IEEE SOCIETY ON MICROWAVE THEORY AND TECHNIQUES

NEWSLETTER

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TRW ESG, One Space Park, Redondo Beach, California 90278

Number 111, Winter 1985

OUTGOING PRESIDENT'S COMMENTS

by George Oltman

In the United States, we are in the throes of a widespread "quality" revolution. The buying public is showing through its purchases that it is fed up with poor quality. It is voicing a demand for both better quality, better warranty, and better repair service. In recent years, this is most evident by the large increase in purchases of Japanese and European automobiles. However, this is not limited to cars only. This affects other industries, including microwaves. There are signs that the Japanese may be facing our problems in the future.

The fundamental human characteristic that is the cause for poor quality is the basis for two comments that I would like to make before my term as MTT president ends. These two comments are completely unrelated in subject matter except through this singular human characteristic. Product quality is one subject; election to the MTT-S Administrative Committee is the other.

The demand for quality was really brought close to me when I read the morning newspaper in early August. The Navy was refusing to accept deliveries of my company's missiles. This was because of poor assembly workmanship. This was a subject for prime time national TV News and the whole nation heard about it. Within a few days, the Air Force also stopped deliveries of certain missiles.

My company shut down most of our missile assembly operations. The assembly line is now back in operation. This was only after we developed a better quality assurance program. My company wasn't the only contractor affected by this new Defense Department tactic; subsequently, two other major contractors were also so "honored".

My company has had a long standing quality assurance program. The last two years our management had been placing substantially increased emphasis on quality. The Navy's action really focused our attention. Now everyone in our company; the managers, the designers, the machinists, and assemblers, is acutely aware of the need for better care in building products. How did this come about? How did the Navy arrive at this unusual action?

I certainly don't know the details, but a large measure of the credit, yes, credit, goes to Willis J. Willoughby, Deputy Chief of Naval Material for Reliability, Maintainability, and Quality Assurance. His thesis was that no one has to accept poor quality in its purchases. If you do, you are at fault too.

I had the pleasure of viewing a video tape of Mr. Willoughby addressing an attentive audience at Texas Instruments. He expressed his views on the cause of poor quality. Stated succinctly, the cause for poor quality is "lack of caring" - lack of caring by the managers, the designers, the machinists and the assemblers. It's an attitude that currently pervades our U.S. society. Lack of pride in workmanship is another statement of the same human characteristic. Not taking responsibility or being made accountable for our product is a third and fourth statement of the problem. I was ecstatic when I heard those words. He summed up, in a few well chosen statements, the basis for what I too believe and have long pondered to be the major problem of our current U.S. society.

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Editor's Notes

by R.S. Kagiwada

1984 was truly an exciting year for the MTT-S. In addition to the normal extensive activities of MTT-S, we were fortunate to also celebrate the IEEE Centennial Year. These events kept our 1984 MTT-S president, George Oltman, extremely busy with never a dull moment. We all enjoyed working with George and found it a very rewarding experience.

We all look forward to working with Harlan Howe, Jr., our 1985 MTT-S president. Harlan has already made his appointment and his organization is already running at full steam.

Special congratulations are in order to Kiyo Tomiyasu who is our new Division IV Director.

John Horton is publishing his second special article by Ambros P. Speiser on "The Impact of Science - The marriage of Science and Technology in Telecommunications". I am sure that you enjoyed Speiser's discussion on the evolution of microwave technology. John Horton is still actively soliciting for the "Special Articles" column and would appreciate your comments and suggestions.

The newsletter intention is to service needs of the MTT-S members. We encourage your thoughts and have an open invitation to send information to Kurtis L. Kurisu's "Feedback Column".

ARFTG HIGHLIGHTS

by Mario A. Maury, Jr.

The Automatic RF Techniques Group (ARFTG) is a professional society that is affiliated with MTT-S. It is primarily concerned with computer-aided microwave measurements and design. The following is a summary of its recent activities.

24th CONFERENCE

The Fall 1984 ARFTG Conference was held at the Columbia Inn, Maryland (near Baltimore) on December 6 and 7, 1984. A complete report on this conference will be published in the Spring 1985 issue of the newsletter.

ANNOUNCEMENT 25th CONFERENCE

The Spring ARFTG Conference will be held as a workshop as part of the 1985 MTT-S International Microwave Symposium in St. Louis, Missouri. The Conference will start at 12:00 p.m. on Thursday, June 6 and end at 4:30 p.m. on Friday, June 7; it will be held at the Sheraton Hotel in St. Louis. Advance registration is recommended utilizing the symposium registration form, although attendees can register directly preceeding the Conference.

The theme of the Conference will be "Automated Active Devices Measurements." Papers are solicited on recent hardware and software developments on this topic, as well as other computer-aided RF design and testing topics. Technical presentations will be informal 25 minute talks using viewgraphs or 35 mm slide illustrations. Manufacturers are also encouraged to discuss or demonstrate new products that have been developed for RF design and testing; a separate area will be available for demonstration. Authors should submit a one page abstract and a 500 to 1,000 word summary, with illustrations, etc., attached, providing sufficient technical content to properly evaluate the paper's contribution and its usefulness to the Conference attendees. Two copies of the abstract and summary should be sent to the Technical Program Chairman before March 29, 1985. All accepted papers will be published in the Conference Digest. Please refer to the "ARFTG Instructions to Authors" for additional information.

Submit papers to the Technical Program Chairman (TPC):

Dr. Barry S. Perlman
RCA Laboratories
P.O. Box 432
Princeton, NJ 08540
(609) 734-2661

For further information, contact the ARFTG Conference Chairman (CC):

Mr. Robert Nelson, Div. 724
National Bureau of Standards
325 Broadway
Boulder, CO 80303
(303) 497-5736

ADCOM HIGHLIGHTS

by Harlan Howe

The fall ADCOM meeting was held on the evening of the 17th and all day on the 18th of September at the Marriott Essex House in New York City, New York. During the afternoon of the 17th, ADCOM donned their hard hats to tour the construction sites of the Marriott Marquis Hotel, scheduled to open in 1985 in Times Square, and the new New York Convention Center on the Hudson River, which is scheduled to be completed in 1986. Both of these facilities are under consideration to house the 1988 MTT-S Symposium.

George Oltman convened the meeting which quickly approved a number of expenditure requests. Following this and the President's remarks, Don Parker, as Chairman of the Awards Committee, presented the nominations for the 1984 award recipients. These were unanimously approved and will be announced elsewhere.

Jim Degenford reported that during the first half of 1984 our net worth as a Society increased by $108,000 to a present total of $726,500.

The eleven man Nominations Committee selected 22 candidates for consideration for election to ADCOM. A list of 14 was submitted to ADCOM and an additional 2 candidates were added for a total of 16. All nominations were seconded. The following were elected for three year terms: H. Howe, T. Itoh, R. Levy, S. March, J. Raue, and M. Schneider. In addition to this, S. Temple was elected to a two year term filling the vacancy created by George Oltman as he becomes Past President. Balloting for the 1985 President and Vice President was also held, with H. Howe and R. Knerr being elected to those respective positions.

Ed Niehenke nominated Mr. Kenneth L. Carr, a Senior Vice President of M/A-COM, for the position of the 1985-1986 Distinguished Microwave Lecturer. Mr. Carr's topic will be, "The Application of Microwave Technology to the Detection and Treatment of Cancer." The nomination was seconded and approved unanimously. Mr. Carr will start his lecture series next Fall.

There were a number of reports on meetings and symposia. These included Steve Adams' report on the 1984 Symposium and its record attendance. Over 5,690 people participated in the San Francisco meeting. After some discussion, ADCOM gave its approval to the Marriott Marquis and the New York Convention Center for the 1988 MTT Symposium to be held in New York. The uncertainty of the exact location of the 1989 Symposium was resolved with an announcement by Chuck Swift that Long Beach, California, rather than Anaheim, has been selected as the site. It had been ADCOM's plan to make a decision on the 1990 Symposium. However, after reviewing proposals from Atlantic City, Dallas, and Phoenix, it was decided to delay that decision until January in order to permit the Committees to submit more detailed information on the actual hotel and meeting hall layouts since there is an increasingly difficult problem in handling the large crowds which are now attending our Symposia. As a final action of Meetings and Symposia, the ADCOM approved a renegotiated version of the contract with Horizon House for the continued management of the exhibition portion of our meetings.

Bob Hicks offered a detailed proposal for Undergraduate Fellowships for children of MTT-S members. While not all of the details have been firmed up, it is probable that there will be two such scholarships annually at a maximum of $2,000 each. It is also likely that these will be administered through the National Merit Scholarship Corporation and it is anticipated that the first awards will take place in 1987. We hope to have the exact details worked out within the next few months so that an appropriate announcement of eligibility and rules can be made.

Under new business, ADCOM considered sending the Symposium Digest to all members at no charge. It was determined, however, that the cost of this would be prohibitive, and as an alternative a motion was made and passed to offer the option of purchasing the Symposium Digest at incremental cost including a nominal fee to members checking the appropriate box in the annual IEEE Dues Statement. The Publications Committee will generate a plan to implement this action.

The meeting was adjourned precisely on time at 3:50 PM. On-time meetings have been the hallmark of George Oltman's Presidency - I hope I can keep it up.

St Louis, Missouri

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All of these attitudes have a bearing on the quality of whatever we do — the product we make, the state of repair of our house, our relationship with others, our recognizable achievements and our contributions to our profession. Caring, pride, responsibility, and accountability are attitudes that were once paramount in the U.S. and in other world societies. Those countries that still have it are currently emerging as the dominant economic societies of the world. It affects our microwaves industry just as much as it affects the automobile industry. We need to stand back and view ourselves and our attitudes and take care, pride, responsibility, and accountability for our actions. If we don't do it voluntarily, the marketplace may force us.

It's my view that a large measure of the industrial quality problem is associated with current, general union-management adversary relationships. This relationship has resulted in a caringless (if I may coin a word) attitude in the workers and has several causes. First, management has not been adequately responsive to worker needs or held them (or been able to hold them) accountable for their workmanship. Second, workers have transferred their allegiance to the union and forsaken their own small responsibility, yet necessary full concern, for their company's production of a quality product. Happily, there are signs that this adversary and caringless relationship is starting to change.

It's my view that another cause of the problem is the result of the affluence of the U.S. society, especially true of people growing up the last 30 years. They were raised in the absence of economic concerns. They did not witness the economic hardships of their parents. They have not realized the need to maintain economic viability. Instead, they focused their interests on more altruistic endeavors. They rejected and blamed technology for the problems of the world and took up *the simple life.* They took pride in not accomplishing, instead of pride in contributing to society and doing a good job. Fortunately, today's students are showing signs of economic concern. They are again focusing on studying and doing well in schools and colleges. Over the past 10 years, it's interesting to note that the now more affluent Japanese are witnessing "an erosion of traditional work-ethic values". There is an aimlessness in some of their youth. (See Newsweek, November 19, 1984, p.71.)

Now let's move on to the *related* subject of *election to MTT Administrative Committee (AdCom).* Our society and the AdCom also need members who care about the profession and are willing to take responsibility for running the society. How are they elected?

The corporate IEEE and most of the IEEE societies use the *democratic* election-by-the-membership process where two or more candidates are presented to the members in a mail ballot. The MTT Society does not. It elects its AdCom members by vote of the remaining AdCom members who are not up for election.

At times, we have been criticized for this seemingly non-democratic process. I would like to address this issue and show that it is a means by which the AdCom can identify those individuals who care and who exhibit responsibility and accountability. I will then suggest avenues by which you can become involved. We have one of the strongest societies in the IEEE family. That strength is wholly due to the professionally minded members who are willing to contribute a significant amount of their time. In return, they reap the rewards of association with some of the world leaders in our microwave society.

In both election processes, nominating committees select a slate of candidates by reviewing the professional and technical activities of members known to them. Provisions are made for nomination by petition. The difference between the two election processes is in the next step, election by membership vote or AdCom vote. I suggest that the AdCom is more knowledgeable than the membership about the caring and the sense of responsibility of the nominees. These special characteristics are important to running a society characteristics such as willingness to spend extra time accomplishing non-technical professional endeavors. In our case, past accomplishments are in MTT Chapter Committees, Symposia Steering Committees, AdCom support, and MTT Technical Committees. The alternative election-by-the-membership process largely results in a popularity contest based primarily on technical accomplishments, not professional activities which are often more important to optimal operations of the society. Quite often, the less qualified candidate is elected and, what's worse, a good contributor to the society may be lost.

The AdCom is continually looking for new blood with new ideas. The key to getting elected is to first become known. That requires offering your services and actively participating in the society's business. It has been my observation over more than 10 years that prior participation in non-elected societal activities is the major avenue by which current members have been elected. Those of you who are interested should contact or write our 1985 President-elect Harlan Howe, or else contact a current AdCom member and express your interest. Their names and addresses are in the Centennial MTT Directory that you received in October. There are many activities. The rewards are a sense of contributing, pride in association, and professional maturing.

ADCOM ELECTIONS

by C.T. Rucker

ADCOM NOMINATIONS CHAIRMAN, 1984

This year, at the September Committee meeting, four new Adcom members were elected and three members were reelected for a new three year term. Those reelected were Harlan Howe, 1985 Society President; Tatsuo Itoh, outgoing Transactions Editor and Steve March who will chair the 1987 Symposium in Las Vegas. We are most fortunate to have dedicated workers such as these to insure our continued success.

Newly elected are Jorg Raue, outgoing Adcom Secretary; Ralph Levy, incoming Transactions Editor; Martin Schneider, long time contributor to numerous MTT affairs and Steve Temple who, from 1976 and 1980, served on the Membership Services Committee of Adcom. I am confident that each of these newly elected Adcom members will contribute in an innovative way to the Society.

So that you may know these newly elected members better, their biosketches are included below. Biosketches of those reelected have been included in earlier Newsletters.

JORG RAUE

Jorg E. Raue received his BSEE degree from the Milwaukee School of Engineering and his MS and Ph.D. degrees from Marquette University. He joined TRW in 1969 and is currently a senior scientist in the Electronics and Technology Operations organization. His present interests include EHF communications systems and advanced ferrite materials for millimeter wave applications.

Dr. Raue was a manager of the Millimeter Wave Technology Department at TRW prior to his joining California Polytechnic University in September, 1979, where he was head of the Electrical Engineering Department through August, 1980. At TRW, he managed many advanced technology development contracts for solid state power amplifiers at 35, 40 and 60 GHz, as well as component development at 90 to 100 GHz. Dr. Raue was responsible for all millimeter wave technology oriented IR&D and contractual programs at TRW, including both active and passive circuits such as avalanche diode amplifiers, upconverters frequency multipliers, mixer preamplifiers, circulators and filters. Among his accomplishments, he discovered a new technique for extraordinary wideband injection-locking of avalanche diode oscillators.

Dr. Raue is the author of more than 30 technical papers and has been awarded several patents. During 1982 and 1983, he delivered a total of five invited papers at various technical meetings, including two international symposia. He is a senior member of the IEEE, the professional groups of MTT, ED and MAG of the IEEE and Sigma Xi. He organized the millimeter wave technology session at the 1978 AIAA Communications Satellite Systems Conference, and chaired millimeter wave technology and applications sessions at the 1982 and 1984 International MTT Symposia. He is a past chairman of the Milwaukee Joint ED/MTT chapter and has served as a director of the Milwaukee IEEE section. Dr. Raue is a member of the MTT technical paper evaluation committee and was the editor of the 1981 MTT Symposium Digest. During 1984 he served as AdCom Secretary. He is a technical reviewer for the National Science Foundation. He has taught graduate courses in field theory, microwave solid state electronics and microwave systems at several universities.

RALPH LEVY

Ralph Levy (SM'64-F'73) was born in London, England on April 12, 1932. He received his B.A. degree in Physics from Cambridge University (St. Catharine's College) England in 1953, and the M.A. degree in 1957. His PhD in the Applied Sciences Faculty of London University was awarded in 1966, the work for this being carried out part time while employed in industry.

From 1953 to 1959, he was a member of the Scientific Staff at GEC, Stanmore (now Marconi Space and Defense Systems), England, where he worked on guided missile, radar, countermeasures systems, and on waveguide components. In 1959 he joined Mullard Research Laboratories (now Phillips Research Laboratories) Redhill, Surrey, England and continued his work on microwave components and systems, utilizing coaxial and stripline media. He developed a widely-used technique for accurate instantaneous frequency and/or bearing measurement using several microwave discriminators in parallel ("digital IFM"). This work in electronic countermeasures included the development of very broad-band components, such as decade bandwidth directional couplers and broadband matching theory applied to amplifiers.

From 1964 to 1967 he was a member of the faculty at Leeds University and carried out research in microwave network synthesis, including realizations of dis-

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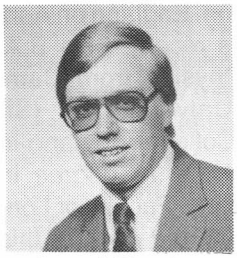
tributed elliptic function filters, and exact synthesis techniques for branch guide and multi-aperture directional couplers.

From 1967 until November 1984 he was with Microwave Development Laboratories, Natick, MA., as Vice President of Research. His work included the development of practical techniques for designing very broad band mixed lumped and distributed circuits, and synthesis and field theory techniques to facilitate the design of a variety of microwave components.

In 1984 he joined K.W. Engineering, San Diego, CA. as Vice President of Engineering.

Dr. Levy has authored about 50 papers, 2 books, and 12 patents. While in England, he was a member of the IEEE Professional Group on Microwave Theory and Techniques and joint Editor of "Electronics Letters". After emigrating to the USA in 1967 he became active in the local Chapter of MTT-S (Chairman 1973-74), and was an Associate Editor of the Transactions on Circuits and Systems (1973-75). He was the Chairman of the Technical Program Committee for the 1983 MTT-S International Microwave Symposium held in Boston.



STEVE TEMPLE

Steven J. Temple was born on 23 March 1952 in Kingston, New York. He received the B.S. and M.E.E. degrees from Cornell University in 1973 and 1974, respectively.

