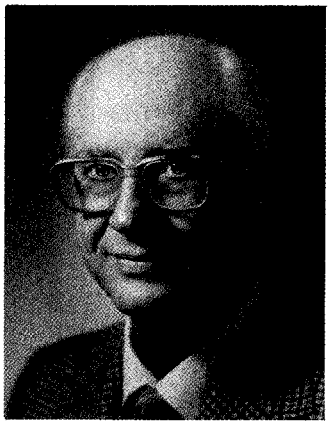


1986
Microwave Career Award

George L. Matthaei

"For a career of meritorious achievement and outstanding technical contributions in the field of microwave theory and techniques."

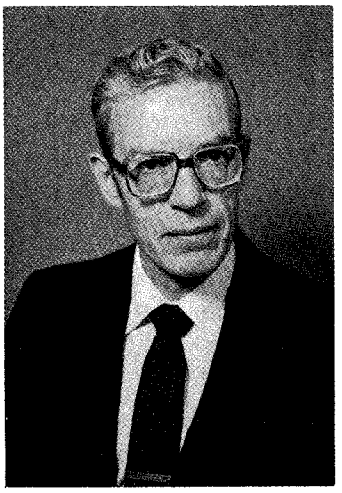
George L. Matthaei was born August 28, 1923, in Tacoma Washington. He received the B.S. degree in 1948 from the University of Washington. His college education was interrupted by three years of military service before he received his bachelors degree. He obtained an MS Degree in 1949, and a Ph.D. in 1952 in electrical engineering from Stanford University. He was a Research Assistant in Stanford's Electronic Research Laboratory from 1949 to 1951.

From 1951 to 1955 Dr. Matthaei was first an instructor and then Assistant Professor in the Division of Electrical Engineering at the University of California Berkeley. His specialty was network synthesis. He was on the Technical Staff of the Ramo-Wooldridge Corporation from 1955 to 1959 where he was engaged in system analysis and research in microwave components. In 1958 he joined Stanford Research Institute where he conducted research on microwave devices. He served as a Project Leader, and in 1962 became Manager of the Electromagnetic Techniques Laboratory of SRI. While at SRI he taught part-time at Stanford University. In July 1964, Dr. Matthaei joined the Department of Electrical Engineering of the University of California at Santa Barbara where he is a Professor.

Dr. Matthaei's professional specialties are microwave and acoustic devices and network synthesis. He is currently doing research in the area of millimeter-wave integrated circuits. He has published approximately eighty articles on his research in the area of network synthesis, wide-band impedance-matching structures, microwave filters, parameteric amplifiers, quasi-optical filters, acoustic bulk-wave and surface-wave devices, and most recently dielectric-waveguide filter and coupler techniques for mm-wave and optical integrated circuit applications.

In 1961, Dr. Matthaei was awarded the Microwave Prize for his paper "A study of the Optimum Design of Wide-Band Parametric Amplifiers and Up-Converters." He is coauthor or contributor to six books. The most widely known of these is *Microwave Filters, Impedance-Matching Networks and Coupling Structures,* which is coauthored with L. Young and E. M. T. Jones.

Dr. Matthaei is a Fellow of the IEEE and a member of MTT-S, AP-S, Sonics and Ultrasonics, Sigma XI, and Tau Beta Pi. He has served a term on the Administrative Committee (AdCom) of the MTT-S and also on the AdCom of Circuit Theory. He is on the Editorial Board for the *IEEE Transactions on Microwave Theory and Techniques* and the journal, *Wave Electronics*. Dr. Matthaei received an IEEE Centennial Medal at the 1984 International Microwave Symposium in San Francisco.



1986
Microwave Applications Award

Clarence Burke Swan

"For pioneering the application of diamond heat sinks useful for high-thermal-power-density semiconductor devices."

The Microwave Applications Award is presented to an individual for outstanding application of microwave theory and techniques. The eligibility requirements are creation of a new device, component or technique, novel use of a device or component or a combination of all of the above. The recipient of the 1986 Microwave Applications Award is C. Burke Swan of AT&T Bell Laboratories at Murray Hill, New Jersey.

