

President's Column

Ferdo Ivanek

This year's third and last AdCom meeting is behind us (see the accompanying "highlights" by Dan Swanson), and my term is coming to an end. Among my remaining duties is the pleasure to welcome the President-elect Reynold Kagiwada, the Vice President-elect Peter Staecker and the newly elected AdCom members Dan Swanson, John Wassel and Eikichi Yamashita, and to congratulate the fifteen MTT-S award recipients (see the write-up by Fred Rosenbaum).

It is my special pleasure to thank all the 1991 AdCom members and other volunteers who chaired or actively participated in the work of the numerous MTT-S Committees and of the more than 70 Chapters worldwide. Collectively we made substantial progress in 1991, which includes keeping the membership well informed through this *Newsletter*. I therefore prefer to leave it to the individual member to draw his/her own conclusions about the reported 1991 results, which permits me to restrict the traditional "Outgoing President's Message" to the single area in which I believe that this year's progress will have the most far-reaching impact on MTT-S' future.

Every MTT-S President has to set priorities and act accordingly. One of my predecessors gave me the good advice to concentrate on a single major objective. It occurred to me that this must be the further improvement and expansion of our largest and most important collective activity: the International Microwave Symposium (IMS) and the associated events which add up to one of the most successful IEEE conferences/exhibitions. Typically, about one sixth of the entire MTT-S membership worldwide attends and a large percentage of those actively participate as organizers, paper authors, etc.

What is then the problem to be addressed? It is twofold. On the one hand, we seem to be approaching the capacity limits of this week-long group of events. On the other hand, compared to others in the leading group of IEEE Societies with similarly strong central events, MTT-S holds fewer additional symposia, workshops, etc., in other locations and at different times during the year. These are two distinct problem areas which we have addressed in two ways.

First, we have established the Ad Hoc Committee on "MTT-S Week" Structure. Its name describes clearly the intent of planning ahead to continue to effectively serve the

(Continued on page 31)

Incoming President's Message

*by Reynold Kagiwada
1992 MTT-S President*



As the new president, I look forward to having an extremely challenging and productive year. I hope that I can follow the tradition set by my predecessors over the last forty years. They have demonstrated great leadership and vision in leading MTT-S into the third largest society within the IEEE. Above all, I would like to thank Ferdo Ivanek for his creative and systematic leadership. Hopefully by close association with him in 1991, his wisdom would have been instilled in me. This is the second time that I have benefited from his pioneering work. As the Microwave Symposium Technical Program Chairman, Ferdo created the now standard format of 90 minute sessions made up of short papers (10 minutes) and regular papers (20 minutes). His concept of focused sessions has added a new dimension to our symposium. The Society is truly indebted to Ferdo for his innovation and hard work.

In the present decade, the MTT Society has to look toward and respond to rapidly changing environment. With the major world powers advocating peaceful coexistence, there is a rapid de-emphasis in defense spending. I envision for our Society, a stronger future emphasis on commercial application of microwaves, and a stronger participation in our Society from Regions 7, 8, 9 and 10. My goal for 1992 is to establish the foundation for the Society to meet the challenges of the next decade. I know that I can count on the support of everyone. I know that Jorg Raue and Zvi Galani, through Technical Activities Committees, will find new and exciting technological areas to expand into so that these can be incorporated into our publications, meetings, and symposia. As we transition into new areas, Membership Services will find fertile ground to find new members. I also expect expansion of members in Regions 8, 9 and 10 with activities of the Transnational Committee being coordinated by Dr. Rolf H. Jansen and Prof. Eikichi Yamashita. I look to our capable Vice President, Peter Staecker, and Treasurer R. E. (Skip) Bryan for establishing the financial guidelines necessary for our future activities.

Our Society has a large number of talented and hard working volunteers. I have included the 1992 AdCom Committee chairmen for your information (see back page). Please contact them if you have any specific questions or comments. I look forward to working with everyone during 1992. Happy New Year!

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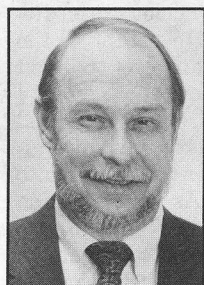
WANTED—Asia Pacific Editor/Correspondent.
Please Contact John Wassel.

The MTT Newsletter staff is interested in obtaining feature articles dealing with current topics in the technical and professional areas of interest to MTT members. These articles should provide members with a general understanding of the topic and its significance in current and future activities in the microwave field. I would like to emphasize, however, that these special articles should cover topics in a broad, general sense. Specific design techniques and applications will be covered in the papers appearing at the MTT Symposium and in the *Transactions*.

If you know of a topic that is current and/or you are willing to contribute an article to the Newsletter, please contact:

John Eisenberg
25 Parson Way • Los Altos, CA 94022 • (415) 941-7426

Editor's Comments



by John Wassel

Hopefully, this issue of the *MTT-S Newsletter* will be delivered to our members shortly after the beginning of 1992. On behalf of AdCom, we wish each of you a happy and prosperous New Year for 1992.

The MTT Society launches the New Year in Albuquerque, New Mexico (USA), starting with the Third Emerging Technologies Planning Meeting on Saturday, 11 January 1992, the AdCom Meeting on 12-13 January, and the Technical Program Committee Meeting on Sunday, 12 January. How-

ever, the new year is only a calendar date because these meetings are to continue the activities that have been started a long time past. For example, the 1992 IMS has been planned for over five years, the papers to be selected at the TPC have been in progress for some time, and the AdCom Committees are usually working several long-range programs. It's wonderful to have this continuity and to see the evidence of dedication by our many members.

Several technical committee reports are included in this issue. I encourage the chairmen of other technical committees to consider submitting reports of their activities. I hope to see several of these reports in our future newsletters.

On another note, Dick Sparks of Raytheon has decided to retire this year. He plans to stay involved in MTT-S activities. We appreciate his loyalty and dedication in service to the MTT Society.

And finally, I wish to note an acknowledgement to our last issue (No. 129) of the *MTT-S Newsletter*. The report on "Microwaves in Medicine '91" on page 25 was previously published in *Microwave News*, Vol. XI, No. 4, page 11, July/August 1991 as "Medical Microwaves in Yugoslavia." Dr. Louis Slesin, Editor and Publisher, had edited the submitted copy and this is the version published in our newsletter. We appreciate his contributions to this news release.

Nominations for Microwave Theory and Techniques Society Awards

by L. N. Medgyesi-Mitschang
Awards Associate Chairman

The professional recognition of our members through the awards process is an important MTT-S activity. It serves to enhance the stature of our Society in the technical community and the public at large. Your assistance in this process is vitally needed and most appreciated.

This year we begin the process early so that as many deserving candidates as possible are identified for the 1992 awards. We are soliciting nominations for the following awards:

Microwave Career Award
Applications Award
Distinguished Service Award
N. Walter Cox Award
Pioneer Award
Microwave Prize Award

A short description of these awards follows.