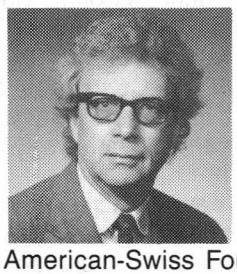
He joined the Bedford Laboratories of Raytheon Company's Missile Systems Division in 1974 and was involved in the development of solid state microwave sources and subsystems for advanced missile seekers. Between 1977 and 1980 Mr. Temple directed the development of pulsed power FET amplifiers and transmitters and was involved in the development of planar power combining networks.

In 1981 he was appointed manager of Monolithic Microwave Circuit Development and Computer-Aided Design within the Bedford Laboratories. In this position Mr. Temple has directed the design and application of a variety of MMIC's for advanced missile and radar systems. In parallel with evolving monolithic microwave technology within MSD he has provided engineering direction for the implementation of a variety of computer-aided design and test software for microwave applications.

Mr. Temple has authored numerous papers on a variety of topics including power FET amplifiers, combining techniques, monolithic circuits; computer-aided design and engineering education and is a recipient of the Division's Outstanding Author Award.

Mr. Temple has been actively involved with MTT-S since 1976. From 1976 to 1980 he served on the Membership Services Committee as chapter record's chairman. More recently he served on the Steering Committee for the 1982 Microwave Symposium as Publicity Chairman. Mr. Temple was also a member of the 1983 and 1984 symposium technical program committee and served as a session chairman for the 1984 symposium. He is currently chairman of the Boston Chapter of MTT-S.

In April 1981, Mr. Temple was one of three electrical engineers in the United States, recognized in the Outstanding Young Electrical Engineer Awards program of ETA KAPPA NU. In June 1984, he was selected to receive an "IEEE Centennial Keys to the Future" award as MTT-S outstanding young engineer.



MARTIN V. SCHNEIDER

Martin V. Schneider was born in Bern, Switzerland and received the M.S. in Physics from the Swiss Federal Institute of Technology in Zurich, Switzerland in 1955. After graduation he was awarded a fellowship by the American-Swiss Foundation for Scientific Exchange. He did graduate studies under James A. Van Allen at the State University of Iowa, worked at Cubic Corporation in San Diego, CA on radar test instrumentation, and returned to the Swiss Federal Institute of Technology in late 1956. There he received the Ph.D. in physics in 1959 and worked as a research assistant at the Institute until 1961.

Martin Schneider joined the Radio Research Laboratory at Bell Laboratories in Holmdel, NJ in July 1961. He performed research on mixer diodes, varactors and metal-semiconductor photodetectors, and developed thin film circuits for microwave oscillators and frequency multipliers. In 1969 he became a supervisor in the Radio Physics Research Department and lead the research group on microwave and millimeter-wave integrated circuits. He and his group devised microstrip and stripline frequency converters which have been introduced into Bell System digital radio systems and circuits built by other microwave communication companies. He also demonstrated that thin film circuits can be built with relatively small attenuation up to frequencies of 230 GHz and developed novel stripline receivers both at 100 GHz and 230 GHz. He is presently engaged in advanced work on solid-state devices and circuits for use in microwave and millimeter-wave communication systems and for remote sensing.

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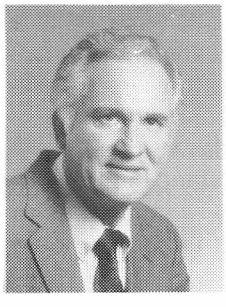
Martin Schneider is a recipient of the Microwave Prize of the IEEE-MTT Society and the IEEE Centennial Medal. He is a member of the IEEE Awards Planning and Policy Board and the Editorial Board of the IEEE Transactions on Microwave Theory and Techniques and the International Journal of Infrared and Millimeter Waves. He has been elected Course Director of the next NATO International School of Solid-State Device Research in Erice, Sicily. He has published 42 papers, holds 16 patents, and has presented 8 invited papers at international conferences and major scientific meetings.

Martin Schneider is a member of the American Association for the Advancement of Science, the New York Academy of Sciences, the American Physical Society, and Sigma Xi. He is a Visiting Professor of Electrical Engineering at the University of Virginia, Charlottesville, VA and a consultant and contributor to the 1986/87 space shuttle experiment on earth limb observations of the atmosphere which is a joint project with NASA, the Institute of Applied Physics at the University of Bern in Switzerland, and the Max-Planck Institute for Aeronomy in Munich, West Germany.

SPECIAL ARTICLES SOLICITED FOR THE MTT NEWSLETTER



by J.B. Horton

Recently, the MTT Newsletter staff began a new feature for the Newsletter, publication of special articles dealing with current topics in the technical and professional areas of interest to MTT Members. Our first article concerned high electron mobility transistors (HEMT) and appeared in the summer issue. Our second article, discussing the impact of science on industry appears in this issue. Dr. A.P. Speiser discusses the importance of the marriage of science and technology in telecommunications.

I would like to emphasize that these special articles will cover topics in a broad, general sense. The idea is to provide the members with a general understanding of the topic and its significance in current and future activities in the microwave field. Specific design techniques and applications will be covered in papers appearing at the MTT symposia and in the Transactions.

If you know of a topic that is current and you are willing to contribute an article to the Newsletter, please contact John Horton (213/535-8491) or Reynold Kagiwada (213/536/2402) at TRW, One Space Park, Redondo Beach, CA. 90278.

PROLOGUE

The impact of advancements in science since the early 50's has had great effect on all of us in the engineering field, and has certainly caused the application of microwave technology to change greatly. When I first read Dr. Speiser's paper on The Impact of Science, I kept comparing the evolution of microwave technology with the events cited in his article. With the exception the Shannon theory on communications, the major events discussed could just as well apply to us in the microwave field. After more thought about the history of the microwave industry, this seems very logical. The microwave industry was initially based on the needs for radar and we still serve the radar community. However, since the 50's the telecommunications industry has had as much or more impact on the microwave field as any other user. Consider, for example, how many major microwave technology contributions have evolved from the Bell Telephone Laboratories to meet the needs of the telecommunications industry.

So, why should an MTT member be concerned with a Communications Society article on the marriage of science and technology? The answer is straight forward. We are an integral part of the telecommunications industry and a supplier of technology and equipment. In reading Dr. Speiser's article you will notice that almost all the major scientific cornerstones were also significant events for the microwave industry. The importance of this coincidence is that the future of the microwave industry is in many ways tied directly to the telecommunications industry, and the future of both may depend very much on scientific developments of the types highlighted in Dr. Speiser's article.

J.B. Horton
Chairman, MTT-16

THE IMPACT OF SCIENCE

by A.P. Speiser

The impact of science upon engineering developments in telecommunications is one of the truly fascinating aspects in the history of technology. In fact, there are few domains of human endeavor where science and technology have consistently been as closely coupled as in telecommunications. The path from Maxwell to Heinrich Hertz to Marconi, in other words - the path from theoretical physics to business success, lasted less than 30 years, a short time even by today's standards.

Before looking at the impact of science in the past and in the future, I would like to review some of the engineering advances of the recent past. I would like to address this question: What are the three most important steps in telecommunications during the past quarter century? In finding the answer there is no disagreement among the experts; the three items are satellite communications, optical fibers, and integration of communications and computer systems. Let us look at them one by one.

Satellites and Optical Fibers

One of the remarkable aspects in the evolution of telecommunications is the continued competition between the *wirebound channel* and the *wireless channel*. Each one of the two recorded important victories; they seemed to take turns in claiming superiority. The first telegraph, the carrier-frequency telephone line, and the deep-sea cable were victories of the wirebound channel. On the wireless side, radio broadcast and microwave links were major steps.

Satellite communications is now perhaps the ultimate victory of the wireless channel, a victory well deserved by those who have brought it about. It is surely no overstatement to call space technology the greatest achievement of mankind in technology. Many of yesterday's dreams are realities today. Men have walked on the moon; the entire planet Earth was photographed in one picture. Space technology is so unique because it combines the highest technology with the fascination of the love of adventure which seems to be deeply entrenched in humans. Even those who are involved and have contributed to the exploration of space cannot help admiring the results with amazement when looking over the past 20 years. Communications satellites are a part of this development, and they have profoundly changed the world of telecommunications.

Optical fibers are the second of the three items on our list. This time it is the wirebound channel that has recorded a big step forward. For the first time, copper is being replaced by another medium in the conduction of signals. Bandwidth is expected to reach well into the gigabit region, and the deep-sea optical cable is clearly in sight.

Computers and Communications Systems

Probably the most profound change currently taking place is the integration of digital computers and communications systems. By digital computers I do not simply mean digital circuits — they are not new; they are classical. The telegraph is inherently digital; a telephone exchange is largely a digital circuit; and pulse code modulation is also digital. I mean the *stored-program computer.* This integration started in two ways: In the beginning, computers were stand-alone systems. As time progressed, the need to interconnect several distant computers arose, and this was performed by means of a communications channel. An example of the opposite process in the telephone system which, originally, was used exclusively for communications between humans. Gradually, the computer penetrated into the switching network, beginning with the private branch exchange. Today, we witness systems, such as Local Area Networks, where data channels and information processing are so closely linked as to wipe out the separate identity of computers and communications, a process from which, for example, the Integrated Service Digital Network is emerging.

The Scientific Foundation

Let us now turn from engineering to science. What is the scientific basis of our communications systems? Where do we find the cornerstones on which rests today's large and diversified engineering structure?

Many fields of science underly today's systems, but there are four disciplines that clearly stand out: electrodynamics, communications theory, semiconductor physics, and computer science. Let us look at them one by one.

Electrodynamics

The basis of electrodynamics is formed by the equations of Maxwell:

All the vastly complex properties of the electromagnetic field can be deduced from these four equations; they describe the propagation of signals as well as the behavior of circuits. Their beauty lies in their simplicity and symmetry — an impressive demonstration of the

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fact that among the laws of nature those that are truly basic, and also those that have far-reaching consequences, are also simple.

Maxwell's equations are linear. As a consequence, the field contains no frequencies other than those imposed by the boundary conditions. Indeed, this property is the key to our communications systems. Without it, no electrical communications would be possible beyond the most primitive form. We should remember that linearity is not to be taken for granted! Scientists tell us that under extreme conditions of short distance and high energy, Maxwell's equations have to be replaced by quantum electrodynamics, which is highly nonlinear. Fortunately, communications engineers can stay away from these conditions — unless they wish to install their systems at outrageous places such as the surface of a neutron star or the vicinity of a black hole!

Communications Theory

The second cornerstone is the theory of communications, formulated by Claude Shannon. The theory shows that for a given amount of power there exists a channel capacity within which signals can be transmitted essentially without error-provided the right code is being used. This formulation of the limit of what can be achieved with the best possible engineering is as important as are the basic laws of thermodynamics to the mechanical engineer. Shannon also introduced *the bit* as the unit of information, a very basic concept indeed. It is the deep-space channel where Shannon's theory applies most directly, because power as well as antenna size in a deep-space probe are severely limited, whereas bandwidth is freely available.

Unfortunately, Shannon's theory is, as the mathematicians say, nonconstructive. It does prove that a system for encoding a signal exists, but it gives no hint of how such a code might be designed. Although many sophisticated systems have been constructed, schemes that perform as well as the theory promises have still not been found. But they do come close: The best systems are about 5 dB away from the Shannon limit.

The Physics of Semiconductors

The third among the four pillars that carry communications is the physics of semiconductors. It has its roots in quantum mechanics, and names such as Schrodinger and Sommerfeld come to mind. But the decisive step towards coupling science and technology was the work that preceded the invention of the transistor — an idea of the highest importance, and an idea that has probably changed our everyday lives more than any other engineering achievement of this century. The transistor is a scientific principle and an engineering invention at the same time. Its significance is equally high in the sciences and in technological applications. Today, transistors and integrated circuits have replaced virtually all other active devices. There are only a few isolated niches where their predecessors, vacuum tubes, have stayed alive and healthy. And semiconductor physics is also the basis of the electronic devices at the sending and receiving sides of optical-fiber channels.

We owe semiconductor physics and transistor technology to a large number of creative individuals in many places of the world. But let us not forget that nature has been exceptionally kind to them, and to us. It has included in the periodic chart of the atoms the element number 14 — silicon, a substance which combines useful properties for the communications engineer in a way which is almost a miracle. Its bandgap is just right for semiconductor devices. Its melting point is comfortable for crystal growing. Its oxides are ideal insulators. It is the basis of quartz, a crystal with a wonderful combination of mechanical and electrical parameters; without quartz, communications engineers would be hard put, and today's generation of wrist watches would probably be impossible. Silicon is the basis of optical fibers, our new communications carrier, and it provides us with solar cells, the power sources of satellites. Silicon is indeed a great gift of nature. Is silicon going to be scarce? No — a quarter of the earth's crust is silicon! Thus, for electronics there are no limits to growth.

Computer Science

And finally, the fourth cornerstone is computer science. I believe a few words are in order on the identity of this discipline. Is computer science really a science in its own standing? Or is it a part of mathematics, or is it an engineering discipline? This is being debated, sometimes hotly debated. Coming to an agreement on this question is probably not the most urgent need of the day. My personal opinion is that computer science is indeed *a science in its own standing.* While the primordial roots of computer science are to be found in mathematics, computer science has developed its own structure to such a large extent that it should be regarded a science of its own standing — much in the same way as chemistry is a separate science although it is entirely based upon the structure of physics.

The first computer scientist in today's sense of the word was probably the British mathematician Alan Turing. The most prolific single contributor, however, undoubtedly was John von Neumann. He was the first to clearly formulate that a computer must consist of the five elements: arithmetic unit, memory, control, input, and output. *And he invented the stored-program machine* — the concept that instructions and data are stored in the same memory and can be processed in the same arithmetic unit. This feature fundamentally

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distinguishes the von Neumann machine from its predecessors which had their programs on punched tapes. To us, the stored program seems obvious, even natural. It was not obvious at that time, it was an idea of the greatest significance. Is the stored program a scientific principle, or is it an engineering invention? I guess it must be qualified as an engineering invention; but it is so fundamental that it comes close to being a scientific principle. Von Neumann as a researcher was a mathematician, a physicist, and an engineer at the same time, and has made major and lasting contributions in all three fields. In all of history there are probably not more than half a dozen people for whom this claim can be made.

These, then, are the four scientific cornerstones. Before leaving the subject, it is worthwhile to look at the time and the place of origin of the four subjects:

Electrodynamics: Maxwell—Cambridge, 1873
Stored Program: von Neumann—Princeton, 1944
Transistor: Bardeen, Brattain, Shockley—Murray Hill,
Communications Theory: Shannon—Murray Hill, 1948

Note that three of these four events occurred within a period of four years and within a geographic range of less than 50 kilometers — an impressive demonstration of the intellectual fertility of the United States east coast during that time period.

Future

Let me now turn to the future. What will the future bring us? The future cannot be predicted — it is basically unknown. But there are certain events that can be foreseen with a high probability; others are more speculative.

I find it particularly fitting to speculate about the future while I am a guest of the Netherlands — in other words, of a country which has contributed to the science and the technology of communications far in excess of what would be expected by its size. After all, it was the Dutchman Christiaan Huygens who, besides many other contributions to science, formulated basic facts that underly the propagation of waves. It is in Holland that ferrites were brought to maturity, where the important concept of the gyrator had its origin, where in the early years of radio astronomy the world's largest radio telescope was built and operated. To Holland we owe the pentode; we owe important contributions in the domain of television cameras, as well as the compact disc, which is surely the most valuable innovation in entertainment electronics in a long time. Holland figures prominently on the map of contributors to communications technology; this may well be related to the country's tradition of worldwide travel and trade.

What will the future bring us? In integrated circuits, the million-transistor chip is at our doorsteps, and the billion-transistor chip is being discussed as a possibility for the year 2000 — there seems to be no fundamental barrier to rule it out. In fiber-optic channels, the deep-sea cable is on its way to realization. In coding systems, the Shannon limit is being approached, but the remaining room for improvement is small — unlike the domain of computer architecture, where there are huge unexplored areas. The well-known machine which performs one arithmetic operation at a time is being replaced by other concepts, called non-von Neumann architectures, which are made up by large arrays of processors and memories that interact in a highly complex fashion, somewhat similar to the human brain, where processing, memory, and control are spread almost throughout the entire system. Data encryption and the use of public key codes will make our systems increasingly complex, and the generation of software, as against the design of hardware, will absorb an ever-increasing share of our efforts.

It has been proposed to use neutrino beams for telecommunications. The neutrino is an elementary particle that travels at the speed of light. Its interaction with matter is so small that a neutrino can travel from Amsterdam straight through the earth to New Zealand with no trouble at all. This sounds ideal for communications! Yet, the idea of modulating such a beam and detecting the signal very likely is in violation of the fundamental laws, especially with regard to Shannon's theory. (The imaging with neutrino beams has recently been the subject of a swindle of major proportions on an international scale. If Shannon does not permit such a system, he apparently does not rule out the possibility of making a great deal of money with it!) It seems likely that we will have to continue with the electromagnetic field — happily, at least as happily as in the past.

Let us look at Maxwell's equations again: Despite their beautiful symmetry, they have a flaw: The first equation has a *"j"* term, which describes the current carried by electrons; the second one has nothing corresponding. The reason is that there are no isolated magnetic charges, or magnetic poles. Such particles have been predicted, and named "magnetic monopoles." Imagine the effect if they were discovered! Extra terms would be introduced into the second and the fourth of Maxwell's equations; they would become fully symmetric. Besides the well-known dipole antenna, where an electric current produces a magnetic field, there would be another dipole in which a magnetic current produces an electric field. What a dream for the antenna designer! A gifted engineer could go to work and write down invention after invention. And yet, while the monopole itself does not seem to violate fundamental laws, the antenna probably does, and we will have to accept Maxwell's equations with their limitations as we know them today.

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Much is to be expected from research into the interaction between waves and solid matter. There are a few long-standing problems whose solution could come from this domain. As yet, it is impossible to deflect a light beam without using delicate mechanisms such as rotating mirrors. The light amplifier does not exist: In order to amplify light pulses, they must first be converted to electrical pulses. And the purely optical digital system does not yet exist. Switching a light beam on and off with another light beam has been demonstrated only under laboratory conditions. Integrated optics offer a great potential indeed.

Replacing the ubiquitous cathode ray tube with something more convenient is an urgent need. It seems that liquid crystal displays which are light, flat, and consume little power will soon find their way into the workstations that are becoming so widely used. As far as full-size color television is concerned, the question remains open whether the shadow mask tube will be replaced by something else before the end of the century and it is uncertain when a satisfactory solution for the large-screen projection of TV pictures will be forthcoming.

