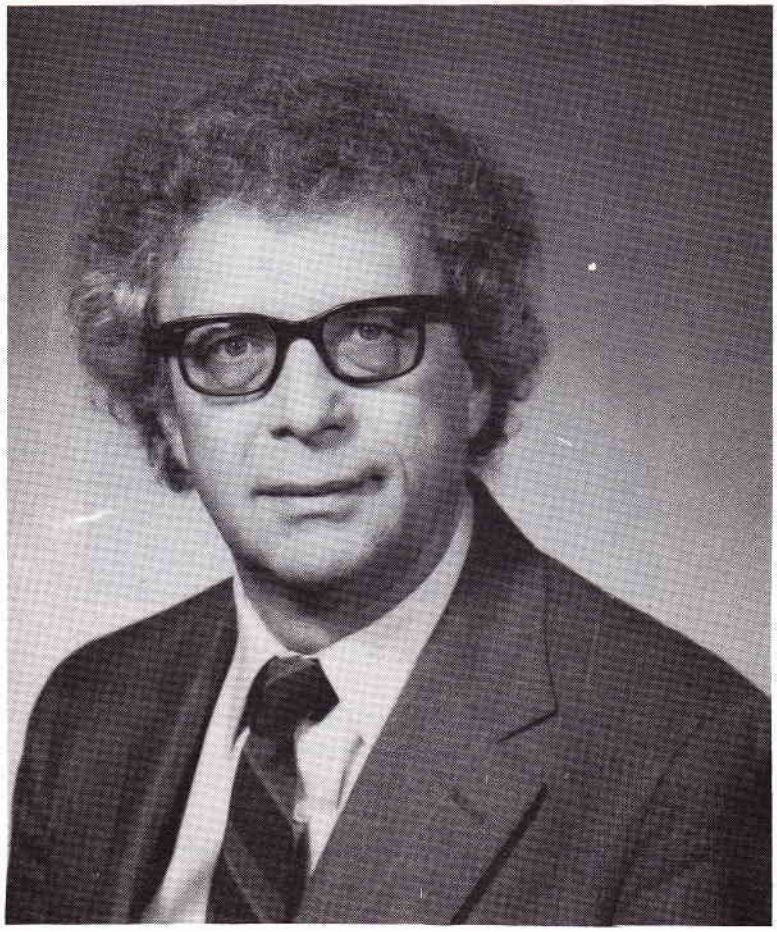
An outstanding career in engineering management which he has extended well into retirement by accepting voluntary and part-time assignments to solve local and national problems.

Nordahl holds a BS in EE from the University of Washington and did graduate work at Columbia University. He is a member of Tau Beta Pi, is a licensed Professional Engineer, and is a Senior Life Member of the IEEE.

Nordahl's career was with the Bell Telephone Laboratories from 1925 to 1968, where developed radio transmitters managed a production group at Western Electric, and directed aspects of the Nike Zeus anti-ICBM program. He was instrumental in selecting and setting up the Nike Zeus test range on Kwajalein Island. Later he managed the "Value Engineering" for this program, leading to outstanding cost savings.

Especially noteworthy have been his volunteer and part-time contributions,following his retirement. He served as manager for the Federal Emergency Management Agency in disaster areas and as a counselor for the Service Core of Retired Executives (SCORE) in Monmouth County.

IEEE REGION 1 CENTENNIAL AWARD
and
NJ COAST SECTION CENTENNIAL AWARD



MARTIN V. SCHNEIDER

Research Supervisor
Radio Physics Research Department
Bell Laboratories, Holmdel, NJ

FOR

Outstanding record on contributions and related publications in the fields of semiconductor devices and thin film circuits at microwave millimeter-wave and optical frequencies.

Long service to the IEEE, including Joint Group Chapter Chairperson MTT, ED & QFA, NJ Coast Section IEEE, 1982/83. Initiator of tri-chapter meetings held jointly with North Jersey and Princeton MTT Group Chapters at Rutgers University. Initiated foundation of the Swiss and Scandinavian IEEE-MIT Group Chapters.

NJ COAST SECTION CENTENNIAL AWARD

ROBERT C. ECKENFELDER

Director of Engineering
Bendix Electric Power Division
Eatontown, NJ

A recognized authority in the application of solid-state circuit designs, Eckenfelder has contributed to the development of scores of electric power systems used in both military and commercial aircraft. He designed the first transistorized AC voltage regulator to be used in aircraft; and managed a number of important electric power system programs for such applications as the U.S. Air Force B52-G, Boeing 747, NASA's highly successful Orbiting Astronomical Observatory, and the recent Gulfstream Aerospace GIII. This latter system is the latest state-of-the-art Variable Speed Constant Frequency (VSCF) System, the first ever to be used in commercial/business jet aircraft.

Eckenfelder is a 1954 graduate of New York University, holding a B. S. in Engineering Physics, and has attended graduate school at City College of New York. He holds a number of patents in control systems and power conversion equipment. Of recent significance is a patent entitled "Polyphase Transformer for a Variable Speed, Constant Frequency System", co-invented with R. Kautz; and a patent entitled "DV/DT Circuit for Use in DC Link Converters", co-invented with L. Bourgeault and R. Kautz.

A member of the IEEE, U. S. Navy League and the American Defense Preparedness Association, Eckenfelder has served as a board member and engineering curricula advisor at Monmouth College.

NJ COAST CENTENNIAL AWARD

A. GARDNER FOX

Head, Radio Systems Research Department
Crawford Hill Laboratory
ATT-Bell Laboratories
Holmdel, NJ

FOR

Outstanding contributions to the Microwave Art including many microwave advancements and authoring chapters in noteworthy texts such as George Southworth's "Principles and Applications of Waveguide Transmission".

As head of the Radio System Research Department at the Crawford Hill Laboratory, he generated many publications for the IEEE and earned 53 patents. He has received the Microwave Career Award of the IEEE Quantum Electronics Society in 1978, the IEEE Fellow Award in 1956 as well as the David Sarnoff Award in 1979.