Microwave Career Award

Prize—Certificate, a Plaque and \$2,000

Eligibility—A career of meritorious achievement and outstanding technical contribution by an individual in the field of microwave theory and techniques; individual must be a member of IEEE.

Basis for Judging—Publication in technical journals, presentation of lectures, contributions to the advancement of microwave technology, and other technical contributions considered in conjunction with any or all of these areas of contribution; nominations are considered annually; award is made aperiodically.

Presentation (when presented)—At the annual MTT-S Symposium. Note: Travel allowance of up to \$1,000 is granted on a need basis for travel to the Symposium.

Microwave Application Award

Prize—Certificate and \$1,000

Eligibility—Outstanding application of microwave theory and techniques by an individual to create a new device, component or technique; novel use of a device or component; or any combination of the above.

Basis for Judging—The most outstanding application of microwave theory and techniques by an individual; nominations must be submitted by a member of the Society; nominations are considered annually; award is aperiodic.

Presentation (when presented)—At annual MTT-S Symposium.

Distinguished Service Award

Prize—Plaque and Certificate

Eligibility—Significant contributions and outstanding service to the Microwave Theory and Techniques Society and the microwave profession over a sustained period of time.

Basis for Judging—Service to AdCom and IEEE. Nominations considered aperiodically and awards made aperiodically.

Presentation (when presented)—At annual MTT-S Symposium.

N. Walter Cox Award

Prize—A Plaque

Eligibility—Any MTT-S member.

Basis for Judging—A Society volunteer whose efforts on behalf of MTT-S best exemplify the contributions of N. Walter Cox.

Presentation—Aperiodically; at the annual MTT-S Symposium.

Pioneer Award

Prize—Certificate, a Plaque and \$1,000; feature publication in *MTT Transactions* and *Newsletter*. If a team is named recipient, each shall receive a plaque and the honorarium shall be shared.

Eligibility—Publication of contribution in an archival journal by an individual or team not exceeding three persons. Deceased persons are ineligible for nomination. Preference may be given to IEEE members.

Basis for Judging—Proposed award is to recognize an individual(s) who has made a major, lasting contribution in the field of interest of MTT-S at least 20 years prior to the year of the award.

Presentation (when presented)—At the annual MTT-S Symposium. Upon request, travel and living expenses for the recipient for attendance at the presentation ceremony shall be reimbursed.

Microwave Prize

Prize—Plaque and Certificate

Eligibility—Authors of papers making significant contribution to the MTT-S field of interest published in any IEEE publication during the year ending June 30th preceding the award; the author need not be a member of IEEE.

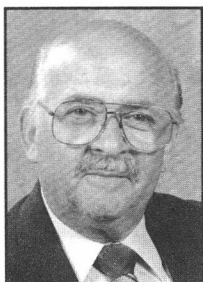
Basis for Judging—The most significant contribution in the previous year in the field of interest to the MTT Society.

Presentation (when presented)—At the MTT-S Symposium.

Candidates nominated for the above categories will be considered by a Nominations Subcommittee prior to a final selection and recommendation to AdCom at the fall 1992 meeting. A copy of the requirements and the nominating forms for these awards together with a list of previous recipients is available by writing to:

Dr. L. N. Medgyesi-Mitschang
McDonnell Douglas Research Laboratories
Bldg. 110, Mail Code 111-1041
P.O. Box 516
St. Louis, MO 63166

1992 IEEE MTT-S International Microwave Symposium



by Jerry Hausner, Chairman

Which Way

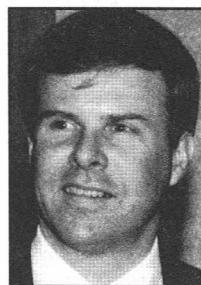
Uncertainty. That is what we are all dealing with right now. Which way will technology go? What will happen with the economy and when? These questions are on everyone's mind. The 1992 IMS is being billed as "A Look to the Future." Does that mean it will answer these questions? Probably not. If I had a crystal ball that could, I'd be sitting on top of one of these picturesque New Mexico mountains and publishing another one of those monthly newsletters telling you how to invest your money. However, not having a crystal ball, I just have to keep working as a microwave engineer and take my chances with everyone else. What then does a look to the future mean? Simply stated, it means keeping your options open.

You, as cold as it may seem, have a market value. That value is highly dependent on your knowledge of microwave electronics. That knowledge is not limited to the best ways to design a microwave circuit but perhaps even more important are ways to apply that technology. The best means of maintaining your value is to keep yourself current. The IMS provides the means to accomplish just that. The symposium offers more than 300 papers being presented in a formal environment and of equally prodigious importance, in an interactive environment. The latter situations occur in the Interactive Forum (formerly Open Forum), workshops, panel and rump sessions. At these presentations you have the opportunity to discuss the material being presented with the respective authors and experts in various fields. Also encouraged are alternate means of presentations which include, but are not limited to, video and computer demonstrations. Authors may also bring hands on experiments. This does not even count the 500 plus exhibits that are all live. What better way is there to learn so much in so short a time?

With the defense programs no longer holding the hope of being big daddy, everyone is scrambling to find other uses of their technology. New Mexico has been and still is a frontier. It is a frontier of population growth, economic growth, biological and medical research, weapons of the future research, energy research, and it stands to reason that it is also the frontier for the concept called tech transfer. It is the logical place to take that look to the future. Your Technical Program Committee is feverishly attempting to organize a blue ribbon panel session dedicated to tech transfer which is composed of leaders from industry, research and government.

A symposium like this will arm you with knowledge and ideas. If we can give you enough food for thought, each attendee will combine those ideas with prior thoughts and experience and reach his own conclusions. Be in ABQ in 92 to develop that look to the future that is within you.

AdCom Elections



by Glenn Thoren
Chairman, Publicity Committee

The annual fall elections for the Administrative Committee of the Microwave Theory and Techniques Society were held on September 28, 1991, in Orlando, Florida. John Horton, the chairman of the Nominations Committee, presided over the introduction of nominees, the explanation of the election procedures and the election. Each year the difficult process of selecting new AdCom members from the list of highly qualified candidates is a challenge to the committee. AdCom membership involves dedication and service across dozens of activities that are the fabric of the MTT Society. So, as always, the elections are serious and time consuming.

It is important that the MTT-S membership get to know the new officers and the rest of the AdCom committee. AdCom is a vital link to the chapter activities across the U.S. and the world.

This year, for the 1992 AdCom, Reynold S. Kagiwada was elected President of the Society. Peter W. Staecker was elected as the incoming Vice President.

The incoming committee members listed below will serve 3-year terms beginning on January 1, 1992. The chart that follows shows the make-up of the 1992 AdCom and the representation from industry, universities and government.