Biological Sciences

How about biotechnology? When will the biological computer replace our silicon chips? This is a difficult question, and a loaded one. Biotechnology as a science is making rapid progress, and new discoveries come at a fast pace. Events are happening fast, particularly at the interface between biological manufacturing processes, for example in the food or pharmaceutical domains, and computer-based process control. The enzyme sensor is becoming a reality. But speculations go further. There is a vision that circuits could be grown through biological processes on the basis of information coded in the same way as the genetic code in animals and humans. I tentatively call such a circuit the "biodigital chip." Signals would no more be carried by moving electrons, but by organic molecules.

When will this become a reality? There is always risk in predicting that something will not occur. The idea of the biodigital chip does not violate fundamental principles. After all, nature has implemented it in countless different forms. Many of them are right in this room today, as parts of our nervous systems. It is obvious that biology has the potential for systems that are vastly more complex than today's silicon systems. But the difficulties in reproducibility, in interfacing, and in long-term stability are formidable. I do not believe that the biodigital chip in the true sense of the word will become commercial within the next few decades. This is a personal opinion, and I know there are other views.

Conclusion

In conclusion, let me return to the main theme of my talk, which is the impact of science. Is basically new science needed now? One thing can be said for sure: The present scientific structure still leaves room for much technological progress. The potential in space technology, in integrated optics, in microelectronics, and computer architecture is enormous. The four cornerstones of science are not overloaded; they are not saturated, so to speak. There is no pressing *need* for new science. But it would be careless to say there is going to be no *use* when it comes. After all, communications lived happily (and profitably) for 50 years with Maxwell's equations only. I doubt whether the three other cornerstones were asked for, or whether they were predicted. Certainly the von Neumann machine was not predicted. But when they arrived they were immediately put to work. Personally, I hope for new basic science; but nobody can say where and when it will occur. Great scientific discoveries are unexpected. They come from truly gifted individuals, and they are a wonderful, but also rare, gift of nature. New science will never come from an Artificial Intelligence system or from a fifth-generation (or any other generation) computer. The creative process on the highest level is inherently human, and I am quite certain that it will so remain.

Reprinted from IEEE Communications Magazine, Vol. 22, No. 10, Oct. 1984. This is the text of the Keynote Address of the IEEE International Conference on Communications (ICC '84) Amsterdam, May 14-17, 1984.

Ambros P. Speiser was born in Switzerland and graduated in 1948 as an electrical engineer at the Swiss Federal Institute of Technology (ETH). After studies at Harvard University and at the Institute for Advanced Study under John von Neumann, he was in charge of the design of an electronic computer at the ETH. He also obtained his Ph.D. during that period. From 1955-1966, he was director of the IBM Research Laboratory Zurich, whereafter he was appointed director of Corporate Research of Brown Boveri, a post which he still holds.

Dr. Speiser's publications include textbooks on digital computers and pulse circuits as well as articles on research management and research policy. He is a member of the Swiss School Council (corresponding to the Board of Trustees) of the Swiss Federal Institutes of Technology, and a member of the advisory board of the Laboratory for Electromagnetic and Electronic Systems at M.I.T. He is a Fellow of the IEEE and an honorary member of the Zurich Physical Society and holds a radio amateur's license with the call HB9EV.

IEEE ELECTION NEWS

Dr. Bruno Weinschel

Dr. Bruno O. Weinschel, President and Chief Engineer of Weinschel Engineering Company, Gaithersburg, MD, has been elected 1985 President-Elect of The Institute of Electrical and Electronics Engineers, Inc. (IEEE). Dr. Weinschel will serve as president-Elect throughout 1985 and will assume the office of President on January 1, 1986. In addition, Merlin G. Smith, Technical Assistant to the Vice President of Logic and Memory at the IBM T.J. Watson Research Center, Yorktown Heights, NY, was elected Executive Vice President of the Institute and will serve in this capacity during 1985. The IEEE, with transnational headquarters in New York City, is the world's largest technical professional organization with some 250,000 members in more than 120 countries.

The current IEEE President is Dr. Richard J. Gowen, President of Dakota State College in Madison, SD. The Institute Executive Vice President is Henry L. Bachman, Vice President of Operations for the Government Systems and Products Division, Hazeltine Corporation, Greenlawn, NY. Dr. Gowen will be succeeded as President in 1985 by Charles A. Eldon, Manager of Capital Equipment for Hewlett-Packard Company, Palo Alto, CA.

A Constitutional amendment, proposed via petition and requiring direct election of the IEEE Vice President for Professional Activities by U.S. members exclusively for a term of two years, was defeated. The amendment had been opposed by the IEEE Board.

A total of 187,892 members of the IEEE were eligible to vote in the election, of whom 23.6 percent voted. This compares with 21.7 percent who voted in last year's election and 23.9 percent who voted in 1982. This year, IEEE members also elected Directors for Regions 2, 4, 6, 8 and 10 as well as for Divisions II, IV, VI, VIII and X. Vice Chairmen were elected for Regions 2, 5, 6 and 7.

Commenting on his election, Dr. Weinschel said he will devote prime attention to those programs he believes will improve industrial productivity and competitiveness while also advancing the technical and professional status of IEEE members. Prime among these is the need for enhanced continuing education programs for older engineers. Here, Dr. Weinschel backs a **tax credit** for the cost of educating or retraining engineers so that they can maintain their technical skills while the state of the art is moving rapidly ahead.

According to Dr. Weinschel, "Many employers are afraid to make a long-term investment in the maintenance of their human technical capital through education, because of the high mobility of their professionals. A tax credit would reimburse them fully and encourage such investments which in turn could improve the technical skills of older members and thereby could enhance industrial productivity."

Dr. Weinschel has been a member of the IEEE since 1945 and was elected a Fellow in 1966, "For contributions in the field of precision microwave measurements and advancement of attenuation measurements." Since 1952, he has served as Chief Engineer and President of Weinschel Engineering. A native of Stuttgart, Germany, he received a BA-Physics (equivalent), and a DR-Engineering at Technische Hochschule, Stuttgart and Munich. He also holds an Honorary DR-Science from the Capitol Institute of Technology.

Prior to setting up his own company, Dr. Weinschel held a number of positions including Supervisory Engineer, Electrical Test Planning at Western Electric Company; Chief Engineer, Industrial Instruments Company; and Research Worker at the National Bureau of Standards. Dr. Weinschel is a Fellow of the Institution of Electrical Engineers (United Kingdom) and has authored or co-authored some 40 journal articles. He is the inventor or co-inventor for 20 patents and is a registered Professional Engineer in the State of Maryland and in the District of Columbia.

Dr. Weinschel has been a member of the IEEE Executive Committee and Board of Directors (1978-80) and has served as Vice President for Professional Activities (1978-79) and as Secretary (1980). He has been active on a wide range of Committees including Finance, Member Conduct and Standards (Vice Chairman, 1972). Dr. Weinschel has also served the IEEE Technical Activities Board (TAB) both as a member of its Operating Committee (1972-76) and as Finance Chairman (1973). In addition, he has been an active member of the United States Activities Board (USAB) which he chaired during 1978-1979.

Merlin Smith, who will take office as Executive Vice President on January 1, 1985, is a member of the IEEE Board of Directors (1983-84) and is a former President of the IEEE Computer Society (1977-78). Mr. Smith joined the International Business Machines Corporation in 1952 and participated in the development of the Naval Ordinance Research Calculator. Later, he served as Engineering Manager for early development of large-scale integration. Mr. Smith has managed programs in advanced computer components, design automation, and cryptographic systems, and has been a frequent author and patentee in the field of electronic components. In his present position, Mr. Smith is engaged in the application of VLSI technologies at the T.J. Watson Research Center.

DISTINGUISHED MICROWAVE LECTURERS

by E.C. Niehenke

The IEEE MTT-S Distinguished Microwave Lecture Program provides the local Chapters with lectures on pertinent microwave technology of interest to the MTT Society membership. The current 1984/85 Distinguished Microwave Lecturers Dr. Paul Greiling, "High Speed Digital IC Performance Outlook" and Dr. Sander Weinreb, "Radio Astronomy — A Challenge to the Microwave Engineer" have collectively given 22 lectures so far this Fall. The lectures have received numerous requests from MTT-S Chapters, IEEE Sections, and Student Chapters and anticipate presenting a total of 65 lecturers. Dr. Paul Greiling started his lectures in Europe and has an informative report in this issue.

Mr. Kenneth L. Carr of M/A-COM has been selected as the 1985/86 Distinguished Microwave Lecturer. His lecture, "The Application of Microwave Technology to the Detection and Treatment of Cancer", is very timely. Due to the high incidence of cancer in our Society, this subject matter will be of great interest to both MTT members and their spouses. Therefore, spouses are encouraged to attend. Mr. Carr's pioneering work in the development and application of microwave techniques to medicine, and, in particular, to the detection and treatment of cancer has been very successful. Mr. Carr's outline and biography follow. To arrange for Mr. Carr to speak contact him as follows:

Mr. Kenneth L. Carr
M/A-COM, Inc.
South Avenue
Burlington, MA 01803
(617) 272-3000 Ext. 1650

DISTINGUISHED MICROWAVE LECTURE HIGH SPEED DIGITAL IC PERFORMANCE OUTLOOK

by Paul T. Greiling
Hughes Research Laboratories
Malibu, California

This year I have had the honor of being selected as one of the Distinguished Microwave Lecturers for the MTT-S to present a lecture, "High Speed Digital IC Performance Outlook." I would like to thank both MTT Adcom for the honor and Hughes Aircraft Company, in particular, Dr. Charles Krumm, for providing financial support and allowing me time away from my job to give the many lectures. Finally, as all of you know who travel a great deal, I appreciate the understanding and sacrifice made by my family for the many nights that I must be away from them.

My first lecture was a dry run at Hughes Research Laboratories in which it immediately became obvious I had too much material to cover in the nominal one-hour lecture. After the appropriate modifications, I started my lecture tour in Europe visiting several of the newly formed MTT chapters and existing IEEE Sections. My tour started in Bergen, Norway at the request of Dr. Reidar Kuvas, a Director of the Chr. Michelsen Institute. I had an informative visit at the Institute and enjoyed renewing my friendship with Reidar which was developed during our "IMPATT diode days" at Cornell and Michigan. Anne Kuvas was a most gracious hostess and is a fantastic cook. From Bergen, I took the train through the fjords and over the "top of Norway" (breathtaking scenery) to Oslo. Dr. Kuvas had arranged for Drs. Johannessen and Longva of ELAB in Trondheim to handle my arrangements in Oslo where I gave my lecture for the Research Council adjacent to the University. From Oslo, I continued to Goeteborg, Sweden by train where Prof. Erik Kollberg of Chalmers University who is head of the newly formed Swedish MTT Chapter, took care of my arrangements. I was honored to have not only students and local MTT members attend my lecture, but also Dr. Ishii and colleagues from RIFA flew in from Stockholm to attend the lecture. Prof. Kollberg arranged for a tour of their radio telescope located a short distance outside of Goeteborg. Next, I visited the University of Zagreb and the IEEE Section in Yugoslavia. Prof. Hrvoje Babic, a friend who also teaches part time at UCLA, had requested my visit and took care of all the arrangements; tour of the EE department laboratories, discussion with students, tour of the old town of Zagreb and even provided me with his cottage on the Adriatic. His wife Nada, a civil engineer, provided a never ending series of excellent Yugoslavian meals. The rest of my European tour had been initiated by Prof. Guissard of ELHY. He had contacted and set up dates for my visit with the newly formed Swiss chapter, the German chapter and his own BENELUX chapter. He also arranged for me to give my lecture at the Ninth European Specialist Workshop in Active Microwave Semiconductor Devices being held in Veldhoven, the Netherlands. I am indebted to him for all the work he did in helping coordinate this part of my

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tour. In Zurich, Switzerland, where Prof. Gardiol is chairman of the new Swiss chapter, Prof. Ray Ballisti took personal care of my local arrangements including a visit to IBM Research Labs to talk with Dr. Drangeid, Director, and his colleagues. Dr. Drangeid is also IEEE Region 8 Director and formerly headed up the team which was instrumental in the early development of GaAs FETs. My next talk was in Brussels, Belgium to the local BENELUX chapter for which Prof. Guissard had made the arrangements. After Brussels, I attended the Workshop which was organized by Prof. Van de Roer of Eindhoven University of Technology and had the pleasure of presenting my talk to many of my colleagues in the field. The technical exchange with Prof. Beneking of Technical University of Aachen, Dr. R. Zuleeg, of McDonnell-Douglas, Dr. M. Rocchi, of LEP, Prof. H. Hartnagel, Technical University Darmstadt, Prof. H. Hasegawa, Hokkaido University, and many others at the workshop was very exciting and stimulating. My visit to the German MTT chapter being organized by Dr. Nigel Keen had to be postponed since all the necessary paper work to formally dedicate the chapter had not been completed. Hopefully at some later date I will have a chance to visit their chapter.

After this whirlwind tour of the European chapters I returned home to start my U.S. tour as shown in the schedule. I first made a trip up the West Coast to Portland to their Electronics Society (nine technical chapters combined) at the request of Joel Johnson. Dr. Tom Reeder provided for a stimulating afternoon round table discussion at Tektronix with his colleagues. After my talk that evening I was given a tour of the Oregon Graduate Center Solid State Laboratories. The following day I visited the student IEEE chapter at Oregon State University where Dennis Brown is student chapter chairman. Prof. John Wager, a former colleague from Hughes Research Laboratories and Prof. Tripathi, a former office mate during our graduate school days at Michigan, provided an interesting tour and overview of their facilities and research. The next day I was in Palo Alto where I gave my talk for Dr. John Chen at Xerox Research Laboratory in the afternoon and then repeated it to the Santa Clara Valley MTT chapter that evening. This was a most rewarding experience because of the many friends and experts in the field who are members of this active chapter. Dr. Larry Stark and Dr. Craig Snapp organized the meeting which brought out over 100 attendees. I ended the West Coast trip with an afternoon graduate seminar at U.C. Berkeley where a research program in high speed GaAs ICs is beginning.

The week after my West Coast tour I visited the Lehigh Valley and Lehigh University student sections. On the two days before my talk Comedian Mark Russell (Washington 1980 MTT Symposium Banquet Speaker) and Nobel Peace Prize Winner Bishop D. Tutu had also given talks at Lehigh! I next stopped in Minneapolis at the request of Dr. Chente Chao to visit the Twin Cities MTT chapter headed by Chuck Seashore. The Minneapolis chapter was formed only one year ago and already has an enthusiastic membership. I ended this trip at the North Jersey chapter which had organized a mini trade show along with the Princeton and Jersey Coast MTT/AP chapters. Both Distinguished Microwave Lecturers, myself and Dr. S. Wintraub, gave our talks as part of the show. Dick Snyder and his chapter had done an outstanding job in arranging the one day show with over 300 attendees. I have ended the fall series of lectures with a visit to the Phoenix chapter at the request of Dr. Dydyk and had a most enjoyable visit with Drs. Herb Gronokin and Chuck Weitzel of Motorola.

DISTINGUISHED MICROWAVE LECTURE SCHEDULE
PAUL T. GREILING
Hughes Research Laboratory
Malibu, California

Location	Chapter/Section	Date
Bergen, Norway	IEEE Section	September 14
Oslo, Norway	IEEE Section	September 18
Goeteborg, Sweden	Swedish MTT-Chapter	September 20
Zagreb, Yugoslavia	IEEE Section	September 24
Zurich, Switzerland	Swiss MTT-Chapter	October 8
Brussels, Belgium	BENELUX MTT-Chapter	October 10
Veldhoven, Netherlands	European Workshop	October 12
Bonn, West Germany	German MTT-Chapter	October 16 (postponed)
Portland, Oregon	Electronics Society	November 6
Corvallis, Oregon	Student Chapter	November 7
Palo Alto, CA	Xerox Research Lab	November 8
Palo Alto, CA	Santa Clara Valley MTT-Chapter	November 8
Berkeley, CA	University of California, Berkeley	November 9
Lehigh, PA	Lehigh Valley, IEEE Section and Student Chapter	November 14
Minneapolis, MN	Twin Cities MTT-Chapter	November 15
Clifton, NJ	North Jersey MTT-Chapter	November 16
Phoenix, AZ	Waves and Devices Group	November 20
Cedar Rapids, IA	IEEE Section	January 14
Los Angeles, CA	San Fernando Valley MTT-Chapter meeting)	January 22 (inaugural
Alamogordo, NM	Alamogordo-Holloman Section	January 23

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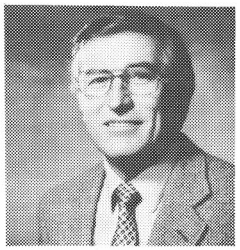
Dallas, TX	Dallas MTT-Chapter	January 24
East Lansing, MI	Southeastern Michigan MTT-Chapter	January 31
Ann Arbor, MI	University of Michigan Student Chapter	February 1
Chicago, IL	Chicago MTT-Chapter	February 4
Baltimore, MD	Baltimore MTT-Chapter	February 12
Boston, MA	Boston MTT-Chapter	February 13
San Diego, CA	San Diego MTT-Chapter	March 20
Atlanta, GA	Atlanta MTT/AP Chapter	April 8
Tampa/ St. Petersburg, FL	Florida West Coast MTT-Chapter	April 9
Orlando, FL	Orlando AP/MTT Chapter	April 10
Melbourne, FL	IEEE Section	April 11
Albuquerque, NM	Albuquerque MTT Chapter	May 17
Philadelphia, PA	Philadelphia MTT Chapter	May 29

To Be Scheduled

Denver/Boulder
Red River Valley, Fargo, MD
Syracuse, NY
Ottawa, Canada
Central Georgia
Huntsville, AL
Japan Chapters



KENNETH L. CARR

Mr. Carr was born in Cambridge, Massachusetts on 15 February 1932. He received his B.S. in Electrical Engineering from Tufts University in 1953. During the past thirty years, he has worked at Philco, Sylvania, and Airtron. In 1958 Mr. Carr co-founded Ferrotec, Inc., serving initially as Technical Director and later as President. Following the acquisition of Ferrotec in 1970 by M/A-COM, INC., 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. He is also Vice President and Member of the Board of the Friends of Eye Research, Boston, Massachusetts.