NJ COAST CENTENNIAL AWARD

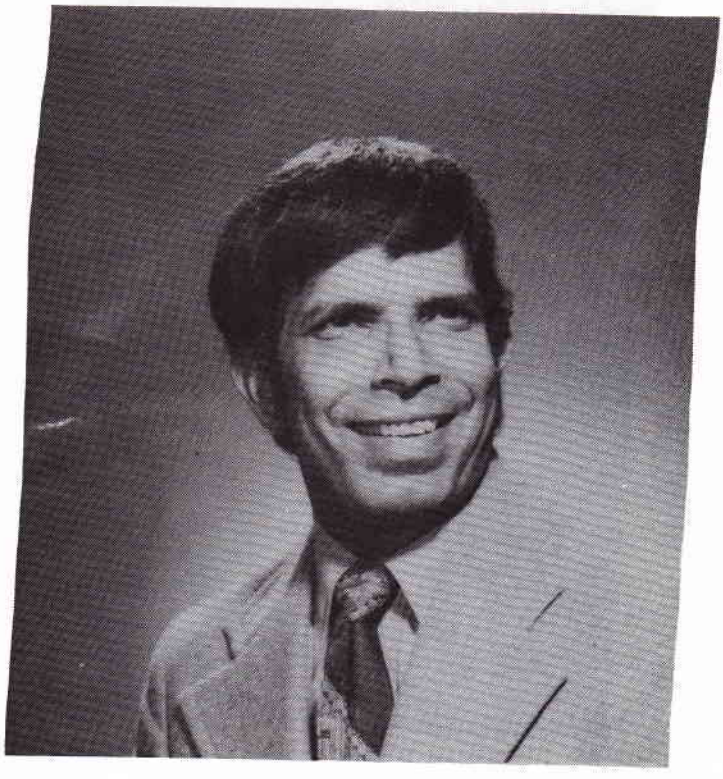
BRUCE C. MILLER

Chief Electromagnetic Vulnerability and
Electronic Counter-Counter Measures (ECCM) Division
Electronic Warfare Laboratory
Fort Monmouth, NJ

FOR

Service to the Government as leader and engineer in the field of electronic defense. Numerous contributions in the areas of vulnerability/ECCM for avionics systems, electromagnetic compatibility, and electromagnetic interference control techniques.

NJ COAST SECTION CENTENNIAL AWARD



VASANT K. PRABHU

Distinguished Member of Technical Staff
Bell Laboratories
West Long Branch, NJ

FOR

Outstanding record on contributions and related publications in the fields of digital modulation, phase shift keying systems and error rate analysis.

Service to the IEEE as NJ Coast Section Chairperson 1974-75 and Associate Editor of the IEEE Transactions on Communications 1976-1979.

NJ COAST SECTION CENTENNIAL AWARD

LUKE G. SCHIMPF

Retired, 1984; ATT-Bell Laboratories
West Long Branch, NJ

Over a career at Bell Labs which has spanned 4-1/2 decades, Luke Schimpf has contributed significantly to a number of communication disciplines, notably radio paging, telephone transmission and mobile telephone. From the battlefields of Africa (World War II) to the radio research laboratory, Luke has never lost his inquisitiveness and his ability to take a job from the idea stage to the working system. In particular, Luke is recognized in the industry as a pioneer in the concept of radio paging which keeps millions of subscribers within reach of their secretaries while away from the office.

An indication of the scope of Luke's contributions are his 13 patents and many papers, principally in the field of mobile telephony.

As Luke nears 70 years of age, he continues to set an example for his younger colleagues in dedication to the cause of efficient, economical and ubiquitious communication.

NJ COAST SECTION CENTENNIAL AWARD

ROBERT W. WILSON

Head Radio Physics Research Department
Bell Laboratories
Holmdel, NJ

Discovered the microwave cosmic background radiation of 3K with the Echo/Telstar hornreflector antenna stationed at Crawford Hill in Holmdel, NJ.

Wilson is one of the few Laureates who has continued working at the bench after receiving the Nobel Prize in Physics in 1978. His experimental work has led to new discoveries in the fields of star formation and giant molecular clouds in our Galaxy.

NJ COAST SECTION CENTENNIAL AWARD

MARY N. YOUSSEF

Associate Professor, Department of Statistics
and Computer Information Systems
City University of New York, NY

1. Switching System Design - Youssef solved one of the most difficult and persistent problems in the area of switching. She defined and developed optimal design rules for interconnecting the outlets of a switching system to the serving trunks. These rules are now implemented throughout the Bell System.

2. Forecasting Methods - She developed an interactive computer system for model building and forecasting of telephone usage demand and formulated improved and useful methods for projecting telecommunication requirements.

3. Performance Evaluation of Systems and Networks - Mary devised and implemented numerous large scale simulators for evaluating system and network performance in the Bell System. Her simulators are widely used by AT&T and the Operating Companies. She also developed useful analytical methods for estimating the carrying capacities and blocking probabilities of systems.

4. Teaching in Academia - Professor Youssef is highly respected and admired as a first rate teacher and researcher by her faculty and students at the City University of New York. In addition to her teaching responsibilities she conducts master thesis seminars and supervises most of the graduate students in the Department.

5. Services to the IEEE - Dr. Youssef has served as a reviewer of technical papers for IEEE sponsored conferences (National Telecommunication Conference, NTC, and International Communication Conference, ITC). She gave a course on "Local Area Networks" for the NJ Coast Section IEEE and the Group Chapters on Computers, MTT, ED & QAE. This course was the best attended and presented lecture of the whole 1982-83 seminar series sponsored by the IEEE Section and its Group Chapters.

III

IEEE

MAJOR AWARD WINNERS

HARALD T. FRIIS

- Morris N. Liebmann Memorial Award - 1939
- IRE Medal of Honor - 1955
- Mervin J. Kelly Award - 1964

Moving Spirit of the "Old" Holmdel

Early in 1920, before Bell Laboratories was formed, a young man who had arrived in the United States a year earlier from Denmark was sent by his employer, Western Electric, to work in a small shack in Elberon, New Jersey. His desk consisted of a board over two packing cases and his job was to study and measure radio reception from ships.

From that day on, Harald Friis made a fair amount of history in radio research. He, and later a group that worked under his leadership, moved soon to a laboratory at nearby Cliffwood and later to Holmdel. There, at the "old" Holmdel lab, long before Bell Laboratories built a major installation in the same neighborhood, Friis and his associates set the course of major developments in radiotelephony, first in shortwave and later in microwave systems.

Friis had no sooner set foot in Elberon than he devised significant circuit improvements in the equipment he was to work with there. A couple of years later he produced, on hurry-up notice, the first superheterodyne broadcast radio receiver—the forerunner, actually, of present-day sets. Then followed, in succession, a receiver that would automatically compensate for fading signals, a more directional antenna, and methods for measuring static and measuring shortwave signals as they faded. It was an antenna designed by Friis that Karl Jansky was using when he discovered the "star noise" that led to the science of radio astronomy (see page 107). In a memoir Friis wrote years later, after he had retired, he remarked, "Note that the inventions always originated because of a definite need."