AdCom Members 1992

1992	1993	1994
K. K. Agarwal	R. E. Bryan	R. H. Jansen
E. J. Crescenzi	E. D. Cohen	R. S. Kagiwada
Z. Galani	S. A. Maas	M. A. Maury
B. S. Perlman	R. A. Moore	D. G. Swanson
S. J. Temple	J. E. Raue	J. W. Wassel
J. C. Wiltse	P. W. Staecker	E. Yamashita
Eastern U.S. 7	Industry 13	Past Presidents
Central U.S. 2	Government 2	F. Ivanek—1991
Western U.S. 7	University 3	T. Itoh—1990
Europe 1		V. G. Gelnovatch—1989
Japan 1		

Newly Elected Members for 1992-1994

Rolf H. Jansen	Industry, Europe
Reynold S. Kagiwada	Industry, West-U.S.
Mario A. Maury	Industry, West-U.S.
Daniel G. Swanson	Industry, West-U.S.
Eikichi Yamashita	University, Japan
John W. Wassel	Industry, Central-U.S.

Biographies of many of the AdCom members are included below. The next issue of the *Newsletter* will include the rest of the AdCom biographies. If you have comments, questions,

(Continued on next page)

concerns, or input for the AdCom, these members and the rest of the current AdCom members are available for you to contact. Each year the *Newsletter* publishes, for your use, the directory of all elected AdCom members and the other selected officers of the AdCom committees and upcoming Symposia committees. This is an excellent reference booklet to use to contact the committee members.

Krishna Kumar Agarwal

Dr. Agarwal is currently the Manager of Microwaves and RF in Electronic Warfare Department, E-Systems, Inc., Garland Division, developing capabilities in MMIC, RF circuits, antennas and systems. Additionally, he is an Associate Professor (Adjunct) at Southern Methodist University, Dallas, and the University of Texas at Arlington and teaches graduate level courses in Monolithic Microwave circuits, RF circuits, and Antennas.



Previously he has worked for Rockwell International, TRW Defense and Space, Bell Telephone Labs, and has over 25 years of management and RF experience requiring development of microwave subsystems and devices.

Krishna Agarwal is the IEEE Press Liaison for the MTT-S, a member of the Long Range Planning Committee, a past Chairman and Coordinator of Technical Committees, and Education Committees of MTT-Society. He has served as the Chairman, MTT-S Dallas Chapter, Vice-Chairman of MTT-S Boston Chapter, and a member of IEEE-EAB/TAAC. Dr. Agarwal is a contributing editor of *Applied Microwave Magazine*, and on the Editorial Board of *MTT-S Transactions and Microwave/Optical Technology Letters*.

Ed. Note: Dr. Agarwal was elected Fellow of the IEEE in November 1991.

Zvi Galani

Zvi Galani, a senior member of the IEEE, received the B.S.E.E. degree from the Milwaukee School of Engineering in 1963 and the M.S. and Ph.D. degrees in Electrical Engineering from Cornell University in 1969 and 1972, respectively.

From 1963 to 1972 he was employed by the General Electric Company in design of low noise microwave sources for multi-channel telecommunication systems. In 1972 he joined Raytheon Missile Systems Division and worked in design of microwave components and subsystems.

From 1976 to 1982 he managed the Sources and Devices Section in the Missile Microwave and Antenna Department of the Missile Guidance Laboratory.

In 1985 he was promoted to Consulting Engineer, the highest engineering level attainable at Raytheon. Presently Dr. Galani is on the Technical Staff of the Missile Guidance Laboratory. He holds numerous patents and has authored papers on microwave signal generation, frequency synthesizers, power FET amplifiers and amplifier combiner circuits.

In January 1986 he joined the MTT-S Membership Services Committee as Chapter Records Chairman and served in that position until May 1990. From 1987 through 1989 he also served as the Special Articles Editor for the *MTT-S Newsletter*. In 1989 he was elected to MTT-S AdCom for the term 1990-1992 and served as AdCom Secretary in 1990. Presently he is Chairman of the MTT-S Membership Services Committee.

Barry S. Perlman

Barry Perlman received a B.E.E. degree from the City College of New York in 1961 and an M.S.E.E. and Ph.D. degree in Electrophysics from the Polytechnic Institute of New York in 1964 and 1973, respectively.



Dr. Perlman is currently Chief of the Microwave and Opto-Electronic Devices Branch, Electronics Technology and Devices Laboratory, USA LABCOM, Fort Monmouth, New Jersey, where he is responsible for research and advanced development of microwave/millimeter wave and opto-electronic components for radar, EW, communications and smart weapons. Prior to his current position, he was Head, Design Automation Research, in the Microwave Laboratory at the David Sarnoff Research Center (formerly RCA Labora-

tories) in Princeton, New Jersey.

Barry Perlman is a Fellow of the IEEE, a member of Sigma Xi, he is Co-Chairman Educational Committee, Technical Program Committee and Emerging Technology Committee and Past Chairman of subcommittee MTT-1 (CAD). He is also the Program Manager for the DoD initiative to develop a MIMIC Hardware Description Language (MHDL) and serves as an Army representative to the Advisory Group on Electron Devices (AGED).

R. E. (Skip) Bryan

Skip Bryan received his Bachelor's and Master's degrees in Electrical Engineering from the University of Southern California, respectively in 1969 and 1972.

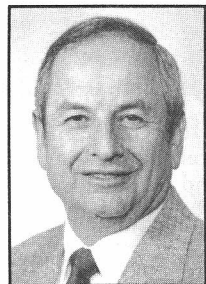
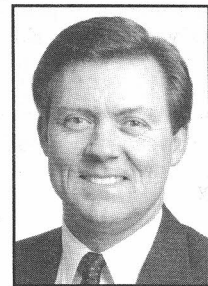
He is currently the manager of the Antenna and Microwave Subsystems Department in the Radar Laboratory at Hughes Aircraft Company's Missile Systems Group. As manager of the microwave activity in Missile Systems Group, he manages various program and internal R&D design teams developing microwave and millimeter wave phased array radar components, radar exciters, solid-state transmitters, antennas and low noise RF receivers.

Skip has experience in the design of microwave components and subsystems for satellite communications and radar-guided missiles. He has worked on subsystem hardware development in both high-reliability satellite systems as the design manager for the Ku-band ANIK-C and SBS communication receivers, as well as low cost missile systems as the design manager for the AMRAAM Frequency Reference and Target Detection Device subsystems.

Skip has been a member of the IEEE Microwave Theory and Techniques Society since 1969. In 1989, he served as the Treasurer of the International Microwave Symposium in Long Beach, California. He is a past Chairman and Treasurer of the San Fernando Valley chapter of the MTT. He was elected to the AdCom in 1991 and currently serves as the Treasurer of the MTT and as the financial liaison for Meetings and Symposia.