He is currently a member of MTT-S, AAPM, BEMS, IMPI, the Radiation Research Society, and a Senior Member of the IEEE. Much of his recent work has been in the development and application of microwave techniques to medicine and, in particular, to the detection and treatment of cancer.

THE APPLICATION OF MICROWAVE TECHNOLOGY TO THE DETECTION AND TREATMENT OF CANCER

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 aboard. 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 differences between the normal and malignant tissues are though 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 remission due to ionizing radiation alone is approximately 31%, whereas hyperthermia used in combination with ionizing radiation results in excess of **70% remission.**

St Louis Missouri

MEMBERSHIP MATTERS

by P.A. Green

MTT-S total membership for this October surpassed the 1983 year total with 7,503 current members. This is an increase of 532 memberships or a 7.6% increase over October 1983. This total is well above the 6.2% the IEEE membership is experiencing, and further surpasses the Society membership of 4.7% during the same period.

MTT-S membership has continually ranked seventh out of thirty-two Societies throughout most of the year and will continue to do so. We shall exceed our goal of 7,770 members by year's end and achieve close to 7,900 total members.

The Membership booth did extremely well by acquiring thirty-three new MTT-S members. Of those, twenty-two joined IEEE, ten are currently IEEE members, the other is a student member.

IEEE PRESS PUBLISHES MICROWAVE AND MILLIMETER-WAVE MIXERS

New York, NY, September 13, 1984: The publication of **Microwave and Millimeter-Wave Mixers** has just been announced by the IEEE Press, book publishing arm of the Institute of Electrical and Electronics Engineers, Inc. Microwave and Millimeter-Wave Mixers is a volume in the IEEE Press Selected Reprint Series, prepared under the sponsorship of the IEEE Microwave Theory and Techniques Society. Editor of this volume, Erik L. Kollberg, is a professor in the Department of Electron Physics at Chalmers University of Technology (Gothenburg, Sweden) and leader of a group which is responsible for the development of low-noise microwave and millimeter-wave receivers at the Onsola Space Observatory.

This state-of-the-art discussion of microwave and millimeter-wave mixers provides an extensive overview of modern mixer theory and techniques. The book consists of 71 carefully selected papers that cover a variety of mixers and practical circuits.

Single-ended, balanced and subharmonically pumped mixers are discussed, as well as theories for the calculation of conversion loss, noise, saturation, and intermodulation properties. Established circuits, both narrow-band and broad-band, and new types of mixers using nonlinear devices other than diodes, such as FET's or superconducting elements, are also dealt with.

The papers are divided into ten major parts, each of which contains a brief commentary and bibliography for further reference. They are as follows: Basic Mixer Theory; Accurate Modeling and Computer-Aided Analysis of Schottky Diode Mixers; Practical Implementations of Microwave Mixers; Other Practical Implementations of Microwave Mixers; Harmonic Mixers; Intermodulation in Microwave Mixers; Cryogenic Schottky Barrier Mixers; Superconducting Junction Mixers; FET Mixers; and Further Aspects on Microwave and Millimeter-Wave Mixers.

A detailed introduction provides the inexperienced reader with a fundamental understanding of microwave and millimeter-wave mixers. This book is an essential reference for scientists, engineers and students committed to the field of microwave and millimeter-waves.

SOLID-STATE DEVICES IN COMMUNICATIONS NATO Advanced Study Institute

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IBM Thomas J. Watson Research Center
Yorktown Heights, NY 10598 USA
Phone (914) 945-2342

Location: Ettore Majorana Centre,
Erice, Sicily, Italy

Dates: July 14-27, 1985

Deadline for applications: May 15, 1985

Course Fee: Including accommodations and weekend excursion $650.00

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Objective of the Advanced Study Institute:

The series of lectures and group discussions are aimed at solid-state device researchers and engineers at the postdoctoral level who are actively engaged in research and development of new devices. Each participant attending this Institute is expected to attain a thorough understanding of advanced solid-state devices which are relevant to modern communications systems.

PURPOSE OF THE COURSE

The objective of the 1985 Third Course of the International School of Solid-State Device Research is to continue the tradition of sharing new knowledge among solid-state researchers in a setting isolated from distractions. But in contrast to the previous schools, whose objectives was to treat a specific subject in depth (Large Scale Integrated Circuits, Molecular Beam Epitaxy and Heterostructures), the aim of the proposed course is to widen the scope of the study. Solid-state scientists create and develop devices which are used as oscillators, amplifiers, modulators, switches and detectors in all types of modern communication and transmission systems (satellite, fiber optic link, terrestrial radio link). Yet the researcher's focus is usually limited in scope to only a few particular devices. Consequently, an opportunity is needed to improve the understanding of the applications of advanced devices to overall system design and performance.

The structure of the course is hierarchical. Materials are used to build devices which in turn are interconnected into circuits. The circuits are the building blocks of systems. This approach integrates all aspects of the fabrication and use of solid-state devices. Topic I on Materials and Technologies will lay the foundation of the course and lead into Topic II which will be devoted to advanced solid-state devices. The device lectures and informal discussion sessions will cover structures which are applicable to three categories of use: optoelectronics, high speed logic, and microwave and millimeter-wave electronics. Finally, Topics III and IV devoted to circuits and systems respectively will also treat these categories in depth.

The School on: "Solid-State Devices in Communications" is the first one of its kind. The subject is timely, and the participants are likely to produce creative contributions in other related fields. The wide scope of this course is different from that offered in other NATO Advance Study Institutes which tend to concentrate on relatively narrow subjects.

The series of lectures and group discussions are aimed at solid-state device researchers and engineers at the post-doctoral level who are actively engaged in research and development of new devices. Each participant attending this Institute is expected to attain a thorough understanding of advanced solid-state devices which are relevant to modern communication systems. The course format will be similar to those of previously conducted NATO Advanced Study Institutes at the Ettore Majorana Centre in 1981 and 1983. Thus, six hours per day will be allocated to lectures and two hours per day to tutorials and informal discussion sessions. In, addition, two cultural tours of historic sites will be conducted. These tours will be similar to those organized for the previous International Schools of Solid-State Research.

MAIN LECTURES AND LECTURERS

Topic I. Materials and Technologies

Synthesized Semiconductor Structures - L. Esaki, IBM Yorktown Heights, NY, USA

Growth and Characterization of Compound Semiconductors — S. Palmateer, General Electric, Syracuse, NY, USA

Topic II. Advanced Solid-State Devices

Laser Diode Structures - G. A. Acket, Philips Research Laboratories, Eindhoven, Netherlands

Silicon and GaAs IMPATT Diodes - W. Harth, Technische Universitaet, Munich, Germany

Phase Noise and Linewidth in Laser Diodes and Amplifiers - P. Spano, Fondazione Ugo Bordoni, Rome, Italy

Avalanche Photodetectors - R. Trommer, Siemens, Munich, Germany

Microwave and Millimeter - Wave Frequency Converter Diodes and Circuits - M. V. Schneider, AT&T Bell Laboratories, Holmdel, NJ, USA

Gallium Arsenide and Indium Phosphide Gunn Devices - W. H. Haydel, Fraunhofer Institut, Freibarg, Germany

Low-Noise and Power Field Effect Transistors - N. T. Linh, Thomson CSF, Corbeville, France

Heterojunction Bipolar Transistors - J. R. Hayes, Bell Communications Research, Murray Hill, NJ, USA

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Topic III. Circuits for Modern Communication Systems

Integrated Optics - M. Papouchon,
Thomson CSF, Corbeville, France

Picosecond Optoelectronics - H. Melchior,
Swiss Federal Institute of Technology, Zurich, Switzerland

Placement and Interconnection of Devices in VLSI Circuits - M. Youssef,
IBM, Fishkill, NY, USA

Gunn Local Oscillators and Electronically Tunable Gunn
Sources - J. Ondria
Marconi Ltd., Lincoln, England

Topic IV. Communication Systems

Development of Optical Communication Systems - B. Daino,
Fondazione Ugo Bordoni, Rome, Italy

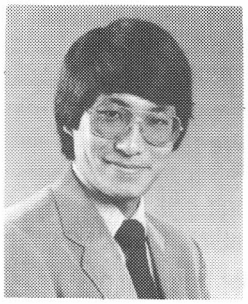
Coherent Fiber Optic Transmission Systems - D. W. Smith,
British Telecommunication Research Laboratories, Ipswich, England

Digital Communications, Satellite and Terrestrial - E. Biglieri,
Polytechnic Institute, Torino, Italy

Local Area Networks - A. Artom,
CSELT, Torino, Italy

Digital TV Transmissions - D. Jeppesen,
Technical University of Denmark, Lingby, Denmark

FEEDBACK



by Kurtis L. Kurisu

The MTT-S Newsletter editorial staff solicits responsible opinions and feedback from MTT-S members regarding topics of interest and importance to our members. This "Feedback" column is designed to respond to readers comments by providing a forum in which we can share our thoughts regarding pertinent and current issues.

If you have an opinion you would like to express in this column, please contact the feedback editor, Kurt Kurisu, TRW, One Space Park, Redondo Beach, CA. 90728.

WEINSCHEL'S QUESTIONNAIRE FOR GUIDANCE ON INTERESTS AND CONCERNS OF IEEE MEMBERS

Dr. Bruno O. Weinschel, President and Chief Engineer of Weinschel Engineering Company sent a survey to Microwave Theory and Technique Society. This survey is entitled "Weinschel's Questionnaire for Guidance or Interests and Concerns of IEEE Members". The survey is published below. As a comparison you can rate yourself relative to how the MTT-S AdCommembers voted.

A) **COMPETITIVENESS** (Use only in Regions 1-6)
In some manufacturing areas we have lost both market share in imports and in the export trade. This indicates a loss of competitiveness.

		YES	NO
A-1	• Do you believe there is a need for both U.S. industry **and** the government to establish **team** relationships and take **new** initiatives to re-establish our **competitiveness** against imports and in the world trade?	____	____
A-2	• Does this require better **quality control** in depth?	____	____
A-3	• Does this require better **reliability engineering?**	____	____
A-4	• Does this require better **after-sales service?**	____	____
A-5	• Does this require better and more entrepreneurial **management?**	____	____
A-6	• Would it help if **management** would be **more knowledgeable in technology** instead of specializing in law or finance?	____	____
A-7	• Should industrial employers spend more of their own funds on **longer term civilian R&D?**	____	____
A-8	• Since this impacts both on the quality of future engineering students as well as on the quality of the general work force, should the IEEE be concerned with the **quality of pre-college science and mathematics education?**	____	____
A-9	• Should more use be made of **quality circles** and other employee participation as a means to increase innovation, productivity and quality?	____	____

B) **CONTINUING EDUCATION OF ENGINEERS**
Some engineering disciplines are developing quite rapidly. The average employer in the U.S. and Britain prefers an engineer 5 years after graduation. This assures that he is not out-of-date and has some experience.

		YES	NO
B-1	• Should an employer **budget** both time and funds **for maintenance of human technical capital** just as he budgets for the maintenance of capital equipment?	____	____
B-2	• Should the employer pay fully for the teaching of continuing education?	____	____
B-3	• Should teaching take place during working hours?	____	____

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B-4 • Should the IEEE pursue Don King's idea to give an employer tax **credits** for the excess expenses over prior years for the continuing education of technical professionals? ____ ____

B-5 • Should engineers, after an extended period with one employer be entitled to a sabbatical leave for graduate study? ____ ____

C) **ENGINEERING CURRICULUM**

		YES	NO
C-1	• Do you believe that engineers require additional training so that they **can communicate more effectively** both orally as well as in writing?	____	____
C-2	• The traditional teaching of engineering usually does not reflect the interdisciplinary requirements of real life engineering problems. Should the IEEE recommend more interdisciplinary teaching in engineering?	____	____
C-3	• The teaching of **manufacturing engineering,** manufacturing processes and manufacturing technology in engineering schools has been almost completely abandoned. While the teaching of engineering science is a necessary base for engineering, should the IEEE recommend the increased availability of courses in manufacturing engineering, manufacturing processes and manufacturing technology?	____	____
C-4	• The teaching of **design** in many engineering schools has been deemphasized in the last 20 years. Should the IEEE recommend that engineering schools not only teach analysis but also synthesis and design?	____	____

D) **STRUCTURE OF ENGINEERING SCHOOLS**

Should the IEEE be concerned with:

		YES	NO
D-1	• The structure of engineering education such as four-year vs. five-year programs?	____	____
D-2	• Should the IEEE recommend a **formal internship** during or after schooling before recognizing an engineer as a professional?	____	____
D-3	• Most engineering schools in the U.S. have **no requirements** that the **faculty** has **industrial experience**. Should the IEEE recommend that engineering faculty have or obtain industrial experience via sabbaticals to industry, exchange programs, concurrent industry employment, etc.?	____	____
D-4	• Medical doctors and lawyers have more than 4 years of college education. Doctors have a higher average income than engineers. Lawyers frequently are the policymakers in industry, government, state and federal legislatures. Most engineers stop at the bachelor degree. • Should the IEEE recommend that the first degree should be a masters degree with a minimum of 5 years of higher education?	____	____
D-5	• Schools of law and schools of medicine are usually separate schools within the university and have a great autonomy. Engineering faculty is usually locked into the salary scale of the university in spite of the greater earning power of an engineering professor in the market place. Should the IEEE recommend that engineering schools become **autonomous, professional engineering schools** within their universities?	____	____
D-6	• The doctor's degree in engineering is usually awarded for basic research leading to **new knowledge.** In some other countries, including West Germany, the doctor of engineering is also awarded for excellence in **industrial design** or for the solution of **industrial problems.** Should the IEEE recommend that doctors degrees for engineers should not be restricted to basic research but also be awarded for industrial problem solving or design?	____	____
D-7	• Faculty tenure is usually awarded for research. Should tenure also be given for a prolonged period of excellent teaching?	____	____

E) **UNDER UTILIZATION**

Good engineers are always in short supply; it is important to best utilize the available talent. Utilization in this context emphasizes the **portion of time spent in professional tasks** vs. time spent on subprofessional tasks which can be delegated to clerks - e.g., following up late purchase orders, making Xerox copies - or to technicians who perform simple tests, wiring, etc. etc.

SUPPORT

Can we improve engineering utilization by recommending that most engineers have qualified and sufficient

		YES	NO
E-1	• subprofessional support facilities and personnel?	____	____

This would include but not be limited to the services of

		YES	NO
E-2	• library research?	____	____
E-3	• computation?	____	____
E-4	• drafting?	____	____
E-5	• clerical services?	____	____
E-6	• purchasing services?	____	____
E-7	• machine shop services?	____	____
E-8	• programming?	____	____

Should engineers be supported by having available

E-9	• personal computers?	____	____
E-10	• intelligent terminals?	____	____
E-11	• CAD/CAM?	____	____

EDUCATION AND TRAINING

E-12	• Should an employer have a long-term human resource plan for engineering personnel (training, continuing education, logistics of replacement, growth and technology change)?	____	____
E-13	• a definite career plan for each engineer?	____	____
E-14	• Do you believe that the employers should assist those older engineers who are interested in upgrading to the current state of the art?	____	____
E-15	• Do you believe that employers should rotate engineers in order to expose them to challenging job assignments thereby preventing overspecialization and obsolescence?	____	____

Do you believe there is a shortage of electrical engineers

E-16	• generally (most fields and geographies)?	____	____
E-17	• in specific mini specialties (e.g., microwave, electrical power)? Please specify _____	____	____
E-18	• in specific mini geographies (e.g., California)? Please specify _____	____	____

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F) **INVOLVEMENT OF ENGINEERS IN POLICY**

		YES	NO
F-1	• Should engineers play a greater role in the top management of industry? Is so, how? _____	___	___
F-2	• Should engineers play a greater role in the top management of government? If so, how? ___	___	___
F-3	• Should an employer have a strategic plan? If so, how? _____	___	___
F-4	• Should engineers participate in the formulation of an employer's strategic plan? If so, how? _____	___	___

G) **LEGISLATION**

In the area of legislation, is it in the interest of the IEEE members for the IEEE to be concerned with:

		YES	NO
G-1	• patent legislation?	___	___
G-2	• anti-trust legislation on joint research?	___	___
G-3	• the portability of pensions by expanding IRA limits?	___	___
G-4	• since the availability of venture capital depends on tax structure, the maximum rate of the capital gains tax?	___	___
	• Other? (specify) _____	___	___

H) **POLITICS** (Only for Regions 1-6)

		YES	NO
H-1	• The National Science Foundation spends about **10%** of its $1.5 billion budget **on engineering** research at universities. The law requires that the NSF support **both science and engineering.** Should the IEEE attempt to increase the portion for engineering research at NSF?	___	___
H-2	• Should the IEEE continue to be active in those political areas which have a direct impact upon the job security and job satisfaction of engineers?	___	___

Should the IEEE be concerned with the **implementation of federal laws or regulations** impacting on the work of its members in the area of:

H-3	• **Quality** of **Measurement Standards** by the National Bureau of Standards?	___	___
H-4	• **Export Licenses; Technology Transfer;** as governed by the applicable federal laws, such as the Export Control Act of the Commerce Department or ITAR of the State Department or DOD security regulations?	___	___
H-5	• Technical **qualifications,** minimum **salary** relative to average domestic salaries, governing the issuance of **work permits** for **alien engineers** or alien engineering students or graduates of U.S. engineering schools (in contrast to legal immigrants)?	___	___
H-6	• Should the IEEE be concerned with the proportion of government R&D support between defense and non-defense?	___	___

I) **INVOLVEMENT IN IMPROVING THE GENERAL WELFARE**

Should the IEEE become more active in those political areas which require the expertise of its members in order to improve the quality of life in the area of

		YES	NO
I-1	• pollution regulation?	___	___
I-2	• development of alternate sources of energy?	___	___
I-3	• increased use of mass transportation?	___	___
I-4	• improved utilization of natural resources?	___	___
I-5	• improvement of health delivery services?	___	___
I-6	• communications policy?	___	___
I-7	• improvement and application of verification methods supporting the enforcement of mutual agreements on limitation of mass destruction weapons?	___	___

QUESTIONS PERTAINING TO THE OPERATION OF SECTIONS, REGIONS, CHAPTERS AND SOCIETIES (For IEEE Volunteers Only):

SS-1	• Regarding Section-Chapter cooperation, is it necessary to improve the quality of meetings in order to increase participation?	___	___
SS-2	• Should one establish better contact with local employers of members?	___	___
SS-3	• Should one involve local members more in issues important to the IEEE?	___	___
SS-4	• Should the section provide for more workshops for updating technical skills of older members?	___	___
SS-5	• Should one recommend that IEEE journals publish more tutorial reviews and updates on those technologies which have changed, are changing rapidly or are emerging?	___	___
SS-6	• Should one recommend that IEEE journals publish more application-oriented articles and assist in obtaining such articles from industry?	___	___
SS-7	• Should one recommend that the IEEE become more involved in standards dealing with emerging technologies, e.g., "interface requirements for components of the wired office", "cellular mobile phones", "standard interfaces for compatibility of modular software", etc.?	___	___
SS-8	• Should we improve our local P.R. to enhance the public perception of the electrical engineers' status?	___	___
SS-9	If elected IEEE President-Elect-1985/President-1986, I do not want to be a figurehead President wasting my time on trivia and excessive ceremonial duties. I would work hard to reduce trivia at meetings of the Board of Directors and make their meetings more meaningful.		
	• Should the Board of Directors concern itself more with important issues (e.g., continuing education of employed engineers, sufficiency of electrical engineering curriculum, how to improve the industrial experience of engineering faculty, etc.)	___	___

AdCom response to Weinschel Questionnaire. Each question number if followed by two numbers, the first is the number of yes votes and second is the number of no votes.