Dr. Swan introduced the use of diamond to conduct the heat away from high-power microwave IMPATT oscillator diodes. This was one of a group of effective measures introduced by him for optimizing the output power, the efficiency, and the reliability of microwave IMPATT diodes. Type-IIa diamond is three-to-five times as effective as copper in conducting heat away from small intense heat sources. He showed that small pieces of diamond, only a millimeter on a side and costing only a few dollars each, could allow power dissipation densities of megawatts per square centimeer in very small area semiconductor devices.

The application of the diamond heat sink, the recognition of the importance of optimizing the heat sink design, and the combination of other contributions resulted in Dr. Swan achieving record power levels and efficiencies for IMPATT diodes over the frequency range 6 GHz to 49 GHz. Dr. Swan authored six papers in 1967 and 1968 which established that the power limitations for IMPATTs were primarily thermal not electrical. His pioneering work helped spark the world-wide thrust on IMPATT development which made these diodes the most important solid-state microwave source in communication and radar until the introduction of GaAs FETs in the 1970s.

The diamond heat sink was immediately extended to semiconductor lasers by co-workers. This made possible for the first time the CW operation of GaAs lasers at room temperature. Today, in addition to high-power IMPATTs, many high-reliability high-power semiconductor lasers are mounted on diamond heat sinks.

C. Burke Swan was born in New Brunswick, Canada, on November 9th, 1932. He received the B.Sc. degree in Electrical Engineering from the University of New Brunswick and the M.A.Sc. and the Ph.D. degrees from the University of Toronto.

He joined AT&T Bell Laboratories in 1962. His early work included research on high power harmonic generation with microwave gaseous plasmas, and the first experiments with stacked varactors for higher power and better efficiency.

In 1969 he became supervisor of the Microwave Integrated Circuits group at Allentown, Pennsylvania. Since 1978 has supervised the development of high-bit-rate lightwave transmitters for both terrestial applications and for the TAT-8 undersea system.

He as been granted eight patents and has published more than twenty papers. Dr. Swan is a Senior Member of the IEEE and is a member of the American Optical Society, the Association of Professional Engineers of Ontario, and the American Association for the Advancement of Science.

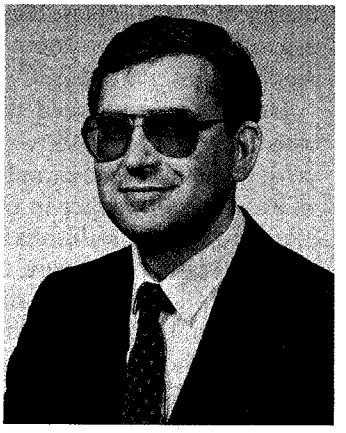
1986 MTT-S Microwave Prize

Yalcin Ayasli, Leonard D. Reynolds, Jr., James L. Vorhaus, Larry K. Hanes

The *Microwave Prize* is awarded annually to the author(s) of that paper, published in the *IEEE Transactions on Microwave Theory and Techniques, Proceedings of the IEEE,* or other official IEEE publication, which is judged to be the most significant contribution in the field of interest of the Society.

The 1986 Microwave Prize is awarded to Yalcin Ayasli, Leonard D. Reynolds Jr., James L. Vorhaus, and Larry K. Hanes, for their paper titled: "2-20 GHz GaAs Traveling-Wave Amplifier," published in the *IEEE Transactions on Microwave Theory and Techniques,* Volume 32, No. 1, January 1984, pp. 71–78.

Yalcin Ayasli

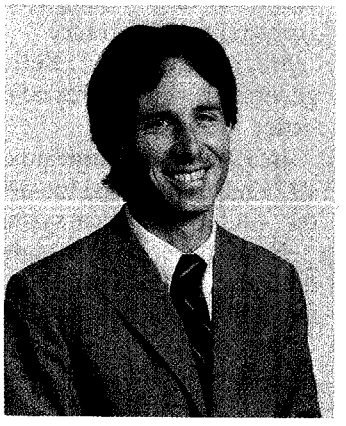


Yalcin Ayasli received a B.S. degree in Electrical Engineering in 1968 from the Middle East Technical University, Ankara Turkey. He received an M.S. degree in 1970 and an Sc.D degree in 1973 in Electrical Engineering from the Massachusetts Institute of Technology.