The rhombic antenna, designed by Friis and Edmond Bruce,

found worldwide use in shortwave radiotelephony, which could hardly have been the same without it. Another system called MUSA (Multiple Unit Steerable Antenna) was not practical for general use but made it possible, in Friis' words, to unravel the phenomena of shortwave transmission. As has also been pointed out, electronically steerable antennas have recently become important in ballistic missile defense systems.

Moving on from shortwaves to microwaves, Friis and another associate, A. C. Beck, created the horn-reflector antenna now seen everywhere on microwave relay towers; and the Holmdel group as a whole investigated all aspects of microwave systems. By the time World War II started, in fact, they were quite prepared to go ahead with microwave transmission, for which the major components were by that time available. So it was that in 1947, soon after the war ended, AT&T was able to place the first experimental microwave relay system in operation.

Friis himself has said that his formula for radio transmission in free space, evolved in the 1930's but first published after World War II,* is his most important contribution. "This formula," his memoir says, "is used in designing the microwave communication system that now covers all of the U.S.A. The adjective simple has been applied several times, but the problems were actually not so simple before they had been solved."

Others have emphasized other aspects of Friis' strength. Ralph Bown, who was vice president for research at Bell Laboratories for several years, once said that Friis' notes told more about the conduct of research than all the books printed on the subject. John Pierce had the notes privately published under the title, "The Wisdom of Harald Friis," and added some interpretive comments of his own based on discussion with Friis. There is room here for just a few of the many ideas Friis brought together.

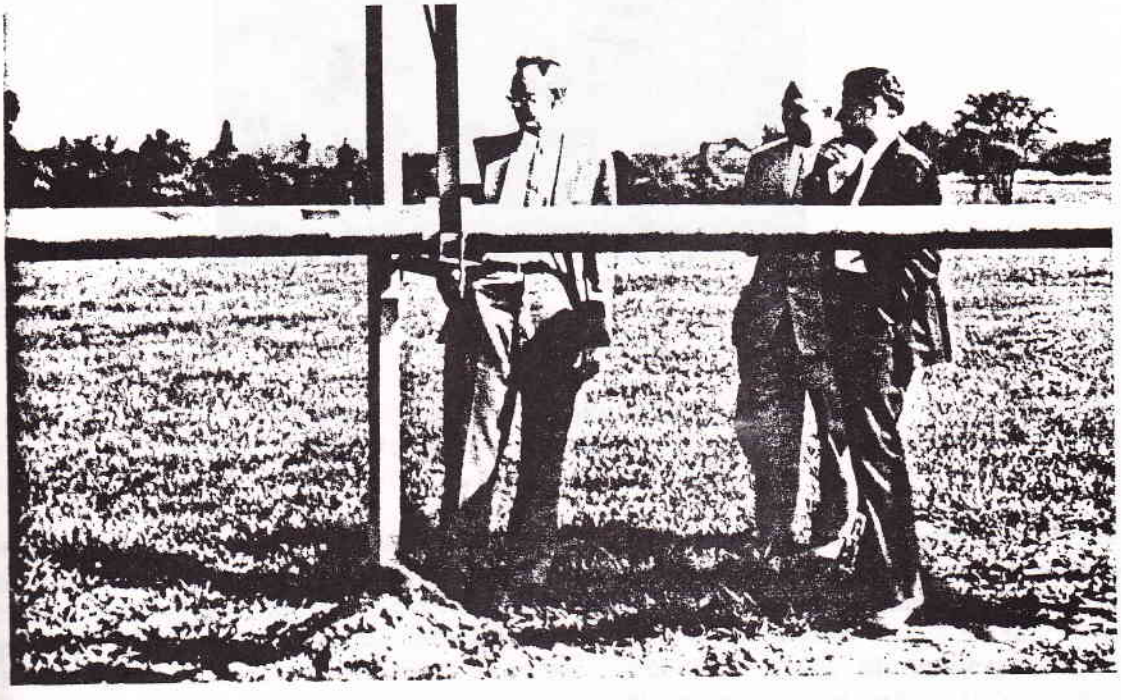
While big research projects might have to start with "the boss," he said, it is much better on small jobs to have the initiative come from the research worker. The boss's function is to help a

---

*"A Note on a Simple Transmission Formula," *Proceedings of the IRE*, Vol. 34 (May, 1946), pp. 254-6.

man do some clearly defined, worthwhile thing. The worker should be sure there is a real need and that the state of the art is ready for his effort. And if he is the right man for the job, it should haunt him day and night. If the importance of the job has decreased with time, or results are meager, it should be stopped.

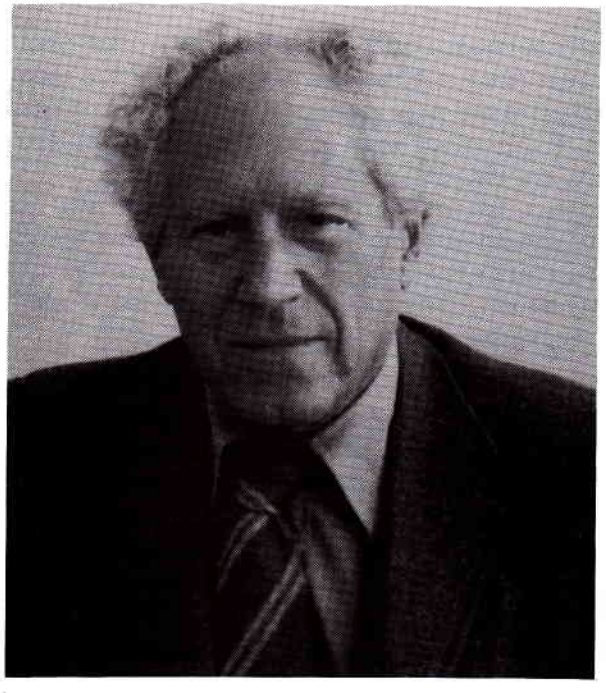
One more thought, at the end of Friis' notes, can also end this sketch. The worker should remember, he said, that some credit belongs to the laboratory employing him; and in discussion with Pierce he modestly added, "The fact that I was planted in the Labs, and all the background, that was everything, John."



Friis (second from left) discusses an experimental circular waveguide with Bell Laboratories executives Ralph Bown (left) and Mervin J. Kelly in 1948.