A-1: 10,1	C-2: 9,2	E-6: 10,1	F-3: 8,0	I-4: 8,3
A-2: 11,0	C-3: 9,2	E-7: 10,1	F-4: 8,0	I-5: 7,4
A-3: 11,0	C-4: 9,2	E-8: 8,3	G-1: 10,1	I-6: 7,4
A-4: 10,1	D-1: 8,3	E-9: 11,0	G-2: 9,2	I-7: 6,5
A-5: 11,0	D-2: 2,9	E-10: 11,0	G-3: 10,1	SS-1: 8,3
A-6: 9-2	D-3: 8,3	E-11: 10,1	G-4: 8,2	SS-2: 9,2
A-7: 10,1	D-4: 2,9	E-12: 11,0	H-1: 7,4	SS-3: 10,1
A-8: 8,3	D-5: 7,3	E-13: 6,5	H-2: 10,1	SS-4: 9,2
A-9: 11,0	D-6: 6,4	E-14: 11,0	H-3: 9,2	SS-5: 10,1
B-1: 10,1	D-7: 10,1	E-15: 10,1	H-4: 8,3	SS-6: 9,2
B-2: 6,5	E-1: 9,2	E-16: 4,7	H-5: 7,4	SS-7: 10,0
B-3: 5,6	E-2: 9,2	E-17: 10,1	H-6: 5,6	SS-8: 11,0
B-4: 11,0	E-3: 7,4	E-18: 7,4	I-1: 5,5	SS-9: 11,0
B-5: 8,3	E-4: 8,3	F-1: 8,1	I-2: 9,2	
C-1: 9,2	E-5: 11,0	F-2: 8,1	I-3: 8,3	

DIVISION IV DIRECTOR'S REPORT

by Emerson W. Pugh

ELECTROMAGNETICS AND RADIATION

December 1984

The final meeting of the IEEE Board of Directors and Technical Activities Board (TAB) was held in San Francisco from November 30 through December 3, 1984. During these meetings, I had the pleasure of presenting IEEE Centennial Keys to the Future Awards to five outstanding young engineers selected by the societies of Division IV: David M. Pozar, University of Massachusetts (Antennas and Propagation Society); L. Gilda Haskins, Haskins Associates Inc. (Electromagnetic Compatibility Society); Ronald S. Indeck, University of Minnesota (Magnetics Society); Steven J. Temple, Raytheon Co.(Microwave Theory and Techniques Society); and Ronald M. Gilgenbach, University of Michigan (Nuclear and Plasma Sciences Society). The award consisted of a handsome silicon key and a certificate.The presentation was preceded by an address by Dr. Gordon E. Moore, Chairman of the Board of Intel Corporation.

The board of Directors selected me as one of its two candidates for the office of IEEE Executive Vice President for the year 1986. If the membership supports my candidacy by their votes, I will be pleased to serve the IEEE in that capacity just as I have been pleased to serve the five societies and members of Division IV. The magnitude of that commitment is only partly indicated by the size and scope of the IEEE, which now has well over 250,000 members, worldwide.

During the meeting of the Division's Management Committee (consisting of the five society presidents and myself) we were pleased to welcome Kiyo Tomiyasu, the newly elected Director of Division IV for the 1985-1986 term. I am sure he will do an outstanding job of representing our members throughout the IEEE. Also in attendance, in addition to the five society presidents and myself, were Harlan Howe (President-Elect of MTT), John A. Martin (President-Elect of NPS),and Alan J. Simmons (Vice President Elect of AP).

Several decisions of interest to our members were made. First, it was agreed that we would initiate a one-page "News of Division IV" to be printed regularly in each society's newsletter. Second, we went on record as favoring the use of a percentage (perhaps 20 percent) of the interest income earned by society reserves to support general activities of IEEE. This has been done in the past, but not made explicit. The practice helps keep IEEE dues low and tends to permit wealthy societies to aid the less fortunate ones. Our support of this practice is significant because the reserves of Division IV are the largest of any division in the Institute. Finally we agreed not to enlarge the simple management structure of our division, which consist only of the five society presidents and the division director in a Management Committee. We did agree that minutes of the meetings of our Management Committee would be distributed to the vice presidents of the five societies--and of course, news from these meetings should be carried in the proposed Division IV news page.

A number of significant items were reported by the society presidents. Allen W. Love (AP) reported on the production of two educational video tapes; Eugene D. Knowles (EMC) reported they have held their first conference outside the United States and have the largest percentage growth rate among all societies; H. George Oltman (MTT) reported on the establishment of a special negotiating team whose function is to obtain the best possible rates for hotels and other conference facilities; Ernesto A. Corte (NPS) reported on the coupling of short courses with their conferences as a cost-effective arrangement; and Clark E. Johnson (Mag.) reported the establisment of a **IEEE Translations Journal on Magnetics in Japan.** It will be published monthly, beginning in April 1985, and will provide English-speaking engineers with access to much of the Japanese magnetics literature. This is the first translations journal to be started in the IEEE and is being underwritten with $75,000 from the Magnetics Society's reserves.

St Louis Missouri

DIVISION IV DIRECTOR'S REPORT

by Emerson W. Pugh

Two eventful years in IEEE are drawing to a close as I complete my second year as Division IV Director. The first year, 1983, saw the successful effort to achieve the same number of technical division directors as there are regional directors, namely ten. The purpose was to provide the societies with more effective representation on the IEEE Board of Directors. With the increased number of directors came the restructuring of Division IV into a "cohesive" collection of five technically "compatible" societies: Antennas and Propagation, Electromagnetic Compatibility, Magnetics, Microwave Theory and Techniques, and Nuclear and Plasma Sciences.

In truth these societies are neither more cohesive nor compatible technically than their predecessors — the restructuring had in fact served to weaken some important existing ties. Nevertheless, the societies now in Division IV have begun to find new areas of common interest. We are fortunate that each of the five societies serves a technical area of great current interest, has excellent technical publications and conferences, and is financially strong. Building from these common strengths, the five societies have been able to share experiences and devise yet better programs to provide important services to their members. In addition to conferences and publications, these services include tutorial sessions and courses, distinguished speaker programs, student scholarships, equipment grants to professors, and the support of local chapters. I expect Division IV to continue to be the leader in IEEE with innovative, well-managed programs; and I expect MTT to continue its leadership in Division IV. Indicative of MTT's outstanding performance in all endeavors is the September 1984 special centennial transactions issue, "Historical Perspectives of Microwave Technology," which I have just begun to read. My congratulations to the Guest Editor, Theodore S. Saad, and all those who worked on this excellent issue.

The second year of my term, 1984, is the Centennial Year — a year of pomp and ceremony, punctuated with an occasional noteworthy accomplishment. One significant accomplishment was production of the movie "The Miracle Force" that shows, for the layman, what engineers do. A second was the survey of our membership conducted by the various IEEE boards. Other significant accomplishments may come from the two major events yet to be held: the Centennial Technical Convocation in Philadelphia on October 8-9 and the Young Engineers Forum in San Jose on November 30.

The movie is remarkably good, depicting the engineer as an intelligent, thoughtful person, doing interesting work that generally benefits mankind. I believe it should be distributed broadly and arrangements are being made for its presentation on satellite and cable TV. Each IEEE Society can help by arranging to show this film to large high school and civic groups. Copies may be borrowed by contacting the TAB Office. A second movie, "Generation of Giants" based on the dramatic presentation at the Centennial Convocation in Boston in May, is being prepared. It deals with the history of electric and electronics innovations of the last one hundred years and could also be excellent.

The survey of members revealed that the vast majority are satisfied with the services they receive from IEEE. The most highly valued services are technical publications, technical conferences, and professional contacts — all of which are provided primarily by the individual societies. Specific areas requiring improvement were the quality and availability of tutorial papers and short courses and the activities of local chapters. These are areas Division IV will specifically address during the rest of 1984 and in the future.

As Director of Division IV, I have enjoyed working with the presidents of the five member societies to achieve society objectives. My membership on the Board of Directors is, of course, essential in that process. On the other hand, I regret that time constrains have prevented me from spending as much time as I would have liked with other society officers, Ad Com members, and individual society members. It is important to remember that this is where the action is. The volunteered efforts of these people and their technical contributions are what make the IEEE one of the finest technical societies in the world.

During 1984, I also had the privilege of serving as Vice Chairman of the IEEE Publications Board. This board oversees all IEEE publications: transactions, conference records, magazines, newsletters, **Spectrum, Proceedings, The Institute,** and **The IEEE Press.** Over 100,000 pages of new material will be published in 1984, constituting approximately 15% of the world's literature in electrical engineering. Assuring the continued quality of this material is a prime concern of the Publications Board. Maintaining a timely, cost-effective publication process is critical and is primarily handled by the 70 some employees of the IEEE New

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York Publishing Services Department. In this regard, I am pleased to report that new training and management procedures instituted at the beginning of 1983 are now paying off. From an average lateness of 30 days for all transactions during 1983, an average lateness of less than 10 days was achieved by July of this year, and continued improvement is projected. This includes lateness caused by volunteers as well as by the staff. Dave Steiger and his staff are to be congratulated and encouraged to keep up the good work. Early this year, I initiated a study to provide an effective means of evaluating our archival journals, and I have worked with the TAB Periodicals Committee to develop monitoring procedures to provide an early alert to publication deficiencies before they get out of hand.

An exciting new publication initiative is **Finding Your Way,** a data base of tutorial material being prepared for on-line access by our members. Initiated by Pete Rodrique, the 1976 president of MTT and 1982-3 Vice President for Publication Activities, this system began experimental operation with 24 hour per day availability this month. The unexpectedly large number of members (28,000) who signed up for this service has been divided into four groups. A small group of 3,000 will have unlimited search access from September 24 through October 14, whereas the three larger groups will have more limited access. From these early experiments, we hope to learn how to improve the system. It is appropriate that this computer-supplied service has been started during the IEEE Centennial Year. Its effective implementation and utilization presents a major challenge and opportunity for all of us.

One of the important functions of your division director is to appoint members to committees and other activities in the IEEE. I urge each person who would like to participate in IEEE activities to speak with an appropriate society president or to contact me directly. I would also welcome your thoughts on a proposal that one page of each issue of each society's newsletter be devoted to Division IV activities.

IEEE SWITZERLAND SECTION — JOINT CHAPTER MTT + AP

Activities of the Chapter on Electromagnetism and Microwaves in 1984

The Chapter held two half-day meetings:

On 15 May 1984 in Bern (Swiss PTT Technical Center), workshop on **"Measurement Techniques in Microwaves and Electromagnetism"**

Prof. G. Epprecht (Microwave Lab., ETH Zurich): Reflections.

Dr. J. Forrer (Lab. Physical Chemistry, ETH Zurich) : An Electron Spin Echo x-band spectrometer with loop gap and bimodal microwave resonators.

J. F. Zürcher (LEMA, EPF Lausanne) : A compact portable six-port reflectometer.

Ch. Rieder (CRPP, EPF Lausanne) : Measurement problems at 120 GHZ.

Dr. T. Sphicopoulos (LEMA, EPF Lausanne) : Automatic determination of frequency response parameters, field distribution and distorsion in microwave cavities.

F. Casper (CERN, Geneva) : Beam pipe coupling impedance measurements.

L.G. Bernier (LEMA, EPF Lausanne) : An efficient technique for the measurement of the phase noise of microwave amplifiers.

J. Heierli (Huber and Suhner, Herisau) : Estimation of errors in attenuation measurements.

46 persons attended the workshop. Some of the presentations will be covered in articles appearing in the Bulletin of the Swiss Electrotechnical Association.

On 8 October 1984 in Zurich (ETH) **Fall Meeting with Distinguished Lectures**

Dr. Paul T. Greiling (Hughes Res. Lab., Malibu, CA, USA): High Speed Digital IC Performance Outlook.

Peter Schmid (Inst. Applied Physics, ETH Zurich) : Tapered coplanar waveguides for picosecond optoelectronic sampling devices.

Hans Kaufmann (AFIF, Zurich) : Optical monomode waveguide modulators in GaAs with high speed driving capability.

Dr. Y. Rahmat-Samii (J.P.L., Caltech Pasadena CA, USA) : Antenna far-fields from near-field measurements - a novel plane polar technique.

38 persons attended the lectures.

In addition, a lecture was presented on 5 October 1984 at Ecole Polytechnique Federale de Lausanne :

Dr. Y. Rahmat-Samii (J.P.L., Caltech Pasadena CA, USA) : Antenna far-fields from near field measurements - a novel plane polar technique.

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AWARDS

by Don Parker

As its September Meeting the AdCom selected the following recipients for the major MTT-S awards for 1985:

Microwave Career Award	Harold Barlow Nathan Marcuvitz
Microwave Prize	Karl B. Niclas Brett A. Tucker
Microwave Application Award	James Cheal
Distinguished Service Award	G.P. Rodrigue

Microwave Career Award is presented to an individual for a career of meritorious achievement and outstanding technical contribution in the field of microwave theory and techniques. The recipient is given a certificate, a plaque, and a check for $1,000. The winner must be a member of IEEE. Two awards will be given in 1985. Twice in the past MTT-S has awarded two Career Awards in the same year, one to a U.S. citizen and one to a non-U.S. citizen. N. Marcuvitz is a U.S. citizen and H. Barlow is a citizen of Great Britain. In view of the qualifications of these two candidates, it is appropriate to make two awards in 1985.

Dr. Harold M. Barlow is Professor Emeritus of University College, London having retired in 1967 after serving as the Head of its Department of Electronic and Electrical Engineering for seventeen years. From the end of World War II to about 1970, he has been one of the most important and respected university contributors to the microwave field in Great Britain.

Dr. Nathan Marcuvitz, although he is now 70 years old, is still active at the Polytechnic Institute of New York. He has over 30 publications or paper presentations including the **Waveguide Handbook** and Chapter 8 of **Principles of Microwave Circuits,** Radiation Laboratory Series, MIT, 1948. One of his most important contributions was the microwave network formulation of electromagnetic field problems. During World War II, he helped to rephrase Schwinger's theoretical results in engineering terms. His work was very systematic and thorough. He exerted great influence through his seminars on colleagues and students. As an extension of this work, Marcuvitz also derived transmission line formulations for nonuniform waveguides and for periodic structure. For nonuniform waveguides he developed radial transmission line theory and spherical transmission line theory. His phrasing for periodic structures has been widely used.

Professor Barlow's and Professor Marcuvitz's citations will read

> For a Career of Meritorious Achievement and Outstanding Technical Contribution in the Field of Microwave Theory and Techniques.

The Microwave Prize is awarded annually for the paper making the most significant contribution in the field of interest to the Society, among those published in an official IEEE publication during the year ending June 30th. The winner receives a certificate and a check for $300. The 1985 winners are Karl B. Niclas and Brett A. Tucker of Watkins-Johnson Company, Palo Alto, California, for their paper titled: "On Noise in Distributed Amplifiers at Microwave Frequencies." published in **IEEE Transactions on Microwave Theory and Techniques,** Vol MTT-31, No. 8, August 1983, pp. 661-668.

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, technique, novel use of a device or component, or a combination of the above. Publication of a paper is not required. The winner receives a certificate and a check for $300. The 1985 recipient is James Cheal, consultant, Southwest Microwave, Inc. In 1958 Mr. Cheal designed the prototype of a new coaxial connector in designated BRM by the Bendix Corp. It solved a need in the design of coaxial and related broadband TEM-type (stripline and microstrip) circuits and their testing and assembly into complex microwave packages. The design helped to open up the top half of the microwave frequency range to use of coax.

As a founder and Vice-President for Engineering of Omni Spectra, Inc., Mr. Cheal was the main contributor to the engineering development and refinement of the connector design called OSM. This was followed by a very extensive engineering development program for a complete product line of many configurations, each optimized for microwave performance and use in almost any location or environment. Along with this, Mr. Cheal was largely responsible for coordinating and sorting the many suggestions contributed by users and other manufactures. This enabled the final documentation and specifications for the SMA design to be adapted in 1968 with a minimum of difficulty. The attractiveness of the design was recognized soon after its introduction and is now widely used.

Mr. Cheal's citation will read:

> For contributions to the design, engineering development, and refinement of the OSM Connector which came to be designated SMA

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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. G.P. Rodrigue is the 1985 recipient. Professor Rodrigue has distinguished himself in meaningful service to the MTT-S and the IEEE over the past twenty years. He first started serving on technical committees in the mid-sixties and then on a variety of committees as a member of MTT-S AdCom for ten years. During this time, he was largely responsible for negotiating the first contract with Horizon House for exhibits at our symposium. He was also a strong proponent of page charges during the time when MTT-S did not have any surplus and operated on a very slim budget. He helped to establish our present page charge policies. His comments in AdCom were always well thought out and helped to focus the discussion on key issues. He has always been very effective in working behind the scenes to accomplish the objective of MTT-S.