He was a member of the faculty of engineering at the Middle East Technical University from 1973 to 1979. While there he also served as assistant chairman of the Electrical Engineering Department. From 1979 to 1985, Dr. Ayasli worked at the Research Division of the Raytheon Company, leading a design, measurement, and wafer fabrication group for development of GaAs microwave monolithic integrated circuit (MMIC) technology. In 1985, he founded the Hittite Microwave Corporation in Woburn, Massachusetts to develop GaAs MMIC components and subsystems.

Dr. Ayasli is the author of a number of technical papers and patents. He is a senior member of the IEEE Microwave Theory and Techniques Society. He is the Chairman of the Technical Program Committee of the 1986 IEEE Microwave and Millimeter Wave Monolithic Circuits Symposium.

Leonard D. Reynolds



Leonard D. Reynolds, Jr. received the B.S. degree in 1975 and the M.S. degree in 1978 in Electrical and Computer Engineering from Clemson University. His undergraduate and graduate studies were concentrated in Solid-State Circuits and Communication Theory, respectively.

In 1978, Mr. Reynolds joined Raytheon Company, Special Microwave Devices Operation to assist in FET evalvation, modeling, and design. In 1980, he joined the Research Division of the Raytheon Company as a member of the GaAs monolithic circuit group. Since then he has developed various monolithic microwave circuits including wideband amplifiers, T/R modules and ECM circuits. Most recently, he has been responsible for design of multioctave bandwidth distributed amplifiers for low-noise, small-signal applications and distributed amplifiers having output power levels up to one watt.

Mr. Reynolds is a member of the IEEE, Eta Kappa Nu, and Tau Beta Pi. He is author of a number of published technical papers.

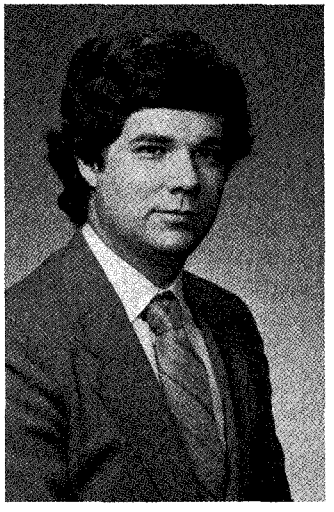
James L. Vorhaus

James L. Vorhaus received the B.S. degree in engineering physics from Lehigh University in 1972 and the M.S. and Ph.D. degrees in physics from the University of Ilinois at Champaign-Urbana in 1974 and 1976, respectively.

From 1973 to 1976, he was a Research Assistant in the low-temperature physics laboratory at the University of Illinois. His work involved state-of-the-art measurements of the specific heat and thermal conductivity of various materials at temperatures below 4 degrees Kelvin. In 1976, he joined the Research Division of the Raytheon Company as a member of the Semiconductor Laboratory. His work involved GaAs device processing technology and the design and fabrication of Monolithic Microwave Integrated Circuits (MMICs). His most recent position at Raytheon was as manager of the MMIC pilot production line. In 1985, he joined the Microwave Division of Epsco, Inc. He is presently the Director of Operations of the Solid-State Components Group which is responsible for designing and fabricating high-power GaAs Microwave Integrated Circuits (MIC) amplifiers.

Dr. Vorhaus is a member of the IEEE, the IEEE Antennas and Propagation Society, Phi Beta Kappa, and Tau Beta Pi. He has published extensively and holds several patents in the areas of GaAs device technology. He is a past chairman of the GaAs Integrated Circuits Symposium.

Larry K. Hanes



Larry K. Hanes received a B.S. degree in 1976 and a Ph.D. degree in 1982 from the North Texas State University.

He joined the Research Division of the Raytheon Company in 1980. His work included the establishment of a GaAs Monolithic Microwave Integrated Circuit (MMIC) layout design center and the development of CAD tools for MMIC mask layout design. He was responsible for the design of GaAs MMIC mask layouts and also worked on the development of GaAs process technology.

Dr. Hanes is now at Raytheon's Special Microwave Devices Oeration where he is responsible for the GaAs direct write electron beam lithography center.

1986
Distinguished Service Award

Harold Sobol

"For his outstanding and dedicated service to the Society."