R. Kompfner

David Sarnoff Award - 1960
IEEE Medal of Honor - 1973



RUDOLF KOMPFNER

Inventor of the Traveling Wave Tube
IEEE Medal of Honor 1973
David Sarnoff Award 1960

Rudolf Kompfner has been awarded the 1973 IEEE Medal of Honor, the highest honor awarded to an individual by IEEE "for a major contribution to world-wide communication through the conception of the traveling wave tube embodying a new principle of amplification." A native of Vienna, Austria, Dr. Kompfner received the degree of Diplom-Ingenieur in 1933. He practiced architecture in London, England, till 1941 pursuing physics and radio engineering as a hobby. Physics and radio engineering became his main profession when the British Admiralty offered him a position in 1941 under Professor M. L. Oliphant at Birmingham University. It was at Birmingham University that Dr. Kompfner invented the traveling wave tube (1943). From 1944 he worked for the various British government institutions, including University of Oxford, where he received the D.Phil degree in 1951. Projects "Echo" and TELSTAR were carried out under his general direction at Bell Laboratories. He was named Director of Electronics Research in 1955, Director of Electronics and Radio Research in 1957 and assumed his present position of Associate Executive Director, Research, Communication Sciences Division in 1962. He is the recipient of the 1955 Duddell Medal of the Physical Society of England. Also he was awarded the David Sarnoff Award by the American Institute of Electrical Engineers in 1960 for creative achievements and leadership in the field of Research and Development. Also in 1960 he received the Stuart Ballantine Medal of the Franklin Institute. Dr. Kompfner is a Fellow of the IEEE and a member of the National Academy of Engineering and the National Academy of Sciences.

ALEXANDER GRAHAM BELL MEDAL

The principal award for exceptional contributions to the advancement of telecommunications.

AMOS E. JOEL, JR.

1976

Mr. Joel was co-recipient in 1976 of the IEEE Alexander Graham Bell Medal for "the conception and development of electronic switching systems and their effective introduction into a nationwide telephone system." He shares the medal with W. Keister and R. W. Ketchledge.

He is a switching consultant at Bell Labs in Holmdel, NJ. His work currently centers on surveys and evaluations of new telephone switching systems developments in the United States and abroad.

Mr. Joel joined Bell Labs in 1940. He worked initially on fundamental development studies of telephone switching systems. During World War II, he designed circuits for early general-purpose digital computers and was instrumental in developing secret-message coding and decoding machines for military and diplomatic use. Following the war, he proposed, prepared, and taught a Bell System course on switching system and circuit design. Later, he was involved in the design of automatic message accounting equipment to automate telephone billing, and in fundamental engineering studies of electronic switching systems.

A pioneer in ESS development work, from 1952 to 1961 Mr. Joel supervised development planning for the Bell System's first electronic telephone switching systems and helped prove the concept of electronic switching for use in the nationwide network. From 1961 to 1967, he was responsible for the development of the Traffic Service Position System, used to automate the work of telephone operators, and the Automatic Intercept System, used to automatically handle calls to nonworking numbers. Both systems are in service throughout the nation.

Mr. Joel received bachelor's and master's degrees in electrical engineering from the Massachusetts Institute of Technology.

ALEXANDER GRAHAM BELL MEDAL

The principal award for exceptional contributions to the advancement of telecommunications.

John Mayo *M. Robert Aaron* *Eric Sumner*

1978

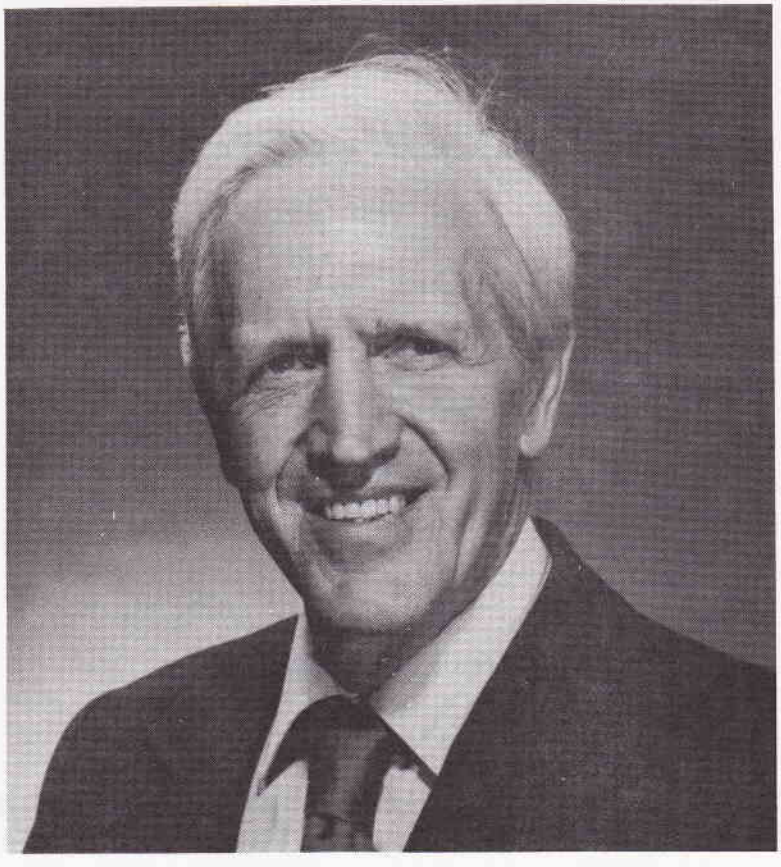
Mr. Robert Aaron has been elected as a co-recipient of the 1978 Alexander Graham Bell Medal for personal contributions to, and leadership in, the practical realization of high-speed digital communications. He shares the medal with J. S. Mayo and E. E. Summer.

Mr. Aaron joined Bell Laboratories in 1951 after receiving the BS (1949) and MS (1951) in Electrical Engineering from the University of Pennsylvania. He is head of the Digital Techniques Department working on exploratory development of digital signal processing terminals and techniques. Since joining Bell Laboratories, he made numerous contributions to various areas, such as computer aided design, submarine cable system, and the TI carrier system.

He is a Fellow of IEEE and the American Association for the Advancement of Science.

EDISON MEDAL

For a career of meritorious achievement in the electrical sciences



C. CHAPIN CUTLER

1981

JOHN R. PIERCE

1963

(See TELSTAR)

HARRY DIAMOND MEMORIAL AWARD

For outstanding technical contributions in the field of government service.