Biographies of each of the above mentioned award winners follow.

HAROLD M. BARLOW

Harold Barlow's interest in radio and electronics spans some 70 years and during that time he has seen the birth of 'electronics' coupled with a vast expansion in the development of electric waves.

He started in 1915 as a student of electrical engineering at the City and Guilds College, Dinsbury, London, where Silvanus Thompson and W.H. Eccles were his teachers. During the First World War he saw 1½ years service with the British Navy working on long-wave radio in submarines and when de-mobilized in January 1919 he received from the Admiralty the citation 'has performed valuable service in connection with the development of apparatus for naval communications.'

His next step was to graduate at University College, London, where he gained a D.Sc. (Eng.) and later a Ph.D. (Science) of London University. Subsequently he joined his father in the family electrical contracting business, Barlow & Young Ltd. At that time he had no thought of a possible academic career but, out of the blue, one day came a letter from Prof. Sir Ambrose Fleming, under whom he had worked at University College, London, offering him a post at the College as Assistant Lecturer in 'Design of Electrical Machines'. That was the beginning of a long academic career extending to his formal retirement in 1968 and broken only by service with the British Air Ministry during the six years of the Second World War. During that War period he worked on radio including microwaves and became Superintendent of the Radio Department at the Royal Aircraft Establishment, Parnborough, England.

It was the great developments in radar during the Second World War that inspired him to concentrate research on microwaves when he returned to University College, London, in 1946 as Professor of Electrical Engineering. It was a long up-hill task building up the resources required for this new research school, particularly as the laboratories were completely bombed out; but the effort was greatly helped by the splendid group of research workers who happily joined in the enterprise.

During his career he has taken a part in most of the varied activities of professional electrical engineers, comprising industry where he was a Director of Marconi Instruments Ltd., consulting engineering with his own firm Barlow, Leslie and Partners, and of course a wide variety of academic pursuits. Now, at the age of 85 he is still contributing scientific papers, particularly on optical fibres.

He is fortunate in having the unremitting support of his wife Janet, of four children and fourteen grandchildren.

NATHAN MARCUVITZ

Nathan Marcuvitz was born on December 29, 1913 in New York, N.Y. After receiving the Bachelor's degree in electrical engineering from the Polytechnic Institute of Brooklyn in 1935, he remained as a graduate fellow until 1936. At this time, he joined the RCA Laboratories as a student engineer, subsequently performing advanced development research on electron tubes, iconoscopes, and orthicons for television applications. Returning to the Polytechnic Institute of Brooklyn in 1940, he received the Master's degree in 1941. After joining the Radiation Laboratory of the Massachusetts Institute of Technology in December 1941, Dr. Marcuvitz was engaged in microwave research there until 1946.

Returning to the Polytechnic Institute of Brooklyn in 1946 as an assistant professor in the Department of Electrical Engineering, Dr. Marcuvitz completed the requirements for the Doctorate in electrophysics in 1947; he obtained an associate professorship in 1949 and a full professorship in 1951. In 1957, he was appointed director of the Microwave Research Institute, serving in this capacity until 1961, when he became Chairman of the newly formed Department of Electrophysics. Shortly thereafter and until 1963, Dr. Marcuvitz served as Vice-President of Research as well as Acting Dean of the Graduate Center.

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On leave from the Polytechnic Institute of Brooklyn, Dr. Marcuvitz became Assistant Director (Research) of Defense Research and Engineering for the Department of Defense in Washington, D.C. from 1963 to 1964. He was then appointed Dean of Research and Dean of the Graduate Center at the Polytechnic Institute of Brooklyn and served in these positions from 1964 to 1965; in 1965 he became an Institute Professor, the first appointment of this kind at the Polytechnic.

In February 1966, Dr. Marcuvitz joined the faculty of the School of Engineering and Science at New York University as Professor of Applied Physics, until he returned to the newly merged Polytechnic Institute of N.Y. with the same position and is currently an Institute Professor.

An author of a number of technical papers and reports, Dr. Marcuvitz has also edited the "Waveguide Handbook," Volume 10 of the M.I.T. Radiation Laboratory Series, published in 1951 by McGraw-Hill Book Company, Inc. Together with L. Felsen he coauthored a book "Radiation and Scattering of Waves" which was published by Prentice Hall Book Company in 1973.

Dr. Marcuvitz was elected to the National Academy of Engineering in 1978; he is also a Fellow of the IEEE, a member of the American Physical Society, Tau Beta Pi, Eta Kappa Nu, and Sigma Xi.

KARL B. NICLAS

Karl B. Niclas was born November 11, 1930, in Ludenscheid, Germany. He received the Dipl.-Ing. and the Doctor of Engineering degrees from the Technical University of Aachen, West Germany, in 1956 and 1962 respectively.

In 1956 he joined the Telefunken G.m.b.H, Ulm-Donau, West Germany, where he was engaged in research and development of low-noise and medium power traveling-wave tubes. In 1958 he became Head of the TWT Section and Assistant Manager of the company's Microwave Tube Department. From April 1962 until November of 1963, he was employed as Senior Project Engineer by the General Electric Microwave Laboratory at Stanford, CA. Subsequently, Dr. Niclas joined the Technical Staff of Watkins-Johnson Company, Palo Alto, CA, where he is presently a Consultant to the Vice President, Devices Group. From 1967 until 1976 he was Manager of the company's Tube Division and prior to that he was Head of the Low-Noise TWT Research and Development Section. His R&D activities in the field of microwave tubes included the design of low-noise and medium power TWTs, as well as the development of advanced permanent magnet focusing structures for low-noise TWTs and new concepts of achieving high efficiencies in power TWTs. His current efforts are focused on very wideband GaAs FET amplifiers and power combining techniques.

Dr. Niclas received the 1962 Outstanding Publications Award of the German Society of Radio Engineers (NTG). He has published more than 30 papers on microwave devices and holds seven patents in the same field.

BRETT A. TUCKER

Brett A. Tucker was born in Elizabeth, N.J. on January 13, 1951. He received the B.S. degree in Physics from the California Institute of Technology in 1973. From 1973 to 1975 he was a teaching assistant and from 1975 to 1980 a research assistant in the physics department at the University of California at Berkeley. His area of research was the application of Josephson junctions in low noise microwave receivers.

In 1980, he joined Watkins-Johnson Company, Palo Alto, CA, where he has been working on the design of monolithic GaAs MICs as well as broadband hybrid amplifiers. He is also currently a Ph.D. candidate at the University of California at Berkeley.

Mr. Tucker is a member of Tau Beta Pi.

JAMES CHEAL

James Cheal was born at Sunfield, Michigan in 1924. After receiving his B.S.E.E. at Michigan State University in 1950, he worked for IBM for two years as a Field Engineer. He joined Bendix Research Laboratories in 1952 and was responsible for the development of missile guidance antennas. From 1955 to 1956 he was a Systems Engineer at the Burroughs Corporation and developed radar/computer interface equipment for the Sage System.

Mr. Cheal rejoined Bendix in 1956 where he worked on a wide range of microwave components including ferrite circulators, phase shifters, filters, mixers, directional couplers and electronically scanned antennas. As the head of the Microwave and Antenna Group, he was responsible for the development of a miniaturized antenna and microwave subsystem which was one of the early examples of microwave integrated circuits using multiple layer suspended substrate stripline along with coaxial ferrite and mechanical switch components.

In 1962 as one of the founders and the Vice President of Engineering of Omni Spectra, Inc., he provided the engineering supervision and guidance for the development of Omni Spectra's microwave compo-

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nents, instruments and the OSM connector with the related adapters to other connector series. He also continued development work on microwave integrated circuits, microwave subsystems, intrusion detectors and microwave proximity fuze systems.

Mr. Cheal left M/A-COM-Omni Spectra in 1983 to join Southwest Microwave where he currently serves as a board member and a full time consultant.

Mr. Cheal was an active member of the joint military industrial committee which prepared the performance standards for r-f connectors, including OSM (SMA) under MIL STD 39012. He was also member and chairman of the Joint Industry Research Committee for Standardization of Miniature Precision Coaxial Connectors.

Mr. Cheal has published three papers and holds seven U.S. patents relating to antennas, phase shifters, and microwave intrusion alarms.

PETE RODRIGUE

G.P. (Pete) Rodrigue was first elected to the Administrative Committee of the MTT Society in 1970 and served continuously through 1980. He was MTT-S President in 1976 and Vice-President in 1975. During his time on ADCOM he was Editor of the MTT Newsletter (71-74), Chairman of the Membership Services Committee, and Chairman of the Awards Committee. He served as Chairman of the Steering Committee for the 1974 International Microwave Symposium in Atlanta, and as Keynote Speaker at the 1976 Symposium in Cherry Hill; he has been a member of the Program Committee for many of the MTT Symposia, and has served on the Editorial Board of the MTT-S Transactions since 1965. He was MTT-S representative on the IEEE Technical Activities Board and Division IV representative on the IEEE Publications Board. He was the recipient of an IEEE Centennial Medal on behalf of MTT-S.

Pete has served the IEEE as its Vice President-Publications Activities (1982- and 83), on the IEEE Board of Directors and its Executive Committee, and on the IEEE Long Range Planning Committee and Nominations and Appointments Committee. He was a member of the IEEE Technical Activities Board in 1976 and in 1979 and 1980 as Chairman of Technology Committees Administration. He served on the IEEE Publications Board in 1977 and 1978, 1982 through 1984. He was named a Fellow of the IEEE in 1975.

He has also been on the Steering and Program Committees of the Conference on Magnetism and Magnetic Materials, the Intermag Conference, and the Ultrasonics Symposium. He was one of the organizers of the Atlanta Section Joint MTT-S/AP-S Chapter and was its first Chairman. He has also served the Atlanta Section in various capacities.

He was born in Paincourtville, Louisiana in 1931 and received his undergraduate education at Louisiana State University. He received his Ph.D. in 1958 from Harvard University, working under Professor C.L. Hogan. From 1958 to 1968 he was with the Sperry Microwave Electronics Company in Clearwater, Florida where he worked on ferrite materials and devices, parametric amplifiers, ultrasonic devices, and microwave integrated circuits.

In 1968 he joined the faculty of the School of Electrical Engineering at Georgia Tech where he is now a Regents' Professor. He teaches graduate and undergraduate courses in electromagnetics, solid state, and circuits. His research activities have included antenna measurements and microwave devices. He was the recipient of Outstanding Teacher Awards at Georgia Tech in 1971, 1972 and 1979. In 1984 he was awarded the first IEEE Region 3 Outstanding Engineering Educator Award. He has served on a number of Institute Committees and was Chairman of the Georgia Tech Executive Board in 1981-82.

Pete and his wife Mary have raised six children and live in Atlanta.

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The Chapter plans to hold again a one-half day spring meeting (workshop) in 1985, in which emphasis would be put on **industrial developments.** It must be noted that, with one exception (which justifies the rule, as we say in French), the presentations at the 1984 Spring Meeting all came from scientific laboratories.

Lausanne, 18 October 1984 FG Fred Gardiol, Chapter Chairman

No Kidding?

AVERAGE COST PER MILE TO OWN AND OPERATE A NEW CAR

Car Size	1978	1983
Subcompact	22.5¢	34.6¢
Compact	24.8¢	43.3¢
Mid-Size	28.7¢	45.5¢
Intermediate	28.9¢	49.6¢
Standard	32.3¢	55.4¢
Average	27.5¢	45.7

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MTT-S CHAPTER CHAIRMEN DIRECTORY

by Ted Nelson

MTT-S Chapter Chairmen fulfill a vital role in leading the 43 MTT-S Chapters throughout the world, providing a technical forum for their local microwave community.

I'm sure many members may have questions about their local MTT-S activities, or are interested in becoming active in their local Chapter. To aid the MTT-S membership, the following Chapter Chairmen's Directory is presented. Each Chapter has been assigned an ADCOM Liaison to assist the Chapter.

Notify me of any changes to the Directory. My mailing address and telephone are:

Ted Nelson
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P.O. Box 1897, Mail Stop 709
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CANAVERAL MTT/AP AdCom Liaison: S.L. March	Elliott P. Valkenburg 518 Picasso Ave., N.E. Palm Bay, FL 32907 (305) 729-3125 Term of Office: 6/84 - 5/85
CENTRAL ILLINOIS MTT/NPS/ED AdCom Liaison: T. Itoh	Dr. Gregory E. Stillman University of Illinois 155 Electrical Eng. Bldg. 1406 West Green Street Urbana, IL 61801 (217) 333-3097 Term of Office: Unspecified
CENTRAL NEW ENGLAND/ BOSTON MTT AdCom Liaison: S. Temple	Steven J. Temple Raytheon Co. M15-50 Hartwell Rd. Bedford, MA 01730 (617) 274-7100 Term of Office 6/84 - 5/85
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ISRAEL MTT/AP AdCom Liaison: E.C. Niehenke	Asher Madjar PO Box 2250 (Code 85) Haifa 31021, Israel 04-738358 Term of Office: 1/84 - 12/84
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MIDDLE & SOUTH ITALY MTT/AP AdCom Liaison: T. Itoh	Roberto Sorrentino University of Rome Dept. Di Electronica Via Eduossiana 18 00184 Rome, Italy 396-4759657 Term of Office: 1/85 - 12/86
MILWAUKEE MTT/ED AdCom Liaison: R. Levy	Alexander Krauska Marquette University Dept. of Electrical Engineering 1515 West Wisconsin Avenue Milwaukee, WI 53151 Term of Office: 7/84-6/85
MONTREAL MTT/AP AdCom Liaison: H. Howe, Jr.	Joseph S. Leizerowicz 137 Hastings Avenue Pointe Claire Que Canada H9R3P8 (514) 342-6000 x4329 Term of Office: 1/84 - 12/84
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Revised IEEE Energy Committee Slide Show, 'Energy in Perspective.' This presentation puts U.S. energy problems in perspective, and is available on loan without cost. It considers existing and new energy sources available to us as well as how we can meet our needs between now and the year 2020. Finally, the revised show suggests ways that the individual can help. A *Speaker's Guide* is also available to aid in the presentation of the show of IEEE members as well as public audiences. Further information can be obtained from the IEEE Washington Office, 1111 19th Street, NW, Washington, D.C. 20036, telephone (202) 785-0017.

'PACE Guide to Pensions: How to Evaluate Your Plan.' This just-released publication, prepared on behalf of the Pension Committee of the IEEE/USAB, outlines how private pension plans work and how to make a general evaluation of the plans. The *Guide* focuses on some shortcomings in existing private pension systems and seeks to aid IEEE members in making more informed assessments of Federal laws and regulations governing private plans. Copies of the *PACE Guide to Pensions* (Catalog No. UHO 161-0) are available for $3.00 (members) and $4.00 (non-members) from the IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854, telephone (201) 981-0060.

'Report on Pension Plans of Top 11 Employers of IEEE Members.' A study of the pension plans of the 11 largest private-sector employers of IEEE members, prepared on behalf of the Pension Committee of the IEEE/USAB, concludes: (1) the complexity of these plans makes it difficult for employees to understand their personal pension rights or to compare their plans with the plans of other companies; (2) mobile employees, in all these companies, face significant hurdles in obtaining adequate retirement incomes; and (3) the plans fail to assure equitable treatment of several groups — older workers, employees at the lower and middle ranges of the income scale, and spouses of employees who die before reaching retirement age. The *Report* is available without charge from the IEEE Washington Office.

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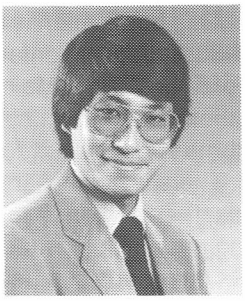
SHORT COURSES



by Kurtis L. Kurisu

A number of organizations are offering short courses this Winter which will be of interest to some members of the Microwave Theory and Techniques Society.

These selected short courses will be offered by the UCLA (University of California at Los Angeles) Extension during January, February, March, April, and May of 1985. These include:

Reliability Engineering, Testing, and Maintainability Engineering, February 11-15, course number 885.75, $945 per person, Instructor is Dimitri Kececioglu.

Modern Microwave Measurements and Applications, February 19-22, course number 881.73, $845 per pupil, Lecturer is Stephen F. Adam, MTT-S Guest Lecturer for 1983-1984.

ECM/ECCM/ESM (Electronic Countermeasures/ Electronic Counter Countermeasures/Electronic Support Measure Systems) for Radar Systems, Communication Systems, Electro-Optical Systems, and Millimeter Wave Systems, February 25-March 1, course number 867.48, $945 per attendee, Lecturers include David W. Berrie, T. Gordon Hame, Gary L. Henshaw, Joseph F. Hoffmann, Anthony J. Kramer, Julio Lopez, Oscar Lowenschuss, Wesley K. Masenten, Donald M. Stuart, and Ray A. Trimmer.

Microwave Solid-State Devices and Circuits, February 25-March 1, course number 881.51, $945 per student, Lecturers are G.I. Haddad, P.T. Greiling, Robert Eisenhart, Douglas Maki, and Dean Peterson.

The Technical Manager in a Dynamic Environment, March 4-7, course number 885.92, $845 per pupil, Lecturer is Melvin Silverman.

Spread Spectrum Systems and Interference Rejection Techniques, March 4-8, course number 867.36, $945 per person, Lecturers are Robert C. Dixon, D.R. Anderson, F.P. Kaiser, W.K. Masenten, and G.D. O'Clock.

Kalman Filtering, March 11-15, course number 881.38, $945 per student, Lecturers are Joseph L. LeMay and William L. Brogan.

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'Enhancing Engineering Careers by Fulfilling Individual and Organizational Goals.' This publication is a compilation of papers from the 1983 Careers Conference organized by the IEEE Task Force on Career Maintenance and Development. The authors suggest crucial changes needed in education and the requirement for societal and governmental support. There is no final and absolute solution to career problems, they contend, and no career model is suitable for all engineers. Most career issues must be readdressed to meet the needs of a new set of companies and engineers, according to the authors. Copies of the publication (IEEE Catalog No. UHO 158-6) are available for $15.00 (members) and $25.00 (non-members) from the IEEE Service Center.