The Distinguished Service Award is presented to honor an individual who has given outstanding service over a period of years for the benefit and advancement of the Microwave Theory and Techniques Society. The 1986 recipient is Harold Sobol, Director of Engineering for Rockwell International's Telecommunications Divisions.

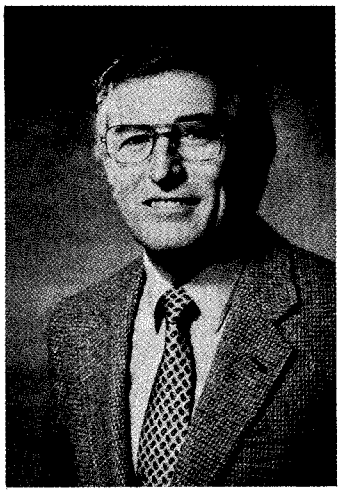
Dr. Sobol has actively served the MTT-S since 1969 and has made many significant contributions. Of particular note is that while chairman of the Awards Committee, he implemented the MTT-S Distinguished Service Award with Ted Saad as the first recipient. In all aspects of Dr. Sobol's work for the MTT-S Administrative Committee (AdCom) he was highly professional and set a standard for all to follow. His extensive and detailed efforts in long-range planning while Vice President were outstanding. He was the Microwave National Lecturer in 1970.

Dr. Sobol was first elected to the MTT-S AdCom in 1972 and served as Chairman Technical Committees, Vice President in 1977 and President in 1978. He served as Chairman of the MTT-S Awards Committee and currently heads a committee to review MTT-S AdCom committees. He has served on the IEEE Awards Planning and Policy Committee and was Chairman of the Dallas Section Student Activities Committee for the past two years. Dr. Sobol was a member of the Editorial Board of Spectrum for five years. He served as General Chairman of the 1974 Electronic Components Conference and of the 1975 International Solid-State Circuits Conference. He has been a program committee member of the above conferences and of many MTT-S Microwave symposia. He was Vice Chairman of the 1973 IEEE INTERCON.

Dr. Sobol also serves on EIA, U.S. Telephone Asociation, National Science Foundation, and Elecromagnetic Energy Policy Alliance Committee. He is a member of the Industrial Advisory Committees at the University of Texas at Arlington and the University of Michigan.

Harold Sobol received the BSEE degree from City College of New York and MSE and Ph.D. degrees from the University of Michigan. He has worked on radar, missile guidance, superconducting devices, microwave tubes, plasmas, solid-state devices, microwave integrated circuits, and microwave and lightwave communication systems. He was with the University of Michigan's Willow Run and Electron Physics Laboratories from 1952–1959, IBM Watson Research Laboratory from 1960–1962, and RCA Laboratories from 1962–1973. He joined Collins Radio which was subsequently acquired by Rockwell International in 1973. He served as Director of Product Development for the Collins Transmission Systems Division until May 1985 when he was promoted to Director of Engineering for all of Rockwell's Telecommunications Divisions.

He has more than forty publications and has presented more than fifty papers at professional meetings. He is an author and editor of an Academic Press volume on Microwave Integrated Circuits. Dr. Sobol was elected Fellow of IEEE in 1973, received an IR-100 Award in 1969 for his work on microwave integrated circuits. He received the Dallas IEEE Section Award for oustanding Engineer of 1975, and was awarded an IEEE Centennial Medal in 1984.



1985–86 MTT-S Distinguished Microwave Lecturer

Application of Microwave Technology to the Detection and Treatment of Cancer

Kenneth L. Carr

Research activity has been underway for the past decade to apply microwave technology, both invasive and noninvasive, to the detection and treatment of cancer. This lecture will review the past and on-going work within the microwave industry, both in the United States and abroad. The lecture will review cancer statistics and trends—for example: with respect to breast cancer, the leading cause of death due to cancer in women; and the impact of early detection.

The application of microwave technology is based on two assumptions; 1) a carcinoma or malignant tumor is normally hotter than the surrounding tissue, and 2) it is known that tumor tissue will die at temperatures above 42°C. It has been reported that tumor temperatures greater than 45°C can be held with adjacent tissue remaining at or near normal temperature. These facts have led to the use of microwave technology to both detect and destroy tumor tissue.