Eliot D. Cohen

Eliot Cohen received the B.E.E. and M.S.E. degrees from The George Washington University, Washington, D.C., in 1963 and 1966, respectively. Since then, he has completed additional graduate work at The George Washington Univer-



sity. He is an IEEE Fellow and the DARPA Member of the OSD Advisory Group on Electron Devices.

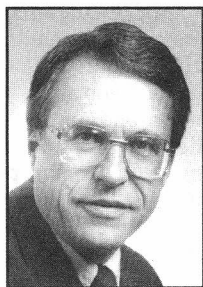


He is currently the Manager of the Microwave/Millimeter Wave Monolithic Integrated Circuits (MIMIC) Program at the Defense Advanced Research Projects Agency (DARPA), having been appointed to this position in January 1989. In this capacity, he has overall responsibility for all aspects of this program.

From 1963 to 1972, he was an electronic engineer at the Naval Research Laboratory. He performed research on microwave and millimeter wave solid state devices and circuits. From 1972 to 1980, he was Head of the High Frequency Devices Section at the Naval Research Laboratory. Between November 1980 and April 1986, Mr. Cohen served as the Navy Director of the Very High Speed Integrated Circuits (VHSIC) Program at the Space and Naval Warfare Systems Command (formerly: Naval Electronic Systems Command). Between April 1986 and December 1988, Mr. Cohen served as Deputy Director for Microwave and Millimeter Wave Programs in the Department of Defense's Technology Analysis Office (DTAO). In this capacity, he had primary responsibility for most aspects of the MIMIC Program. Between February 1990 and May 1991, Mr. Cohen served concurrently as Deputy Director of the Defense Manufacturing Office at DARPA and as Manager, Microwave/Millimeter Wave Monolithic Integrated Circuits (MIMIC) Program.

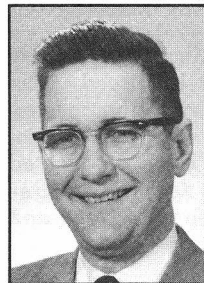
Jorg Raue

Dr. Raue currently is advanced projects manager at TRW, where he has held a variety of technology development and management positions since 1969. He received his B.S.E.E. degree from the Milwaukee School of Engineering in 1961, and his M.S.E.E. and Ph.D. degrees in microwave electronics from Marquette University in 1965 and 1968. He is a Fellow of the IEEE and a member of Sigma Xi. Dr. Raue regularly teaches a graduate class in microwaves at USC.



Robert A. Moore

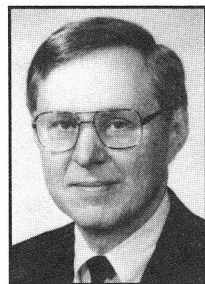
Robert A. Moore received his B.S. in E.E. from the University of Alabama in 1954 and his Ph.D. from Northwestern University in 1960. Since graduating, except for a brief tour in the Army at Fort Monmouth (assigned to what is now LABCOM), he has been with the Westinghouse Electronics Systems Center in Baltimore. Most of his career has been spent in research and development of microwave, microwave acoustic and ferrite device technology for applications in radar and EW systems. He is now Manager of R&D for Design and Producibility Division.



Dr. Moore is a Senior Member of IEEE and active with the Administrative Committee of the MTT-S. Previously he was active with the Administrative Committee of the UFFC-S and General Chairman of the UFFC-S in 1986 Ultrasonics Symposium in Williamsburg, VA.

Peter Staecker

Peter Staecker received the B.S. degree from MIT in 1964 and the Ph.D. degree from the Polytechnic Institute of Brooklyn in 1970, both in Electrical Engineering.



From 1972 to 1986 he was a staff engineer at MIT Lincoln Laboratory, where he worked on microwave device and circuit designs. In 1986, he joined M/A-COM's Corporate Technology Center, and he is presently Director of Advanced Development in the Communications and Subsystems Division. He is an associate editor of the *IEEE Transactions on Microwave Theory and Techniques*, contributing editor of *Applied Microwave Magazine*, and a member of the editorial review board of the

Microwave Journal.

Dr. Staecker has been a member of the Administrative Committee of the IEEE Microwave Theory and Techniques Society since 1985. Since 1983 he has been a member of the Technical Program Committee of the MTT-S International Microwave Symposium, and was General Chairman of the 1991 MTT-S International Microwave Symposium Steering Committee.

Rolf Jansen

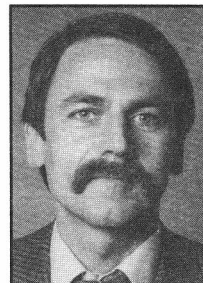
Rolf Jansen received his Master's and Ph.D. in Electrical Engineering from the University of Aachen (RWTH) Germany in 1972 and 1975, respectively. He is a Fellow of the IEEE and the head of Jansen Microwave, which he established in 1985.

From 1976-1979, Rolf Jansen was a Senior Research Engineer at RWTH Aachen, where he was mainly engaged in the modeling and CAD of MIC components and circuits. In 1977 he became a research associate for radio communication division of Standard Electric Lorenz AG (SEL) in Pforzheim, Germany.

Rolf Jansen became a Professor of Electrical Engineering from 1979 to 1985 at the University of Duisburg, Germany, teaching and researching on electromagnetic theory, microwave techniques, and CAD, measurement techniques and modeling.

Since 1984 he has been a member of the IEEE technical committee's MTT-15 (microwave field theory) and MTT-1 (computer aided design). He joined the editorial board of various international journals including the *IEEE Transactions on MTT*, the *IEEE Proceedings*, etc.

In 1987/88 he was the Distinguished Lecturer for the MTT-S on CAD for microwave and millimeter wave ICs.



Reynold Kagiwada

Reynold S. Kagiwada received his bachelor of science, master of science, and doctorate in 1960, 1962, and 1966 respectively, all from the University of California in Los Angeles and all in physics.

Dr. Kagiwada joined TRW in July 1972 as a member of the professional staff to establish a research group on surface acoustic wave development and applications, as well as III-V material growth and characterization, Josephson junctions,



millimeter-waves, acousto-optic modulators, and shallow bulk acoustic waves. In June 1980 he became the manager of the Microwave Products Department of the Microelectronics Center in Redondo Beach, California.

Dr. Kagiwada has served on the physics faculties of both UCLA and the University of Southern California.

Dr. Kagiwada is a Senior Member of the IEEE and has served the MTT Society as the Chairman of the Technical Committee on Microwave Acoustics.

Mario A. Maury, Jr.

Mario Maury attended Mt. San Antonio College and California State College at Los Angeles. Mr. Maury is currently President, CEO and Chairman of the Board at Maury Microwave Corporation, Cucamonga, California, where he was part of the founding group in 1957.



Mr. Maury started his career at General Dynamics—Pomona, California. He has designed a wide variety of passive microwave components and instruments in coaxial, waveguide and strip line structure from literally DC to 110 GHz. Mr. Maury has been actively involved in the development of calibration standards for Automatic Network Analyzers, precision

noise measurement equipment, transistor test fixtures and precision and high frequency coaxial connectors.