MARCEL J. E. GOLAY

1951

HAROLD ZAHL

1954

GEORG J. E. GOUBAU

1957

HELMUT L. BRUECKMANN

1961

JOHN J. EGLI

1966

HAROLD JACOBS

1973

HARRY DIAMOND AWARD

HAROLD A. ZAHL

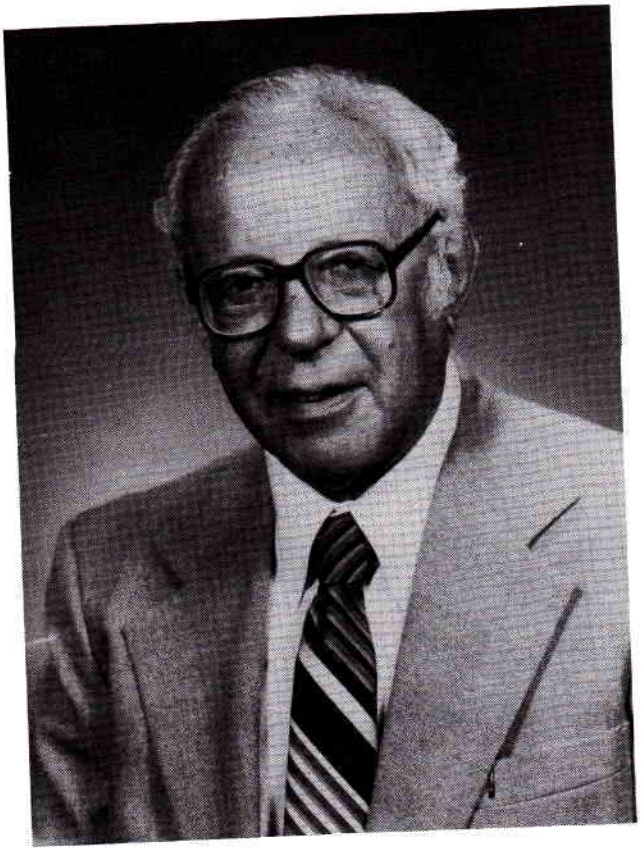
1954

Received the B.S. degree from North Central College, Naperville, IL, in 1927, the M.S. degree in 1929 and the Ph. D. degree in physics in 1931 from the State University of Iowa, Iowa City.

From 1927 to 1931 he was a research assistant at Iowa. In 1931 he became a research physicist at the U.S. Army Signal Research and Development Laboratory in Fort Monmouth, NJ, where he was director of research until 1948. From 1942 to 1946, he was an officer in the Signal Corps, and as a Lieutenant Colonel was involved in the work with the Bikini Atomic Tests in 1946. In the same year, he received the Legion of Merit. He authored 50 technical publications in the fields of molecular and atomic physics, xrays, acoustics, thermodynamics, and astroelectronics. He had patents issued for work in radar, communications, electron tubes, infrared and aircraft instruments.

Dr. Zahl was a Fellow of the American Physical Society and in 1971, received the National Honor Award of the Armed Forces Communications and Electronics Association.

HARRY DIAMOND AWARD



HAROLD JACOBS

1973

Harold Jacobs received the 1973 Harry Diamond Award "for identification of new bulk semiconductor effects at millimeter waves, with application to the fields of imaging and surveillance." Dr. Jacobs passed away on December 24, 1983 and is sorely missed.

A native of Portchester, NY, Dr. Jacobs was a senior research scientist in the Electronics Technology and Devices laboratory of the U.S. Army Electronics Command, Fort Monmouth, NJ. He joined the USAEC in 1949 after serving as a physicist at RCA Manufacturing Company and Sylvania Electric Corporation. He was also active in engineering education having served part time on the faculty of Polytechnic Institute of Brooklyn and was chairman and professor in the Electronic Engineering Department of Monmouth College. He has worked in the fields of electron tubes, solid state devices, quantum electronics, millimeter waves devices and systems, and submillimeter wave lasers. He received the B.A. degree from Johns Hopkins University and the Ph. D. degree from New York University in 1945. Dr. Jacobs was elected a Fellow of the IEEE in 1967. He was given the Decoration for Exceptional Civilian Service by the Department of the Army in April of 1969 for his work on advancing the field of semiconductor millimeter wave devices and opening new research horizons involving submillimeter wave concepts. He was program chairman for the 4th Department of Defense Conference on Laser Technology in San Diego, CA, in January 1970. He was the Army member of the Special Group on Optical Lasers sponsored by the Department of Defense. He was also Chairman of the Group IV Materials Committee of the IEEE.

MORRIS N. LIEBMANN MEMORIAL AWARD

For important contributions to emerging technologies

STEWART E. MILLER

1972

Stewart E. Miller received the 1972 Morris N. Liebmann Award "for pioneering research in guided millimeter wave and optical transmission systems." Mr. Miller is Director of the Guided Wave Research Laboratory, Bell Laboratories, Holmdel, NJ, where he is concerned with the exploration of the use of lasers and associated devices in transmission. He is an MIT graduate and a Fellow of IEEE.

WILLARD S. BOYLE

1974

(See TELSTAR)

JOHN A. PIERCE - 1953

(See Medal of Honor)

HARALD T. FRIIS - 1939

DAVID SARNOFF AWARD

In recognition of outstanding contributions in the field of electronics

1979

A. GARDNER FOX
TINGYE LI

Distinguished Innovators and Authors

1977

HARRISON E. ROWE
J. M. MANLEY

For "work on the properties of nonlinear devices resulting in the well-known Manley-Rowe Relations."

1975

B. C. DeLOACH

Inventor of the IMPATT Diode

W. R. G. BAKER PRIZE AWARD

For the most outstanding papers reporting original work.

1975

STEWART E. MILLER

TINGYE LI

E. A. J. MARCATELLI

BROWDER J. THOMPSON MEMORIAL PRIZE AWARD

For the most outstanding paper in any IEEE publication
between 1 January and 31 December by any author
or joint authors under thirty years of age

1950

ARTHUR W. RANDALS

Arthur W. Randals received the 1950 Browder J. Thompson Memorial Prize Award jointly with Joseph F. Hull for the paper titled "High-Power Interdigital Magnetrons" in the November 1948 Proceedings of the IRE. This paper records the theory and practice of cavity mode interdigital magnetrons operating at high efficiency and wide tuning ranges for the first time.

Mr. Randals received his B.S. in Physics from Lincoln University in 1941 and held the position of Research Physicist in the Thermionics Branch of the Signal Corps Engineering Laboratory, at Camp Evans in Belmar, NJ. Currently Mr. Randals is an Electronics Engineer in Radar Systems Division of Combat Surveillance and Target Acquisition Laboratory of the ERADCOM, at Evans Area, Belmar, NJ.

Browder J. Thompson, associate research director of the RCA Laboratories was killed in action overseas in 1944 while serving as a consultant to the Secretary of War. He was awarded the President's Certificate of Merit post humously. The memorial prize award was established in 1945 in his honor.