'IEEE/USAB Information Line with Updates'. Prerecorded IEEE information is available to the media through the IEEE/USAB Information Line, telephone (202) 785-2180. Recordings are limited to several minutes and updated regularly.

From Another Point of View

Microfiche = A very tiny minnow.
Calculator = A cheery farewell.
Floppy Disk = Chronic back problem.
Glitch = Skin rash.
Interface = Pie target.

Oh well, I've got books of these things but why press it? Save your comments and submit articles!

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Integrated Communications, Precision Position Determination and Navigation, and Identification Systems: Principles, Technology, and Operational Aspects, March 18-22, course number 867.60, $945 per student, Lecturers are Mohar Ananda, Darlow Botha, Alison K. Brown, Peter C. Camana, George Hume, William M. Hutchison, James A. Kivett, Robert Rand, and Mark A. Sturza.

Numerical Methods and Digital Computer Techniques for Engineers and Scientists, March 18-22, course number 867.51, $995 per person, Lecturers are Walter J. Karplus, Kurt Forster, and Jack W. Carlyle.

Operational Readiness and Reliability, Maintainability, and Availability of Maintained Equipment and Systems, March 18-22, course number 885.93, $945 per pupil, Lecturer is Dimitri Kececioglu.

Program and Project Management: Principles and Practice, April 1-5.

VLSI: Processing Techniques, April 10-12.

Material Characterization and Testing in VLSI Processing, April 15-17.

Practical Aspects of Reliability, Maintainability, Human Factors, and Safety for Engineers and Managers, April 16-19.

Guidance and Control for Tactical Aircraft, Missiles, and Armament Systems, April 23-27.

Microwave Circuit Design—Nonlinear Circuits, April 23-27.

Engineering Applications of Correlation and Spectral Analysis, May 6-10.

Modern Telecommunications Networking: Electronic Messaging, Local Area, Packet Radio, and Satellite Communication Networks, May 20-23.

Microwave Circuit Design I—Linear Circuits, May 20-24.

For further information on these short courses, contact Nonie Watanabe at UCLA, Engineering Short Courses, 10995 LeConte Avenue, Room 637, Los Angeles, CA 90024, (213) 825-1047.

The Continuing Education Office of George Washington University is offering the following courses which may interest MTT-S members. These courses are to be held in Washington, D.C. except when noted. They are:

Radar Principles for the Non-Specialist, February 21-22, course number 704DC, $650 per attendee, Instructors are David K. Barton and C. Julio-Torres.

Analysis, Control, and Simulation of Military Systems, March 4-8, course number 1091DC, $920 per participant, Instructor is Naim A. Kheir.

Modern Electronic Interconnect and Packaging Systems, March 7-8, course number 1047DC, $650 per attendee, Lecturer is James L. Tinkoff.

Fiber Optics Systems Design, March 11-13, course number 541DC, $730 per student, Instructor is Robert J. Hoss.

Microwave High Power Tubes and Transmitters, March 11-15, course number 1037DC, $920 per student, Instructors are Arnold Acker and William R. North.

Design and Evaluation of Conventional and Electronic Scanning Radar Systems, March 18-20, course number 995DC, $730 per pupil, Lecturer is Peter Kahrilas.

Vulnerability of Spread Spectrum Communication Systems, March 18-21, course number 632DC, $835 per attendee, Lecturer is David Nicholson.

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ELINT: Analyzing Radar Signals, March 19-21, course number 1022DC, $730 per participant, Lecturers are Grover Boose, Robert B. Shields, and Richard G. Wiley.

Solid State Electronics for Non-Electrical Engineers, March 25-27, course number 4490F, $730 per student, Instructors are Merrill Buckley and Walter Grubb, location is Orlando, Florida.

Mobile Communication Engineering, March 25-27, course number 995OF, $730 per student, Instructor is William Lee, location is Orlando, Florida.

Packet Switching for Modern Data Communications, March 25-28, course number 575OF, $835 per participant, Lecturer is Roy Daniel Rosner, location is Orlando, Florida.

Telecommunication Management Planning, March 26-28, course number 1135DC, $730 per student, Instructors are Robert Heldman and Robert Stoffels.

Monopulse Principles and Techniques, March 27-29, course number 1005OF, $730 per student, Instructors are Samuel Sherman and Dean Howard, location is Orlando, Florida.

Communication Satellite Engineering, April 1-5, course number 259DC, $920 per attendee, Lecturers are Eugene Cacciamani, Willis DeHart, William Garner, James Owens, and Robert Sims.

Modern Air to Air Radar Systems, April 8-11, course number 1034DC, $835 per attendee, Lecturer is Fred Williams.

Modern Communication and Signal Processing, April 8-12, course number 945DC, $920 per student, Instructors are Theodore Lapp and Fred Kaiser.

Spread Spectrum Communication Systems, April 15-19, course number 302DC, $920 per pupil, Lecturer is Robert C. Dixon.

Spectrum Management, April 15-19, course number 551DC, $920 per participant, Instructors are Fred Matos and Richard Gould.

Fundamentals of Data Communications, April 22-24, course number 884DC, $730 per attendee, Instructor is Pete Moulton.

Synchronization in Spread Spectrum Communications, April 29-May 3, course number 699DC, $920 per person, Lecturer is Robert Dixon.

Antennas and Arrays, April 29-May 3, course number 824DC, $920 per attendee, Instructors are Virgil Arens, Jeremy Raines, and J. Paul Shelton.

Microwave High-Power Tubes and Transmitters, May 6-10, course number 1037.

For additional information contact: Merril Ann Ferber, Continuing Engineering Education, George Washington University, Washington, D.C. 20052, (202) 676-6106, Toll free: (800) 424-9773.

The following courses of interest has been announced by Georgia Institute of Technology:

Data Communication System Components, February 12-14, $795 per attendee, Lecturer is Phillip Enslow.

Microwave Devices - Present and Future, February 13-14, $475 per attendee, Instructors are James T. Coleman and Walter Cox.

Laser Technology and Systems Applications, February 25-26, $470 per pupil, Instructors are Donald C. O'Shea and W. Russell Callen.

Infrared Technology and Applications, February 27 - March 1, $630 per person, Lecturers will include David Schmieder and Donald Blue.

Elements of Phased Array Radar Systems Design, March 18-21, $750 per attendee.

Introduction to Network Architecture, April 2-4, $795 per participant, Lecturer is Phillip Enslow.

Managing the Industrial and System Engineering Organization, April 8-10, Instructor is Orlando Feorene.

X25 and Packet Switching Networks, April 23-25, $795 per attendee, Instructor is Phillip Enslow.

Additional information can be obtained from Elaine Nicholas at G.I.T. Department of Continuing Education, Atlanta, Georgia 30332, (404) 894-2547.

The Continuing Education Institute offers the following short courses:

Plasma Etching, March 4-6, course number 196.07, Instructor is S. Broydo, location is Monterey, CA.

Photolithography, March 7-8, course number 103.01, Instructor is F. Pease, location is Monterey, CA.

Plasma Etching, March 25-27, course number 196.08, Instructor is S. Broydo, location is Cambridge, MA.

Correlation and Spectral Analysis, course number 108.17, Instructor is J. Bendat, location is Detroit, MI.

Radar Defense Systems ECCM, March 25-29, course number 216.04, Instructors are S. Johnson and Nitzberg, location is Cambridge, MA.

Photolithography, March 28-29, course number 103.02, Instructor is F. Pease, location is Boston, MA.

Films and Coatings for Technology, April 9-12, course number 111.06, Instructor is R. Bunshah, location is Los Angeles, CA.

Correlation and Spectral Analysis, April 15-18, course number 108.18, Instructor is J. Bendat, location is Boston, MA.

Modern Microwave Measurements, April 15-18, course number 118.23, Instructor is Dr. S. Adam, location is Palo Alto, CA.

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Modern Spectral Analysis, April 16-19, course number 135.09, Instructors are R. Otnes and Enochson, location is Washington DC.

Semiconductor Silicon Technology, April 22, course number 195.05, Instructor is W. O'Mara, location is Austin, TX.

Advanced Composite Materials, April 22-26, course number 177.03, Instructor is C. Zweben, location is Columbia, MD.

Semiconductor Silicon Technology, April 29, course number 195.06, Instructor is W. O'Mara, location is Monterey, CA.

Semiconductor Silicon Technology, May 6, course number 195.07, Instructor is W. O'Mara, location is Falls Church, VA.

Semiconductor Silicon Technology, May 10, course number 195.08, Instructor is W. O'Mara location is Boston, MA.

Modern Microwave Measurements, May 13-16, course number 118.24, Instructor is Dr. S. Adam, location is Alexandria, VA.

Applications of Discrete and Continuous Fourier Analysis, May 14-17, course number 206.07, Instructor is J. Weaver, location is Austin, TX.

Modern Spectral Analysis, May 21-24, course number 135.10, Instructors are R. Otnes and Enochson, location is Houston, TX.

For more information contact: Continuing Education Institute, 10889 Wilshire Blvd, Suite 1000, Los Angeles, California 90024, (213) 824-9545.

The University of Southern California (USC) offers a videotaped short course entitled **Principles of Radar Systems Design.** This short course is available for purchase and/or rental in a variety of video formats. For additional information contact: USC, Instructional Television Program, OHE-214, School of Engineering, Los Angeles, CA 90089-1455, (213) 743-7663.

The Center for Professional Development at the College of Engineering and Applied Sciences of Arizona State University offers the following courses of interest:

Semiconductor Material and Device Characterization, March 4-6, course fee is $695 per person, Presenters are D.K. Schroder, M.G. Buehler, A.M. Goodman, G.B. Larrabee, and R.J. Roedel.

Fiber Optic Communications, March 11-13, course fee is $695 per attendee, Presenters are J.C. Palais, R.J. Roedel, and H. Pirastehfar.

Further information regarding course content or enrollment can be obtained from: Center for Professional Development, College of Engineering and Applied Sciences, Arizona State University, Tempe, AZ 85287, (602) 965-1740.

The University of Wisconsin Extension offers the following courses:

Design of Fiber Optic Communication Systems, February 18-20, $510 per person.

Cellular Radio Systems, June 24-26, $495 per attendee.

Communications Cable Clinic, October 28-30 $495 per person.

For further information contact Mr. Francis Drake, Department of Engineering and Applied Science, University of Wisconsin-Extension, 432 North Lake street, Madison, WI 53706, (608) 263-7427, (800) 262-6243, or (800) 362-3020 in WI.

The University of South Florida offers the following course:

Fundamentals of Hybrid Microelectronics, March 18-22, course fee is $550 per attendee, Instructors are C. Chen, Y Chiou, W. Gasko, M. Kovac, A. Kraus, L LaForest, and M. Silverstein.

Additional information may be obtained by contacting: School of Continuing Education, University of South Florida, Tampa, Florida 33620, (813) 974-2403.

The University of Mississippi, Oxford Campus is offering a three day short course entitled **Dielectric Resonators** on March 18-20. Course fee is $550. Lecturers include P. Guillon, A. Khanna, H. Auda, A. Glisson, D. Hanson, D. Kajfez, K. Michalski, and P. Wheless. Additional information may be obtained by contacting: The Division of Continuing Education, University of Mississippi, University, MS 38677.

Further information can be obtained by contacting: University Extension, University of California, Irvine, P.O. Box AZ, Irvine, CA 92716, (714) 856-5414.

The Santa Clara Valley Chapter of the Microwave Theory and Techniques Society will sponsor a one day short course on March 23. The course **"Advances in Hybrid MIC Design and Fabrication"** will be held at the Stanford Linear Accelerator Center (SLAC) in Palo Alto. The program will include CAD synthesis techniques, hybrid materials and process technology, and examples of state of the art MIC design. Cost for this seminar is $50 for IEEE members, $60 for non-IEEE members, and $20 for students. Enrollment is limited to 250 people. Further information may be obtained from Gerry Helmke at (415) 327-6622.

If you wish to have your short courses of interest listed in this column, please send pertinent information to K. Kurisu, TRW Electronics and Defense, One Space Park, Redondo Beach, CA 90278.

MEETINGS OF INTEREST

The following list of meetings of potential interest to members of the Microwave Theory and Techniques Society covers a period of nearly a year. All efforts will be made to maintain a complete compilation of IEEE-sponsored and non-IEEE-sponsored meetings. Any additions should be sent to the MTT-S Newsletter Editor.

- **The 21st Annual Int'l Workshop on Compound Semiconductor for Microwave Materials and Devices** — February 11-13, Sheraton Yankee Trader Hotel, Ft. Lauderdale, FL. Contact: Dr. H. Goronkin, Motorola, Inc. 5005 E. McDowell Rd. Phoenix, AZ. 85008.
- **OFC/OFS '85** — Feb. 11-14, Town and Country, San Diego, CA 92138. Contact: Ellen McCoy, Optical Society of America, 1816 Jefferson Place, N.W. Washington, D.C. 20036, (202) 223-0920.
- **International Solid State Circuits Conference** — Feb. 13-15, New York Hilton, New York. Contact: Lewis Winner, 301 Almeria Avenue, Coral Gables, Fl. 33134, (305) 446-8193.
- **SOUTHCON '85** — March 5-7, Georgia World Congress Center, Atlanta, GA. Contact: Dale Litherland, Electronic Conventions, Inc. 8110 Airport Blvd. Los Angeles, CA. 90045, (213) 772-2965
- **6th Electromagnetic Compatibility Symposium on Technical Exhibition** — March 5-7, ETH Headquarter, Zurich, Switzerland. Contact: Prof. Dr. P. Leuthold, ETH-Zentrum-IKT, 8092 Zurich, Switzerland, Tel: 01/256-2787.
- **SPIE Santa Clara, Symposium on Microlithography** — March 10-15, Santa Clara Marriott Hotel, Santa Clara, CA. Contact: SPIE P.O. Box 10 Bellingham, Washington, 98227-0010.
- **Pico Second Electronics and Optoelectronics** — March 13-15, Hyatt Lake Tahoe, Incline Village, Nevada, Contact: Optical Society of America. 1817 Jefferson Place, N.W., Washington, D.C. 20036.
- **Very Large Scale Integration (VLSI) — Technology, Circuits, Systems, Applications** — March 18-20, Baden-Baden, FRG, Contact: Dr. Ing F. Coers IEEE Germany Section, Stresemannallee 15, VDE-Haus, D-6000 Frankfurt 70, FRG. Tel: +611-630-8221.
- **4th Annual Phoenix Conference on Computers & Communications** — March 20-22, Sunburst Hotel, Scottsdale, AZ. Contact: Doug Powell, Motorola, Inc. P.O. Box 2953, Phoenix, AZ. 85062, (602) 244-3965
- **IMTC '85 — Instrumentation/Measurement Technology Conference** — March 20-22, Hyatt Regency Hotel, Tampa, FL. Contact: Dr. J. Robert Ashley, Sperry Corporation M.S. 214, P.O. Box 4648, Clearwater, FL. 33518, (813) 577-1900, Ext. 2228.
- **IEEE INFOCOM '85** — March 25-28, Hyatt Regency Crystal City, Washington, D.C. Contact: Ms. Celia Desmond, Bell Canada, HQ Engineering, Room 1855, 160 Elgin St., Ottawa, Ontario K1G 3J4, Canada, (613) 239-4510
- **Int'l Reliability Physics Symposium** — March 26-28, Sheraton Twin Towers, Orlando, Fl., Contact: John W. Peeples, NCR Corporation, 3325 Platt Springs Rd., West Columbia, SC, 29169, (803) 796-9250 Ext. 344/341.
- **SOUTHEASTCON '85** — March 31-April 3, Mission Valley Inn, Raleigh, N.C. Contact: G.E. Shuford, Jr. P.O. box 1551, Raleigh, N.C. 27602, (919) 836-6799.
- **Digital Processing of Signals in Communication** — April 22-25, University of Loughborough, England, Contact: Conference Department IERE, 99 Gower Street, London. Tel: 01-388-3071.
- **ELECTRO '85** — April 23-25, Coliseum & Sheraton Centre, New York, N.Y. Contact: Dale Litherland, Electronic Conventions, Inc., 8110 Airport Blvd. Los Angeles, CA. 90045, (213) 772-2965
- **INTERMAG** — April 29-May 2, Radisson-St. Paul, St. Paul, MN. Contact: E.J. Torok, Sperry Univac, P.O. Box 3525, MS U2 P26, St. Paul, MN 55165, (612) 456-2432. Conference Management: Annmarie Pittman, Courtesy Associates, (202) 296-8100.
- **IEEE 1985 Int'l. Radar Conference** — May 6-9, Marriott Crystal Gateway, Arlington, VA. Contact: Robert T. Hill, 2802 Birdseye Lane, Bowie, MD. 20715, (301) 262-8792.
- **Custom Integrated Circuits Conference** — May 20-22, Portland Hilton, Portland OR., Contact: Wesley N. Grant, Sperry Computer Systems, Sperry Park, P.O. Box 43525, MS H2F26, St. Paul, MN 55164-0525 (612) 456-4130.
- **35th Electronic Components Conference** — May 20-22, Capital Hilton Hotel, Washington, D.C. Contact: J.A. Woolley, 3M Company, 3M Center Building Y, 207-1W-10, St. Paul, MN. 55144.
- **CLEO '85** — May 21-24, Baltimore Convention Center, Baltimore, MD. Contact: John W. Roy, Hughes Aircraft Co., 6155 El Camino Real, Carlsbad, CA 92088.