Mr. Maury is a member of IEEE, MTT-S, IMS, ARFTG and AOC. He became a member of MTT-S in 1968. In 1981 he became chairman of MTT-12 Automatic RF Techniques which provides the coordination function for that group. Mr. Maury has served as a member of the MTT-S Symposium Technical Program Committee continuously since 1982, and he is a member of the Editorial Review Board of the *IEEE Transactions on Microwave Theory and Techniques* also since 1982.

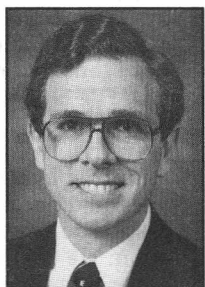
Daniel G. Swanson Jr.

Daniel G. Swanson Jr. received the B.S.E.E. degree from the University of Illinois in 1976 and the M.S.E.E. degree from the University of Michigan in 1978.

In 1978 he joined Narda Microwave where he designed broadband microwave amplifiers and developed a de-embedding system for S-parameter device characterization. In 1980 Mr. Swanson was with Wiltron Company designing YIG tuned oscillators for use in microwave sweepers. He joined a start-up company, Iridian Microwave, in 1983. In 1984 he joined Avantek Inc. where he developed thin film microwave filters, software for filter design, and a low frequency GaAs MMIC amplifier.

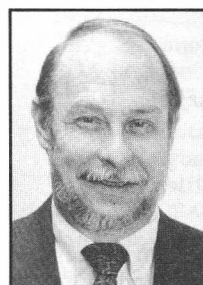
He is presently a Staff Scientist with Watkins-Johnson Co. where he is investigating filters and applying electromagnetic simulation software to microwave component design.

Mr. Swanson served as an officer in the Santa Clara Valley Chapter of the Microwave Theory and Techniques Society from 1985 to 1989. He has been a Member of the IEEE MTT Society since 1974 and became a Senior Member in 1991. He is Chairman of the Membership Development Committee for AdCom.



John W. Wassel

John W. Wassel (M'69-SM'83) received the degrees of B.S. in physics from the University of Oklahoma, Norman, in 1960 and the M.S. in electrical engineering from Southern Methodist University, Dallas, TX, in 1967. He is a Senior Member of the IEEE.



From 1960 to 1964, John was employed at Continental Electronics in Dallas developing high-power radar and radio transmitters. He was an engineer at Microwave Physics in Garland, TX, from 1964 to 1965 developing parametric amplifiers and YIG filters. From 1965 to 1968, he was in microwave telecommunication systems at Collins Radio in Dallas. Since 1968, he has been a senior engineer at Texas Instruments, involved in varied microwave design activities. Presently, he

is deputy manager of microwave and antenna research and development programs.

John has served the Dallas IEEE Microwave Theory and Techniques Group as program co-Chairman, Treasurer, Secretary, and Chairman. He also has served the Dallas IEEE Section as Technical Studies Chairman and now is serving as Conference Coordinator. John was chairman of the 1990 IEEE MTT-S International Microwave Symposium and was a member of the Steering Committees of the 1987 and 1982 MTT-S IMS. He was honored as the Dallas IEEE Section Engineer of the Year in 1991. He is now serving as 1991 MTT-S Newsletter editor.

Eikichi Yamashita

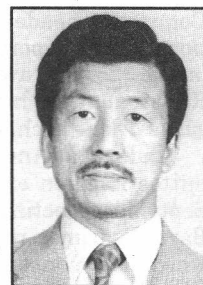
Eikichi Yamashita received the B.S. degree from the University of Electro-communications, Tokyo, Japan, and the M.S. and Ph.D. degrees from the University of Illinois, Urbana, Illinois, all in electrical engineering, in 1956, 1963, and 1966, respectively.

From 1956 to 1964, he was with the Electrotechnical Laboratory, Tokyo, Japan. While on leave from 1961 to 1963 and from 1964 to 1967, he was with the Electro-Physics Laboratory and then Antenna Laboratory, University of Illinois. He became Associate Professor in 1967 and Professor in 1977 in the Department of Electronic Engineering, University of Electro-communications, Tokyo, Japan.

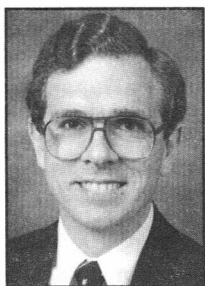
Dr. Yamashita was Chairperson of the Technical Group on Microwaves, IEICE, for the period 1985-1986, and Vice-Chairman, Administrative Committee, Electronics Group, IEICE, for the period 1989-1990. He is a Fellow of IEEE, and has served as Associate Editor of the *IEEE Transactions on Microwave Theory and Techniques* from 1980-1984. He was Chairman of the IEEE MTT-S Tokyo Chapter from 1985-1986. Recently he served as Chairman of International Steering Committee, 1990 Asia-Pacific Microwave Conference, held in Tokyo.

Ed. Note: Biographies of the following AdCom members were not available as we went to press:

E. J. Crescenzi	S. J. Temple
S. A. Maas	J. C. Wiltse



Fall MTT-S AdCom Meeting Highlights



by Dan Swanson
MTT-S AdCom Secretary

The fall MTT-S AdCom meeting was held on September 28-29, 1991, at the Clarion Plaza Hotel, Orlando, Florida. Despite considerable confusion among the new hotel staff (the hotel had been open only two weeks) Keith Huddleston and his committee did an excellent job on local arrangements for the meeting.

The priority and highlighted items for this meeting were the AdCom elections, awards nominations, the Education Committee, the Publications Committee and the President's Assigned Priority Items.

Before the actual election process began, Don Parker reported on the deliberations by the Past Presidents' Council (PPC) on the restructuring of AdCom. The PPC recommended that AdCom should remain at 18 members and informally strive for a balance between industry, government and academia. John Horton directed the election process. There were 20 well qualified candidates nominated for 6 open positions. Congratulations to the following who were elected to a 3-year term: Rolf H. Jansen, Reynold S. Kagiwada, Mario A. Maury, Jr., Daniel G. Swanson, Jr., John W. Wassel and Eikichi Yamashita.

Another important event was the report of the Awards Committee headed by Fred Rosenbaum. The awards nominations will be reported elsewhere in the *Newsletter*. Congratulations to the award recipients and our thanks to Fred Rosenbaum for his efforts on the Awards Committee as he turns over the chairmanship to Reinhard Knerr.

Under the Annual Agenda Framework each major committee is given extra time to report once each year. At the September meeting the Education Committee was highlighted. Barry Pearlman reported on the continuing success of CAEME which has sponsored several successful workshops in the past six months. The *CAEME Software Book* (Vol. 1) will be published soon by the IEEE Press. Committee co-chairman Jim Wiltse is organizing a special *Transactions* issue on micro-wave education; potential authors should contact Jim. Jim also reported on the Fellowships and Grants-in-Aid program which has aided fifteen students since 1988. AdCom voted to reestablish a budget of \$35,000 for this program in fiscal year 1992.