Passive microwave thermography is a noninvasive and nonhazardous method of detecting malignant neoplasia based on thermal differences between normal and malignant tissue. The reasons for hotter temperatures in the malignant processes are not entirely understood. Accelerated local metabolism in the tumor and vascular diffrences between the normal and malignant tissues are thought to be involved. Irrespective of the mechanism involved, temperature differences between normal and malignant tissues have formed the basis for cancer detection by microwave radiometric techniques. It is further hoped that microwave radiometry can provide noninvasive thermometry for hyperthermia treatment and, in turn, that microwave heating can be used to enhance detection.

Hyperthermia employing microwave heating as a treatment modality has been proven. It has been further shown that microwave induced hyperthermia, when used as an adjunctive treatment to radiation therapy and chemotherapy, has had a significant positive impact. For example: total emission due to ionizing radiation alone is approximately 31%, whereas hyperthermia used in combination with ionizing radiation results in excess of **70% remission.**

Mr. Carr received his B.S. degree in electrical engineering from Tufts University in 1953. He has worked at Philco, Sylvania, and Airtron, and, in 1958, he co-founded Ferrotec, Inc., serving initially as Technical Director and later as President. Following the acquisition of Ferrotec in 1970 by M/A-COM, Mr. Carr became Senior Vice-President and Technical Director.

Mr.Carr is currently a trustee of Wentworth Institute of Technology, Boston, Massachusetts; a member of the staff of the Eastern Virginia Medical School, Norfolk, Virginia; and a member of the Engineering Advisory Council for Southeastern Massachusetts University in North Dartmouth. He is a member of AAPM, BEMS, IMPI, the Radiation Research Society, and a Fellow of the IEEE. He has received NASA's Certificate for Recognition in 1980 and in 1983 for his technical innovations and his scientific contributions.

1986 IEEE Fellow Awards

Nine Senior Members of the Microwave Theory and Techniques Society were elected Fellows of the IEEE. We extend congratulations to them.

Kenneth L. Carr	*For contributions to the application of microwave technology in medicine.*
James E. Degenford	*For contributions to hybrid and monolithic microwave integrated circuits.*
Timoth Ting-Jau Fong	*For contributions to the development of millimeter-wave technology.*
John B. Horton	*For leadership in the design of military millimeter-wave systems.*
James Chih-I Lin	*For contributions to understanding the biological effects of pulsed microwaves in the inner ear of humans.*
Robert J. Mattauch	*For contributions to the development of low-noise millimeter-wave diode technology.*
David N. McQuiddy, Jr.	*For leadership in the development of solid-state modules for phased arrays.*
Barry S. Perlman	*For contributions to microwave solid-state device and circuit design, and leadership in computer-aided methods for microwave enginering.*
Jorg E. Raue	*For contributions to the development of millimeter-wave components.*

The candidacy of the above Fellows was endorsed by the Microwave Theory and Techniques Society. Eleven other members of MTT-S who also hold membership in other societies of the IEEE were elected to rank of Fellow based on their other Society's endorsement:

Constantine A. Balanis	*For contributions to electromagnetic education, geometrical theory of diffraction, and electromagnetic geotomagraphy.*
Colin K. Campbell	*For contributions to surface-acoustic-wave devices and electrical engineering education.*
Keith R. Carver	*For leadership in microwave remote sensing.*
William F. Croswell	*For leadership in spacecraft and aircraft antenna research and design.*
Gideon Kantor	*For leadership and contributions to microwave and radiofrequency diathermy and hyperthermia.*
Ray J. King	*For contributions to the theory and experimental modeling of radio wave propagation over nonuniform surfaces.*
J. Barry Oakes	*For leadership in the application of electrical measurement instrumentation.*
Glenn S. Smith	*For contributions to the analysis and measurement of the electromagnetic characteristics of antennas in matter.*
Michio Takaoka	*For contributions to theoretical design and development of high-voltage cable.*
Martti E. Tiuri	*For contributions to the theory and techniques of microwave radiometers and microwave applications in remote sensing and industrial instrumentation.*
Andre S. J. Vander Vorst	*For contributions in atmospheric microwave propagation, satellite communication earth station design, and numerical analysis of microwave components.*