LAMME MEDAL

For meritorious achievement in the development of electrical or electronic apparatus or systems

C. KUMAR N. PATEL

1976

Mr. Patel was born in India where he received his B.E. in Telecommunicaions. After earning an M.S. and Ph. D. from Stanford, he joined Bell Laboratories where in 1970 he became Director of the Electronics Research Laboratory. Dr. Patel was elected a Fellow in the IEEE last year and is also a Fellow in the American Physical Society.

INTERNATIONAL COMMUNICATIONS IN HONOR OF HERNAND AND SOSTHENES BEHN

For outstanding contributions in the field of international communications.

EUGENE F. O'NEILL

1971

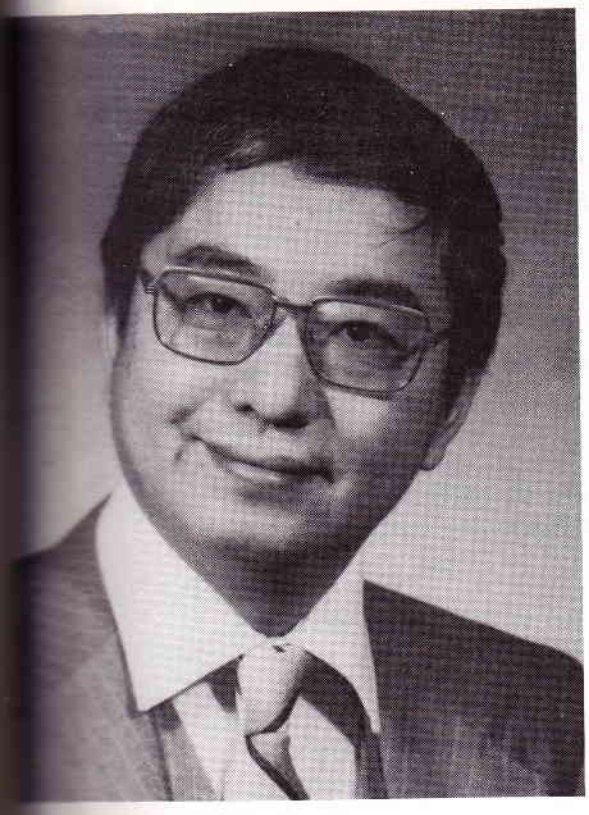
Eugene F. O'Neill has received the 1971 IEEE Award in International Communication "for outstanding technical innovations and management in the development of many key technologies underlying the present day international communication art, especially TELSTAR, the first operational telecommunications satellite, as well as his earlier contributions to transoceanic cable telephony." Mr. O'Neill is Executive Director of the Toll Transmission Division, Bell Laboratories, Holmdel, NJ where he is responsible for all long haul transmission development for the Bell System. His early work was in the development of radar, coaxial cable, radio relay and submarine cable systems. Groups under his direction developed the TELSTAR satellites and the satellite ground terminal at Andover, Maine. He is a Columbia graduate, and a Fellow of IEEE.

IV

NJ COAST SECTION

FELLOWS

1984-1928



YU-SHUAN YEH was born in Wu-Kiang, Kiang-Su, China on September 9, 1939. He received the B.S. degree in electrical engineering from the National Taiwan University, Taiwan in 1961; and the M.S. and Ph.D. degrees in electrical engineering from the University of California, Berkeley, California in 1964 and 1966, respectively.

From 1961 to 1962, he was an electronic officer in the Chinese Navy. He was a research assistant at the University of California from 1963 to 1966. From 1966 to 1967, he was a Research Fellow at Harvard University, Cambridge, Massachusetts, doing antenna research. Since September, 1967, he has been a member of the Technical Staff at AT&T Bell Laboratories, Holmdel, New Jersey. His research interests include Digital Modulations, Radio Propagations, Adaptive Antennas and Communication Systems. He is currently a supervisor in the Radio Systems Research Department.

Dr. Yeh published extensively on subjects related to Mobile Radio, Satellite Communication and Digital Radio. He holds 17 patents and is the recipient of two best paper awards from IEEE Transactions.

Newly Elected Fellows — 1984

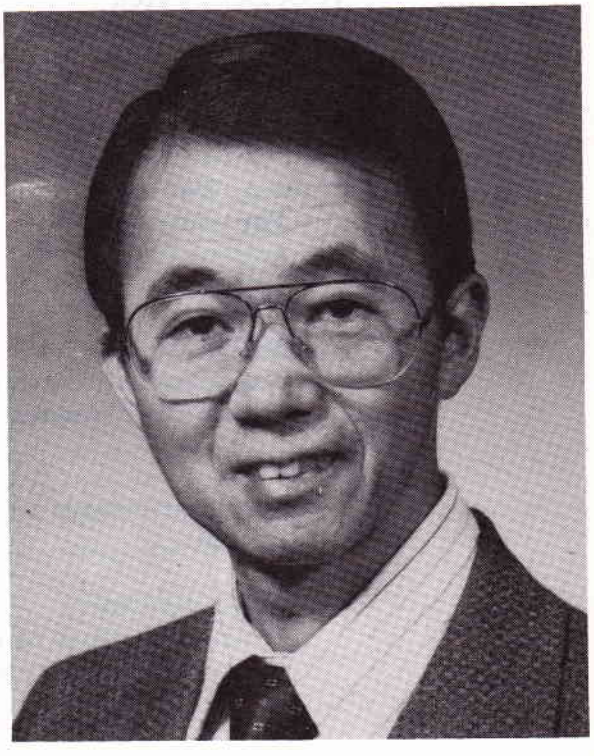
For contributions to advanced communications satellites and high-capacity mobile radio systems.

-PEI LEE was born in Nanking, China, in 1933. He received the degree in electrical engineering from National Taiwan University, Taiwan, China, in 1957; the M.S. degree from the Ohio State University, Columbus, Ohio, in 1959; and the Ph.D. degree from Stanford University, Stanford, California, in 1963.

He joined Bell Laboratories, Reading Pennsylvania, in 1963, where he engaged in the development of microwave semiconductor devices. In October 1966, he was transferred to the Guided Wave Research Laboratory at Crawford Hill, Bell Laboratories, Holmdel, New Jersey. From 1966 to 1968 he had engaged in the research on millimeter wave communication systems. Since 1968 his interest has been in fast optical detectors, semiconductor injection lasers, light-emitting diodes, and optical repeater systems. Recently, his work has been in light sources and photodetectors for applications in the optical fiber communication systems in the 1.0 to 1.6 um wavelength region. He has published over 50 technical papers and several book chapters, and holds five patents in optical semiconductor devices.