Another highlighted committee at this meeting was Publications, led by Jim Crescenzi. Steve Maas reported that he is receiving about 40 new papers a month for the *Transactions*, about 30% more than two years ago. Steve also brought forward a proposal supporting associate editors for the *Transactions*. Many other societies use associate editors with apparent success. A formal proposal is expected on this issue at the January AdCom meeting. If you have comments or suggestions they should be directed to Jim Crescenzi. After a brief report on the *Letters Journal* by Tatsuo Itoh, AdCom voted to appoint Prof. Xu Shan-jia to associate editor for *Chinese Abstracts*.

One of the President's assigned priority items at this meeting was a report from Don Parker and the Past Presidents' Council. They were asked to review two issues, the first was the effectiveness of MTT-S on the IEEE Technical Activities Board (TAB). The PPC recommended that the AdCom Vice President attend TAB meetings along with the President to "learn the ropes" and be more effective the next year. The second issue was professional management support for AdCom. As volunteer time becomes more dear and the society grows it may be time to consider staff support for AdCom. Several societies have full-time staffs in Piscataway, NJ, ranging from 2 to 12 people to support their activities. The PPC recommended that AdCom proceed with caution and that the Operations Committee should study the matter further.

The second President's assigned priority item was the Ad Hoc Committee on MTT-S week led by Barry Spielman. Barry's committee is studying ways to improve our symposium week and has recently addressed co-sponsorship of the GaAs IC Symposium. Ferdo Ivanek has covered these topics in detail in his President's Column in this issue.

The last third of the meeting was devoted to action and information items which are beyond the scope of this summary. Thanks to all AdCom members, committee chairmen, committee members and guests for a successful meeting.

MTT Society Ombudsman



Ed Neihenke
Westinghouse Electric Corporation
P.O. Box 746, MS-75
Baltimore, MD 21203
(301) 765-4573
(301) 993-7432 Fax

As your Ombudsman, I have received three inquiries from MTT-S members since the last reporting in the Summer 1991 *MTT-S Newsletter*. The first inquiry was from a recent MTT-S member who received the *MTT-S Transactions* but did not receive the *Micro-wave and Guided Letters*. He also requested back issues of both periodicals. I contacted IEEE and the issues were sent to the member. The second inquiry was from an MTT-S member who suggested including the addresses, phone, and fax numbers of his editorial team in every issue of the *MTT-S Newsletter* so they could be contacted by the readers with comments, etc. This person could not find his MTT-S directory. I sent his suggestion to the *MTT-S Newsletter* Editor for consideration. He was mailed the MTT-S directory. The final letter was from an MTT-S member who submitted an article to another society's transactions and waited almost a year to hear the results of the status of the paper. The day he contacted me, he did receive news of his article's disposition. The editor was contacted concerning this and the problem was that one of his reviewers was late in submitting his review and also the editor moved which caused further delay.

Please feel free to contact me by letter or telephone concerning any complaint you may have or any assistance you may need in obtaining membership services from IEEE and MTT-S.

MTT-S Meetings & Symposia Committee Report



by Mario A. Maury, Jr.
Chairman

New MTT-S Sponsored Conferences

At the September 29, 1991, AdCom meeting in Orlando, Florida, the following conferences were approved for sponsorship by the Microwave Theory and Techniques Society.

Packaging, Interconnects, Optoelectronics for the Design of Parallel Computers Workshop
3/17-18/92—Shaumburg, Illinois
Sponsored by: IEEE Laser and Electro-Optics Society (LEOS)
Contact: W. Rodielle, (908) 562-3985

5th IEEE Conference on the Computation of Electromagnetic Fields (Biennial)*
8/3-5/92—Harvey Mudd, Claremont, California
Sponsored by: IEEE Magnetics Society
Contact: S. R. H. Hoole, (714) 621-8019

European GaAs Applications Symposium (Biennial)*
4/27-29/92—ESTEC, Noordwijk, The Netherlands
Sponsored by: European Space Agency
Contact: R. H. Jansen, 02102-83095 (Germany)

5th Australian Millimeter and Submillimeter Wave Symposium
8/11-13/92—Adelaide, Australia (held in conjunction with APMC)
Sponsored by: IEEE S. Australia Section
Contact: N. Fourikis, 61-8-259-6816 (Australia)

Microwaves in Medicine '93 (Biennial)*
4/93—Rome, Italy
Sponsored by: MTT-S & AP-S Central & South Italy Chapters
Contact: P. Lampariello, c/o La Sapienza
University of Rome, Via Endossiana 18,
00184 Roma, Italy

*These conferences have been approved for continuous cooperative sponsorship. Should you wish additional information on any of these conferences, please contact the person noted above.

In addition, a motion was also passed to co-sponsor the "IEEE GaAs IC Symposium" in conjunction with the IEEE Electron Devices Society on a continuing basis. Steps are currently underway to implement this motion.

Future Symposia—1992 thru 1998

The following is a listing of International Microwave Symposium sites through 1998 with their chairmen. If you are interested in participating, please contact the chairman directly; they can always use the help and this is a good way to actively support your society.

- 1992—Albuquerque, New Mexico/June 1-5, 1992
Jerry Hausner, Chairman
RDA Logicon
(505) 842-8911
- 1993—Atlanta, Georgia/June 14-18, 1993
Pete Rodrigue, Chairman
Georgia Institute of Technology, MRC
(404) 894-2944
- 1994—San Diego, California/May 23-27, 1994
Don Parker, Chairman
Hughes/RSG
(213) 344-8534
- 1995—Orlando, Florida/May 16-18, 1995
Keith Huddleston, Chairman
Martin Marietta
(407) 356-7201
- 1996—San Francisco, California/June 17-21, 1996
Jim Crescenzi, Chairman
Watkins-Johnson Company
(415) 493-4141, X2506
- 1997—Denver, Colorado/June 9-13, 1997
Hussain Haddad, Chairman
Ball Aerospace Systems
(303) 460-2114
- 1998—Baltimore, Maryland/June 1-5, 1998
Steve Stitzer, Chairman
Westinghouse Electric Corp.
(301) 765-7348

1999-2000 MTT-S Symposium Site Proposals

We have received letters of intent from the following sites:

Year	Location	Chairman	Selected By
1999	Portland, OR	V. Tripathi	June 1992
	Anaheim (LA) CA	M. Maury	
2000	St. Louis, MO	B. Spielman	June 1993
	Dallas, Texas	K. Agarwal	

MTT-S Symposium Proposal Requested

The following is a listing of future MTT-S International Microwave Symposia where we are requesting letters of intent by the deadlines noted.