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- **National Aerospace & Electronics Conference (NAECON '85)** — May 21-23, Dayton Convention Center, Dayton, OH. Contact: NAECON, 110 East Monument Avenue, Dayton, OH. 45402, (513) 223-6266.
- **39th Annual Frequency Control Symposium** — May 29-31, Marriott Hotel, Philadelphia, PA. Contact: Dr. John R. Vig, Electronics Technology & Device Lab., DELET-MQ, Fort Monmouth, N.J. 07703.
- **1985 Microwave and Millimeter Wave Monolithic Circuits Symposium** — June 3-4, St. Louis, MO., Contact: Dr. William R. Wisseman, P.O. box 225936, M.S. 134, Texas Instruments, Inc. Dallas, TX. 75265, (214) 995-2451.
- **Int'l. Microwave Symposium & Workshops** — June 4-6, Stouffer's Riverfront Towers, Cervantes Convention Center, St. Louis, MO. Contact: Dr. Fred J. Rosenbaum, Central Microwave Co., 12180 Pritchard Farm Road, St. Louis, MO. 63043, (314) 291-5270.
- **1985 Int'l. Symposium on Circuits and Systems** — June 5-7, Kyoto Hotel, Kyoto, Japan. Contact: Toshio Fujisawa, Department of Information and Computer Sciences, Faculty of Engineering Science, Osaka University, Toyonaka 560, Japan, 06-844-1151, Ext. 4820.
- **AFRTG** — June 6-7, St. Louis, MO. Contact: Mario A. Maury, Jr., Maury Microwave Corp. 8610 Helm Avenue, Cucamonga, CA. 91730, (714) 987-4715 ext. 21.
- **6th University/Government/Industry Microelectronics Symposium** — June 11-13, Auburn University, Auburn, AL 36849-3501. Contact: Dr. Yonhua Tzeng, Electrical Engineering Department, 200 Broun Hall, Auburn University, Auburn, AL. 36849-3501, (205) 821-476.
- **6th Biennial University/Government/Industry Microelectronics Symposium** — June 11-13, Electrical Engr. Dept. Auburn University, Auburn, AL. Contact: Richard C. Jaeger 200 Broun Hall, Auburn University, Auburn, AL. 36849, (205) 826-4330.
- **OHMCON-High Technology Electronics Show and Convention** — June 12-13, Cabo Hall, Detroit, MI. Contact: Robert Barba, OHMCON, P.O. box 699, Utica, MI. 48087, (313) 781-4551.
- **1985 North American Radio Science Meeting & IEEE Int'l. AP-S Symposium** — June 16-21. University of British Columbia, Vancouver, B.C. Canada. Contact: Dr. E.V. Jull, Dept. of Electrical Engineering, University of British Columbia, Vancouver, B.C. V6T 1W5, Canada, (604) 228-3282.
- **1985 North American Radio, Science Meeting and International AP-S Symposium** — June 17-21. University of British Columbia, Vancouver, B.C. Canada. Contact: K. Charbonneau, Conference Service Coordinator, Conference Center of the University of British Columbia, Vancouver B.C., Canada.
- **NASECODE IV — The Fourth Int'l. Conference on the Numerical Analysis Of Semiconductor Devices and Integrated Circuits** — June 19-21. Trinity College, Dublin, Ireland. Contact: Professor John Miller, Chairman, NASECODE Conference, Numerical Analysis Group, 29, Trinity College, Dublin 2, IRELAND. Tel: (01) 772941, Ext. 1485.
- **IEEE Int'l. Conference on Communications (ICC '85)** — June 23-26, Palmer House, Chicago, IL. Contact: John D. Johanneson, General Chairman, Midwest College of Engineering, P.O. Box 1147 (ICC '85) Lombard, IL. 60148. (312) 627-6854.
- **Int'l. Conference on Properties and Applications of Dielectric Materials** — June 24-29. Shaanxi Guesthouse, Xi'an, China (PRC). Contact: Kwan C. Kao, Dept. of Electrical Engrg., University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada, (204) 474-9649.
- **Ultrasonics Int'l. '85** — July 2-4. King College, London, U.K. Dr. Z. Novak, Butterworth Scientific Lt. P.O. Box 63, Westburry House, Bury Street, Guildford, Surrey GU 25 BH U.K. Tel: 048331261.
- **1985 Int'l. Symposium on Microwave Technology in Industrial Development** — July 22-26, Sao Paulo, Brazil. Contact: Waldyr Lucato, Chairman, IEEE Sao Paulo Section, Rua Cel. Xavier de Toledo, 23, 01408 Sao Paulo, SP, Brazil. Tel: (011) 239-6239. Telex: 1122582 ET BR.
- **Intersociety Energy Conversion Engineering Conference (IECEC)** — Aug. 18-23. Fountainbleu-Hilton, Miami Beach, FL. Contact: Floyd A. Wyczalek, Engineering Staff Div., GM Technical Center, General Motors Corp. Warren, MI. 48090. (313) 575-1153.
- **Midwest Symposium on Circuits and Systems** — Aug. 19-20, The Galt House Hotel, Louiseville, KY., Contact: Dr. P. Aronhime, or Dr. J. Zurada, Electrical Engrg. Dept. University of Louisville, Louisville, KY. 40292. (502) 588-6289.
- **1985 IEEE Int'l. Symposium on Electromagnetic Compatibility** — Aug. 20-22, Colonial Hilton Inn, Wakefield, MA. Dr. Chester L. Smith, The MITRE Corp. P.O. Box 208, Bedford, MA. 01730, (617) 271-7086.

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- **Int'l. Conference on Magnetism (ICM-85)** — Aug. 26-30. San Francisco, CA. Contact: J.F. Dillon, Jr., AT&T Bells Labs, 1D-328, Murray Hill, N.J. 07974. (201) 582-3589.
- **5th Int'l. Symposium on Electrets** — Sept. 4-6, Koenigsaal Castle, Heidelberg, FRG. Contact: Dr. Gerhard M. Sessler, Institute of Electroacoustics, Technical University of Darmstadt, Merckstrasse 25, D-6100 Darmstadt, FRG. Tel: 49-6151/16-2869.
- **Electronics & Aerospace Conference (EASCON '85)** — Sept. 9-11. Shoreham Hotel, Washington, D.C. Contact: Dr. Jack W. Hugus, EASCON '85 Gen. Chairman, General Electric Co., Suite 900, 777 14th Street, NW, Washington, D.C. 20005, (202) 637-4243.
- **Electrical and Electronics Conference & Exposition** — Oct. 7-9. Metro Toronto Convention Center, Toronto, Ontario, Canada. Contact: IEEE Canadian Region Office, 7061 Yonge Street, Thornhill, Ontario L3T 2A6. Canada (416) 881-1930.
- **International Geoscience and Remote Sensing Symposium — IGARSS '85.** — Oct. 7-9. University of Massachusetts, Amherst, MA. Contact: Professor Robert McIntosh, Electrical and Computer Engrg., Room 16, Engrg. Bldg. East, University of Massachusetts, Amherst, MA. 01003. (413) 545-2591.
- **Int'l. Telecommunications Energy Conference (INTELEC '85)** — Oct. 14-17, Hilton Hotel, Munich, Fed. Rep. of Germany. Contact: Dr. Gunther Vau, Siemens A.G., Postfach 3240, Erlangen 2, Fed. Rep of Germany.
- **1985 Ultrasonics Symposium** — Oct. 16-18, Cathedral Hill Hotel, San Francisco, CA. Contact: W.R. Shreve, Hewlett Packard, 1501 Page Mill Road, Palo Alto, CA. 94304. (415) 857-1501.
- **IEEE Military Communications Conference — MILCOM '85** — Oct. 21-23. Stouffer's Bedford Glen, Bedford, MA. Contact: Frank Gicca, GTE Products Corporation, 77 A St., Needham Heights, MA. 02194. (617) 449-2000, Ext. 595.
- **Western Electronic Show & Convention (WESCON '85)** — Nov. 19-21. San Francisco, CA. Contact: Dale Litherland, Electronic Conventions, Inc. 8110 Airport Blvd., Los Angeles, CA. 90045. (213) 772-2965.
- **Global Telecommunications Conference (GLOBECOM '85)** — Dec. 2-5. Hyatt Regency, New Orleans, LA. Contact: G.A. Ledbetter, South Central Bell, 365 Canal Street, New Orleans, LA. 70140. (504) 528-7350.
- **10th Int'l Conference on Infrared and Millimeter Waves** — December 9-13, American Dutch Resort Hotel, Lake Buena Vista (Orlando) Florida. Contact: Kenneth J. Button, MIT, Box 72, MIT Branch, Cambridge, MA. 02139-0901 (617) 253-5561.

1986

- **1986 Reliability and Maintability Symposium** — Jan. 28-30. Riviera Hotel, Las Vegas, NV. Contact: V.R. Monshaw, RCA Astro-Electronics Division, P.O. Box 800, MS 55, Princeton, N.J. 08540. (609) 426-2182.
- **Int'l. Solid-State Circuits Conference (ISSCC)** — Feb. 12-14. San Francisco Hilton, San Francisco, Ca. Contact: Lewis Winner, 301 Almeria Avenue, Coral Gables, FL. 33134. (305) 446-8193.
- **5th Annual Phoenix Conference on Computers & Communications** — March 2-5. Phoenix, AZ. Contact: Doug Powell, Motorola, Inc. P.O. Box 2953, Phoenix, AZ. 85062. (602) 244-3965.
- **Int'l. Zurich Seminar on Digital Communications: "New Directions in Telecommunications Switching and Networks"** — March 10-12. Swiss Federal Institute of Technology (ETHZ), Zurich, Switzerland. Contact: Professor A. Kundig, Institut fur Elektronik ETH-Zentrum, ETZ J87, CH-8092 Zurich, Switzerland. Tel: +41-1-256 51 80.
- **SOUTHCON '86** — March 11-13. Orange County Convention Center, Orlando, Fl. Contact: Dale Litherland, Electronic Conventions, Inc. 8110 Airport Blvd. Los Angeles, CA. 900045 (213) 772-2965.
- **Int'l. Reliability Physics Symposium** — April 1-3. Anaheim, CA. Contact H.C. Jones, Westinghouse, P.O. Box 1521, MS 3664, Baltimore, MD. 21203. Tel. (301) 765-7387.
- **IEEE INFOCOM '86** — April 13-17. Sheraton Bal Harbour, Miami, FL. Contact: IEEE INFOCOM '86. P.O. box 639, Silver Spring, MD. 20901. (301) 589 8142. TWX: 7108250437 IEEECOMPSO.
- **INTERMAG** — April 14-18. Hyatt Regency Phoenix Phoenix, AZ. Contact: R.J. Fairholme, Motorola, Magnetic Bubbles, 7402 South Price Road, Tempe, AZ. 85283. (602) 897-3005.
- **World Conference on Continuing Engineering Education** — May 7-9. Dutch Inn Resort Hotel, Lake Buena Vista, FL. Contact: Dr. Joseph Biedenbach, University of South Carolina, College of Engineering, Columbia, S.C. 29208. (803) 777-6693.
- **National Aerospace & Electronics Conference (NAECON '86)** — May 18-20. Dayton Convention Center, Dayton, OH. Contact: NAECON, 110 East Monument Avenue, Dayton, OH. 45402, (513) 223-6266.

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- **Int'l. Microwave Symposium & Workshops** — June 2-6. Baltimore, MD. Contact: Edward C. Niehenke, Westinghouse Electric Corp. P.O. Box 746, M.S. 339, Baltimore, MD. 21203. (301) 765-4573.
- **Microwave and Millimeter Wave Monolithic Circuits** — June 4-5. Baltimore, MD. Contact: Roger W. Sudbury, L-324, MIT Lincoln Laboratory, P.O. Box 73, Lexington, MA. 02173. (617) 863-5500.
- **AFRTG** — June 5-6. Baltimore, MD. Contact: Mario A. Maury Jr., Maury Microwave Corporation, 8610 Helms Avenue, Cucamonga, CA. 91730. (714) 987-4715. ext. 21.
- **Int'l. Quantum Electronics Conference (IQEC '86)** — June 9-13. Phoenix, AZ. Contact: Meetings Dept., Optical Society of America, 1816 Jefferson Place, NW, Washington, D.C. 20036, (202) 223-8130.
- **Int'l. Conference on Communications — ICC '86** — June 21-25. Sheraton Hotel, Toronto, Ontario, Canada. Contact: Hugh J. Swain, Andrew & Antenna, Ltd. 606 Beach St., West Whitby, Ontario, Canada L1N 562. (416) 668-3348.
- **Intersociety Energy Conversion Engineering Conference (IECEC)** — Aug. 24-29. Town and Country Hotel, San Diego, CA. Contact: Barbara Hudson, Shirley Blackwell, American Chemical Society, 1155 16th Street, NW, Washington, D.C. 20036. (202) 874-4401.
- **1986 IEEE Int'l. Symposium on Electromagnetic Compatibility** — Sept. 16-18. Town and Country Conference Center, San Diego, CA. Contact: Herbert K. Mertel, EMACO, Inc. 7562 Trade St. San Diego, CA. 92121. (714) 578-1480.
- **Electronics and Aerospace Systems Conference** — Sept. 22-24.
- **Int'l. Telecommunications Energy Conference (INTELEC '86)** — Oct. 19-22, Royal York Hotel, Toronot, Ontario, Canada. Contact: R.C. Byloff, Fincor-Incom International, 3750 East Market Street, York, PA. 17402. (717) 757-4641.
- **IEEE Professional Communication Conference — PCCC '86** — Oct. 23-24. Charlotte, N.C. Contact: Dr. Lois K. Moore, Johns Hopkins University, Applied Physics Laboratory, Room 14-132M, Johns Hopkins Rd. Laurel, MD. 20707. (301) 953-1700, Ext. 406.
- **1986 Int'l. Test Conference (Cherry Hill '86)** — Oct. 28-30. Franklin Plaza Hotel, Philadelphia, PA. Contact: Harry Hayman, P.O. Box 639, Silver Spring, MD. 20901. (301) 589-8142.
- **1986 Ultrasonics Symposium** — Nov. 17-19. Conference Center, Williamsburg, VA. Contact: R. Moore, Westinghouse Electric Co., P.O. Box 756, MS 296, Baltimore, MD. 21203. (301) 765-1000.

(continued from page 30)

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1985-1986

Congressional Fellowships

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PROGRAM: Electrical and Electronics Engineers and Allied Scientists are competitively selected to serve a one-year term on the personal staff of individual Senators or Representatives or on the professional staff of Congressional Committees. The program includes an orientation session with other Science-Engineering Fellows sponsored by the American Association for the Advancement of Science (AAAS).

PURPOSE: To make practical contributions to more effective use of scientific and technical knowledge in government, to educate the scientific communities regarding the public policy process, and to broaden the perspective of both the scientific and governmental communities regarding the value of such science-government interaction.

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AWARDS: IEEE plans to award two Congressional Fellowships for the 1985-1986 term. Additional funding sources may permit expansion of awards.

APPLICATION: Further information and application forms can be obtained by calling W. Thomas Suttle (202) 785-0017 at the IEEE Washington, D.C. Office or by writing:

Secretary, Congressional Fellows Program
The Institute of Electrical and Electronics Engineers, Inc.
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Applications must be postmarked no later than March 30, 1985 to be eligible for consideration.

IEEE REGION 8
and
IEEE SPANISH SECTION

melecon'85

mediterranean electrotechnical conference, madrid, spain. october 8, 9, 10, 1985

SECOND ANNOUNCEMENT AND

CALL FOR PAPERS

The IEEE Region 8 and the IEEE Spanish Section invite you to participate in MELECON '85.

The Mediterranean Electrotechnical Conference 1985, will cover topics in the areas indicated below, with special emphasis in applications of interest to the Mediterranean countries. It will provide an opportunity for interaction among engineers and scientist in the four areas of interest.

AREAS OF INTEREST

A) – BIOENGINEERING
- A1 – Diagnostic devices
- A2 – Therapeutic and functional aids
- A3 – Biomedical signal processing
- A4 – General medical informatics

B) – DIGITAL SIGNAL PROCESSING
- B1 – Spectral analysis and adaptive systems
- B2 – Speech and image processing
- B3 – Hardware implementations
- B4 – Applications to radar, sonar, communications, and others
- B5 – Special topic: Computer communications

C) – RADIOCOMMUNICATIONS
- C1 – Active radio frequency circuits, including integrated circuits
- C2 – Passive radio frequency circuits, including non-reciprocal circuits
- C3 – Antennas, radiating systems, wave propagation in the natural media
- C4 – Electromagnetic theory, numerical methods in electromagnetism

D) – SOLAR ENERGY
- D1 – Photovoltaic Physics and Technology
- D2 – Photovoltaic systems
- D3 – Solar Thermal Energy
- D4 – Wind generators and systems

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	EARLY REGISTRATION (PRIOR TO SEPTEMBER 10th 1985)	LATE REGISTRATION
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TO: Profesor Antonio Luque
MELECON '85

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ABSTRACT DEADLINE: July 1, 1985. Authors of contributed papers must submit a 35-40 word abstract to the Program Chairman:

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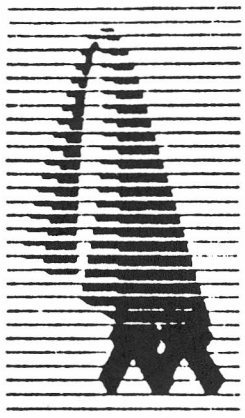

1985 IEEE MTT-S

International Microwave Symposium

St. Louis, Missouri

June 4, 5, and 6, 1985

The 1985 IEEE MTT-S International Microwave Symposium will be held in St. Louis on June 4-6, 1985. The technical program will consist of both Regular Sessions and an Open Forum. The latter, consisting of poster presentations, gives the author the opportunity not only to present conventional theoretical and experimental information, but also hardware for inspection or display.

- Biological Effects & Medical Applications
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- Microwave Systems
- Ferrite Devices
- GaAs Monolithic Circuits
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- Low Noise Techniques
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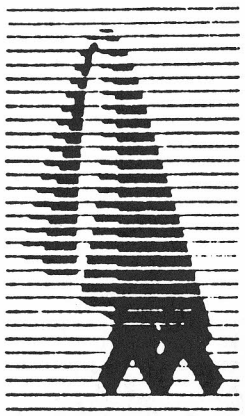

1985 IEEE MTT-S

International Microwave Symposium

St. Louis, Missouri

June 4, 5, and 6, 1985

HOUSING ADVANCED REGISTRATION

Use this form to reserve housing for the 1985 International Microwave Symposium. You will receive your confirmation directly from the hotel assigned. All hotels require a deposit. Do not send deposits to the Housing Bureau—send deposit directly to the hotel after you receive your confirmation. In the event you have a cancellation or change, please notify the IEEE Housing Bureau, 10 South Broadway, Suite 300, St. Louis, MO 63101.

RATE INFORMATION

Hotel Room Rates	Singles	Doubles	Suites
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Holiday Inn	66	76	95/110/125
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Reservations must be received by Housing Bureau no later than May 1, 1985.

1985 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM

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