Dr. Lee is a member of Sigma Xi, Chinese Institute of Engineers, IEEE and Optical Society of America.

He and his wife Josephine, children Charlottee, Sherry and Daren reside at 5 Marion Drive, Holmdel, New Jersey. They enjoy tennis, swimming, jogging, camping and traveling.



For contributions to semiconductor elements for lightwave communications.

NJ COAST SECTION FELLOWS

1984-1976

Tien-Pei Lee — 1984
For contributions to semiconductor elements for lightwave communications.

Yu-Shuan Yeh
For contributions to advanced communication satellites and high capacity mobile radio systems.

Noach Amitay — 1983
For contributions to design and application of satellite phased arrays

Warren Kesselman
For contributions to EMC and EMI measurement techniques

L. A. Coldren — 1982
For contributions to SAW devices.

V. G. Gelnovatch
For contributions to microwave circuit design

Morton I. Schwarz
For leadership and contributions in fiber optics.

Bruce A. Wooley
For contributions to design of ICs and communications systems.

Arthur Ballato — 1981
For contributions to the theory of piezoelectric crystals and frequency control.

Ira Jacobs
For contributions and leadership in lightwave systems.

Douglas O. Reudink
For contributions to satellite communications and microwave mobile radio systems.

Ta-Shing Chu — 1978
For contributions to dual polarization radio transmission and to propagation of radio and light waves in precipitation.

Erich Hafner
For contributions to the improvement of piezoelectric crystals and frequency control devices.

John O. Limb
For contributions to efficient coding of color and monochrome video signals.

Peter W. Smith
For contributions to tuneable gas lasers

Clyde N. Hardin — 1977
For contributions to, and leadership in, the development of radar and ordinance electronics.

E. R. Kretzmer
For contributions to understanding of video transmission, and for leadership in the development of data communication systems.

D. G. Thomas
For contributions to the understanding of luminescence in semiconductors and to the development of light emitting diodes.

F. D. Waldhauer
For contributions to the development of pulse code modulation systems and design techniques for feedback amplifiers.

Arthur Ashkin — 1976
For contributions to microwaves and lasers.

Gary D. Boyd
For contributions to the field of ultrasonics.

James C. Candy
For contributions on digital coding devices.

Detlef Gloge
For contributions to optical fiber transmission systems.

FELLOW AWARDS

1975 AND PRIOR YEARS

Frederick E. Bond	1974
Frank A. Brand	1967
Charles A. Burrus, Jr.	1974
Roger B. Colton, MG (RET) USA	1946
Arthur B. Crawford	1952
C. Chapin Cutler	1955
George C. Dacey	1964
Fred B. Daniels	1965
Stanley F. Danko	1966
James R. Davey	1966
Edward E. David, Jr.	1962
Owen E. De Lange	1966
Stephen Doba, Jr.	1960
Willie L. Doxey	1964
John J. Egli	1967
Hayden W. Evans	1970
Michael Ference, Jr.	1961
William O. Fleckenstein	1971
A. Gardner Fox	1956
Harald T. Friis	1929
Fritz E. Froehlich	1975
Kenton Garoff	1968
Edward A. Gerber	1958
Marcel J. E. Golay	1960
William M. Goodall	1951
Georg J. E. Goubau	1957
Richard Guenther	1965
Paul G. Hansel	1957
David C. Hogg	1965
Harold Jacobs	1968
William C. Jakes, Jr.	1962
Amos E. Joel, Jr.	1962
Ivan P. Kaminow	1974
John E. Karlin	1965
Herwig Kogelnik	1973
Rudolf Kompfner	1950
Tingye Li	1972
Walter E. Lotz, Jr. LTG (RET) USA	1968

Robert W. Lucky	1972
William A. Malthaner	1962
Enrique A. J. Marcatili	1967
Dietrich Marcuse	1973
William S. Marks	1952
James D. Meindl	1968
Harold F. Meyer	1964
Stewart E. Miller	1958
James D. O'Connell	1957
Eugene F. O'Neill	1969
Arthur A. Oswald	1928
Salvatore E. Petrillo	1956
John R. Pierce	1948
Bernard Reich	1973
Irving Reingold	1975
Douglas H. Ring	1966
Aldred W. Rogers	1960
Ian M. Ross	1966
Harrison E. Rowe	1971
Clyde L. Ruthroff	1974
John C. Schelleng	1928
Sol Schneider	1973
Herbert A. Schulke, Jr., MG (RET) USA	1973
Gustave Shapiro	1961
William M. Sharpless	1958
Jack M. Sipress	1975
Rudolf A. Stampfl	1971
Clarence G. Thornton	1966
Frank S. Vigilante	1975
Herbert B. Voelcker	1973
Roger I. Wilkinson	1968
Carl R. Wischmeyer	1951
Robert S. Wiseman	1970
John M. Wozencraft	1965
William Ray Young	1964
Hans K. Ziegler	1961

COM's IEEE Fellows Now Number 13

DR. RUDOLF BECHMANN
Shrewsbury

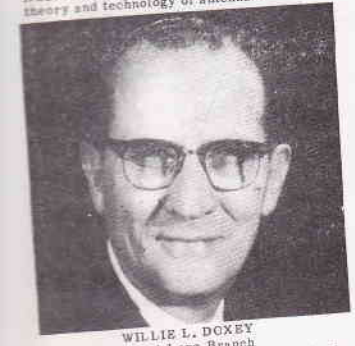
E FELLOW CITATION — "For con-
ons in the field of piezoelectric
le." Dr. Bechmann who received his
rate from University of Munich, is
ior scientists in the Solid State and
ency Control Divison of the Elec-
Components Laboratory.

STANISLAUS F. DANKO
Neptune

IEEE FELLOW CITATION — "For con-
ption and development of soldier-dipped
rinted wiring for military and commer-
al use, and for his pioneering work in
icrominiaturization." Mr. Danko, a Coop-
Union alumnus, is deputy director of
e E-Command's Electronic Components
aboratory.

DR. HELMUT BRUECKMANN
Little Silver

IEEE FELLOW CITATION — "An-
tennas." Dr. Brueckmann received his
PhD in Electrical Engineering from the
University of Berlin. He is a research
physicist in the Institute for Exploratory
Research at the Fort Monmouth ECOM
laboratories. In 1961 Dr. Brueckmann also
received the Harry Diamond Memorial
Award for outstanding contributions to the
theory and technology of antennas.



WILLIE L. DOXEY
West Long Branch

IEEE FELLOW CITATION — "For lead-
ership in research and development of
electronic materials and devices," Mr.
Doxey is Director of Research and De-
velopment at the Army Electronics Com-
mand. He holds a master's degree from
Louisiana State University.