Year	Location	Letter of Intent	
		Deadline	Selected By
2000	Middle	June 30, 1992	June 1993
2001	East	June 30, 1993	June 1994
2002	West	June 30, 1994	June 1994

Chapters wishing to host any of these Symposia are encouraged to submit their proposals to my attention:

Mario A. Maury, Jr., Chairman
MTT-S Meetings & Symposia Committee
Maury Microwave Corporation
2900 Inland Empire Blvd.
Ontario, CA 91764
(714) 987-4715, X200



MICROWAVE AND GUIDED WAVE LETTERS

JANUARY 1991 VOLUME 1 NUMBER 1 (ISSN 1051-8207)

A PUBLICATION OF THE IEEE MICROWAVE THEORY AND TECHNIQUES SOCIETY



by Tatsuo Itoh
MGWL Editor

ANNOUNCEMENTS	
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LETTERS	
Effects of Superconducting Losses on Pulse Propagation in Microstrip Lines	O. R. Baiocchi, K.-S. Kong, H. Ling, and T. Itoh 2
Calculation of Multiconductor Microstrip Line Capacitances using the Semidiscrete Finite Element Method	M. Davidovitz 5
Modeling of Nonlinear Active Regions in TLM	P. Ruster, P. M. So, and W. J. R. Hofer 8
THz Dichroic Plates for Use at High Angles of Incidence	P. H. Siegel, R. J. Dengler, and J. C. Chen 10
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First issue of IEEE Microwave and Guided Wave Letters.

The *IEEE Microwave and Guided Wave Letters* (MGWL) is now one year old. This journal was proposed by the Publications Committee (then headed by Dr. Martin Schneider) of the MTT-S AdCom. MGWL is intended for quick dissemination of the latest development of emerging technologies in the area of microwaves, millimeter and sub-millimeter-waves, and guided waves toward infrared and beyond, written in a **concise** manner. Although MGWL is intended for quick publication, the utmost importance is quality. By being archival in nature, MGWL is not a place for publication of articles which did not make publication in other archival journals such as the *MTT Transactions*. MGWL is neither supplement nor replacement of the Short Paper Section of the *Transactions*. Technically significant development which requires dissemination in an archival format within a shortest possible time is the content of the MGWL. With a start of its first issue with a modest number of only four articles, MGWL now enjoys a large number of submissions which is increasing steadily. The rejection rate now reaches 38%. The turn-around time for publication in MGWL is intended for three months or less. In the initial part of this past year, the average turn-around time was 3.5 months. However, it has gradually been stretched to 5 months in recent issues. The Editorial office is striving for reducing the time by implementing a number of methods including the improvement of the Editor's Software for which our *Transactions* Editor, Dr. Steve Maas, has been quite instrumental, in addition to the dedication of my able assistant, Dorothy Treece. The Electronic Publication implemented by the IEEE is expected to help reduce the publication time further. The detailed instructions for the authors intending to use this provision can be found in each issue of MGWL.

When an article arrives in the Editor's office, the length is counted and the overlength paper is returned, unreviewed. I assign three reviewers to each article usually within 2 days. Each reviewer is requested to review the article within 3 working days. Many reviewers return their review by fax. Even when I am out of town, I am in constant communication with my office via fax so that assignment of reviewers and editorial decisions are completed in a reasonable time.

A significant part of the delay can be corrected by the cooperation of the authors. By means of this article, I would like to request collaboration of the prospective authors. First, please *read and follow* the "Information for Authors" printed in each issue. It is absolutely essential that the length limitation be observed. The articles should be less than 2 printed pages in MGWL and must not exceed 2.5 pages. Please make every effort to clearly stay within the length limitation. Figures, tables and equations all must be included in the length limitation. The numbers of figures and tables must be conservatively counted for the length estimate. Assembling several figures in a form of Fig. 1a, b, c, etc., does not make them one figure. The physical space occupied by all the figures is what counts. Any overlength article will be returned to the author. This adds up the administrative cost and time, and delays the processing of otherwise significant and timely articles. The best way to avoid this delay is to write the article within a definite length limit. If you cannot write an article within the limit, such an article may not be for MGWL. Secondly, in a number of cases of accepted papers, the authors do not respond quickly to the Editor for the final version which may require corrections as suggested by the reviewers, resulting in some delay.

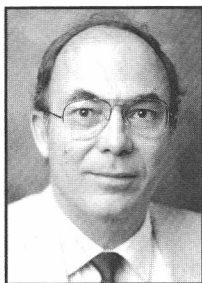
The articles for MGWL should be written differently from those for the *Transactions*. The review process should also be different, although the quality review process cannot be degraded. Up to now, the reviewer can choose "accept," "modify," and "reject." The "modify" is intended for suggestions for clarification and minor corrections. In many instances, the "modify" results in revision which requires another review cycle. I have recently implemented a change in the review process. Now the articles are "accepted" or "not accepted."

Some letters journals do not feedback the comments by the reviewers to the author. However, MGWL intends to provide the feedback. Since the feedback is particularly important to the authors of the articles "not accepted," the new review policy specifically requests comments from the reviewers. Incidentally, I, as a professor, still need to publish. When a paper with my name on it as one of the authors is submitted to MGWL, such an article is immediately transferred to Dr. Steve Maas who makes the assignment of the reviewers, and then makes the editorial decision on behalf of myself. This type of mechanism should be continued for the future editor so that he will not be penalized for being the editor and can thus avoid a conflict of interest problem.

One of the positive experiences I encountered as the Editor is the discovery of a new set of enthusiastic authors who are mainly from industry and ordinarily do not write journal articles often. In addition, I am amazed with the level of dedication on the part of the reviewers. All of the reviewers are very busy individuals. For them, a turn-around of 3 working days is extremely tough. Nevertheless, the majority of the reviewers complete the reviews in an extremely timely fashion. This type of dedication makes the MTT-S one of the best run IEEE Societies and I am thankful and am proud to be a part of MTT.

Tatsuo Itoh
Editor, MGWL

MTT Goes Video!



*Jim Crescenzi
Video Tapes Committee*

The MTT Society has sponsored a wide range of video tapes, and the fruits of the latest effort are a bumper crop! Tapes are available from four of the recent MTT-S Distinguished Lecturers, as well as other recognized experts on a variety of topics of current interest. The tapes are all timely, carefully prepared, and generally enjoyable viewing.

Video tapes offer a low-key and rather personal means of obtaining a perspective on a complex field, or for introduction to new concepts. The original intent for sponsoring video tapes was to provide wider access to the MTT-S sponsored Distinguished Lecturers. It was expected that individuals would use video tapes to view these and other lectures as a means of continuing education. An advantage of video tapes is that they are totally adaptable to viewer schedules.