DR. HANS K. ZIEGLER
Elberon

IEEE FELLOW CITATION — "For gui-
dance and leadership in military electron-
ics." Dr. Ziegler, a graduate of the Tech-
nical University, Munich, is Deputy for
Science and Chief Scientist of the Elec-
tronics Command.

FORT MONMOUTH — Recent announcement of the 1967 list of Fellows selected by the Institute of Electrical and Electronic Engineers from its international membership included the names of three scientists from the Army Electronics Command here at Fort Monmouth.

With the addition of the newly-named three, the Command's roster of IEEE Fellows now numbers 13, all currently working in its research and Development Laboratories complex.

The Fellows are Dr. Hans Ziegler, Deputy for Science and Chief Scientist; A. W. Rogers, Deputy for Engineering and Chief Engineer; Willie L. Doxey, who heads the Command's R & D Directorate; Dr. Helmut Brueckmann, Dr. George Goubau, and Dr. Fred B. Daniels of the Institute for Exploratory Research; John J. Egli of the R&D Directorate's Engineering Support Services; and, from the Electronic Components Laboratory, Dr. Rudolf Bechman, Dr. Edward A. Gerber, Dr. Harold Jacobs, Frank A. Brand, Stanislaus Danko, and Kenton Garoff.

Ten other Fellows, retired or resigned from the Command, are also carried on the IEEE's honor list.

According to the IEEE, "the grade of Fellow is one of unusual professional distinction conferred only by the Board of Directors upon a person of extraordinary qualifications and experience."

The 1967 selection included some 150 names from a worldwide membership of over 150,000, equivalent to about one Fellow per thousand members annually.

The individual citation accompanying each Fellow award acknowledges the field in which the recipient has rendered unique service and identifies the nature of his contributions.

Reflecting the varied span of Army electronics research, the field in which the ECOM Fellows were cited are widely diversified. Included are piezoelectricity, antennas, frequency control, wave propagation, printed wiring, electromagnetic compatibility, electronic materials, high power tubes, solid state devices, microwave semiconductors, quantum electronics, and microminiaturization.

Citations awarded Dr. Ziegler and Mr. Doxey for "personal leadership in military electronics" and "leadership in research and development of electronic materials and devices," respectively reflect their management responsibility in the Electronics Command.

Honors gleaned by the Command's professional personnel have not been limited to the IEEE Fellow classification.

During the past 17 years, ECOM people have five times received the Harry Diamond Memorial Award for outstanding contributions in government service. Recipients have been Dr. Goubau, Dr. Brueckman, and Mr. Egli, as well as former Fort Monmouth employes Dr. M.J. Golay and Dr. Harold A. Zahl.

About 1600 engineers, physicists, chemists and mathematicians now staff the Fort Monmouth laboratories. Annually these professional scientists publish over 600 research and development papers in various technical media reporting results of studies and investigations in their specialized fields.

Honors won by their papers in recent years include the Barry Carlton Award from the IEEE's Aerospace and Electronics Systems Group, Army Science Conference Awards, and the Electronics Components Conference's Best Paper Award.

The E-Command's researchers have been honored by other organizations as well. Samuel DiVita of the Electronics Components Laboratory is a Fellow of the American Ceramic Society. Herbert L. Mette, of the same Laboratory, is a Fellow of the American Physical Society. Dr. S. Benedict Levin, director of the Institute for Exploratory Research, is a Fellow of the Geological Society of America.

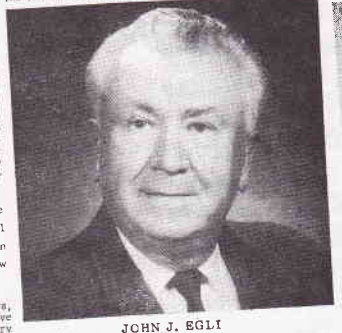
Dr. Gerber is also a Fellow of the American Association for the Advancement of Science. Dr. Ziegler is a Fellow of the American Astronautical Society.

Dr. Levin, Dr. Horst Kedesdy, and Dr. Jack A. Kohn, are Fellows of the Mineralogical Society of America and along with Dr. John Mrgudich, also Fellows of the American Association for the Advancement of Science.

Drs. Kedesdy, Kohn and Mrgudich are all with ECOM's Institute for Exploratory Research.

DR. HAROLD JACOBS
West Long Branch

IEEE FELLOW CITATION — "For his many contributions in the field of solid-state and semi-conductor devices." Dr. Jacobs received his doctorate from New York University. He is senior research consultant in the E-Command's Electronic Components Laboratory.



JOHN J. EGLI
New Shrewsbury

IEEE FELLOW CITATION — "For contributions to wave propagation, electromagnetic compatibility, and advanced radio communications." Mr. Egli is also a Harry Diamond Award winner. Now chief of the Electromagnetic Environment Division of the R&D Directorate's Engineering Support Services Department, he is a graduate of New York University.

FRANK A. BRAND
Elberon

IEEE FELLOW CITATION —
tributions in the field of
conductor and quantum
Mr. Brand, a supervisory
chief of the Integrated
of the E-Command's
ent Laboratory. He holds a
from Polytechnic Institute

DR. FRED B. DANIELS
Red Bank

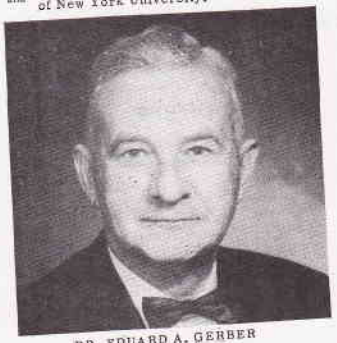
IEEE FELLOW CITATION —
pioneer work on radar
from the moon and
communications." A
with the Institute for
Dr. Daniels is a graduate
Texas.

KENTON
IEEE FELLOW
ership in planning
devices research
grams in the
for military
chief of the
the Electronic
holds a B.A.

DR.
IEEE FELLOW
tributions to
mission."
sicist with
Research.
the Technical

A. W. ROGERS
Shrewsbury

IEEE FELLOW CITATION — "For contributions in the development of electronic components." Mr. Rogers is the Army Electronics Command's Deputy for Engineering and Chief Engineer.



DR. EDUARD A. GERBER
West Long Branch

IEEE FELLOW CITATION — "For his many contributions to piezoelectricity and frequency control." Dr. Gerber received his degree from the Institute of Technology, Munich, Germany. He is director of the Electronic Components Laboratory.