It has become apparent that the MTT tapes also are appropriate viewing for small classes or seminars. For those wishing to cover the whole series of tapes, substantial discounts are offered on the full set of tapes (refer to the advertisement in this issue). Pricing of the tapes may seem high compared to prices encountered for mass produced entertainment media, but they are a real bargain for specialized educational tapes. The MTT-S Administrative Committee has supported aggressive (i.e., subsidized) pricing to help determine the reception of our membership to the video media. Orders are, in a real sense, "votes" for more video activity.

The newest offerings include:

MTT-S Distinguished Lecturer Videos

John R. Whinnery	Some Relations Between Microwaves and Optics
Paul F. Goldsmith	Quasi-Optical System Design for Millimeter Wavelengths
Walter R. Curtice	Nonlinear GaAs FET Modeling: A Mixture of Art and Science
Rolf H. Jansen	CAD of Hybrid and Monolithic Microwave and Millimeter-Wave MICs

Additional Microwave Topics of Current Interest

Fred Sterzer	Microwaves in Medicine: Hyperthermia Treatment of Cancer
Sander Weinreb	Noise in Microwave Circuits
Charles Holmes	Nonlinear Circuit Analysis and Design
Madhu Gupta	Anticollision Radars
Lauren F. Palmateer	High Performance Modulation Doped Field Effect Transistors

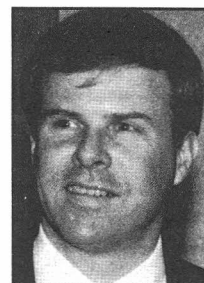
We are indebted to all of the speakers for their contributions, the sum of which makes an exceptional series on micro-

(Continued on next page)

Defense Research and Development Policy Committee



Dave McQuiddy



Glenn Thoren

The Defense Research Development Policy Committee is one of many committees sponsored by the United States Activities Board of the IEEE. The committee is part of the Technology Policy Council and convenes once every other month in Washington, D.C., to review issues impacting the industries that support the defense of the country primarily through Department of Defense related contracts. Each month the committee receives updates on ongoing working groups that are developing position papers for the IEEE that may ultimately be presented to Congress and the executive branch.

Current topics include:

1. Cooperative Research in Multi-Use Government Laboratories
2. Defense Engineering
3. Technology Transfer and Dual Use Technology
4. Promoting Multi-Level Consortia
5. Strategic Defense Initiative

The MTT-S representatives to this committee are David McQuiddy, Texas Instruments, and Glenn Thoren, Lockheed Sanders.

Members are encouraged to provide their inputs to either of the MTT-S representatives.

The last Defense R&D Committee meeting was held on Thursday, September 12, 1991. Glenn Thoren and Dave McQuiddy were in attendance representing the MTT-S in the discussions.

An IEEE, USAB position paper on IR&D funding was submitted to the government in May of 1988. It proposed the two-year cycle and on-site visits for the evaluation of IR&D projects. It also proposes relaxing or removing the funding cap and separating the evaluation and allocation of short-term IR&D, long-term IR&D and B&P funds. As you know the government has adopted new regulations for IR&D review that respond to the former recommendations of this report.

Currently the Defense R&D committee is addressing a position paper on Cooperative Research in Multi-Use Government Laboratories and approved positions on Dual Use of Technologies and Domestic Transfer of Federally-Funded Technology.

A Symposium on U.S. Policy for Competitive Technology Development is scheduled for November 6 and 7 at the Cosmos Club in Washington, D.C. Merrill Buckley, IEEE President-Elect, will be the keynote speaker at the luncheon on the first day. The rest of the sessions will address the critical

(Continued on next page)

New MTT-S Distinguished Lecturers Announced

*L. N. Medgyesi-Mitschang
MTT-S Distinguished Lecture Program Coordinator*

MTT-S AdCom has nominated Dr. Ferdo Ivanek and Professor Paul F. Goldsmith as the new Distinguished Lecturers for our Society for 1992.

Dr. Ivanek, our Society's past President, has chosen as his lecture topic, "Progress and Change in Microwave Radio Communications." Professor Goldsmith of the Five College Radio Astronomy Observatory at the University of Massachusetts has selected the following two topics:

- "Quasioptical Components and Systems for Millimeter Wavelengths"
- "Radiometric Imaging Systems and Applications"

Chapters interested in inviting these lecturers may contact them directly:

Dr. Ferdo Ivanek
Communications Research
1646 Madrono Ave.
P.O. Box 60862
Palo Alto, CA 94306
Telephone: (415) 329-8716
Fax: (415) 328-8751

Professor Paul F. Goldsmith
Five College Radio Astronomy Observatory
University of Massachusetts
619 Lederle Graduate Center
Amherst, MA 01003
Telephone: (413) 545-0925
Fax: (413) 545-4223

Professor John R. Whinnery of the University of California at Berkeley will continue on as Distinguished Lecturer in 1992. His topic is "Relationship Between Optics and Microwaves." Similarly, Professor Vittorio Rizzoli of the University of Bologna will continue in his lectureship in Europe for part of 1992. His topic is "Simulation and Design of Nonlinear Microwave Circuits."

Defense Research & Development

(continued from page 11)

aspects of responding to the international competitive challenges including improving the process of moving R&D to market. Craig Fields and Senator Bingaman are also scheduled to speak during the meeting.

A case for Vertical Consortia was made by Arvid Larson in preparation for drafting a position paper on the subject.

Copies of news articles were distributed on preparing for a Peacetime Economy, SDIO Funding and Shaping Industrial Policy.

The membership of MTT-S will be kept up to date in future Newsletters about Defense R&D Policy Committee activities.

Electronics Industry Challenge in Newly Industrializing Countries

*IEEE Colloquium '92 Lecture
by Ferdo Ivanek*

The growing worldwide industrialization and the transformation of electronics from a narrow specialization into an infrastructure industry is particularly challenging to the newly industrializing countries (NICs). Their problems are compounded by the accelerating pace of technological developments, intensifying international competition, and unfavorable domestic business climate.

The subject is of vital interest to IEEE members in NICs, but the growth of global industrial cooperation makes it also of interest to industrialized countries dealing with NICs. To accommodate the different interests, the lecture will be available in different formats, ranging from an overview to a seminar or workshop.

This lecture evolved from consulting for The World Bank on a telecommunication infrastructure project in an Eastern European country. Significantly, the major problems encountered in this particular case turned out to be typical for NICs, irrespective of geographical location, political system, cultural background or social structure.

The lecture will first address the impact of technological progress from analog to digital electronics and from discrete to integrated electronic components, which drastically altered the conditions for technically and economically sound electronics manufacture in NICs. Adherence to outdated concepts and criteria for the evaluation of plans and results accounts for a large portion of earlier ventures that turn out to be unsustainable in the long run. A set of realistic evaluation criteria will be presented and validated with illustrative examples of sustainable independent domestic efforts, licensed manufacturing and joint ventures.

The most common and most damaging NIC problems are non-technical, but they are usually more difficult to address and remedy because they are ingrained in the country's infrastructure and societal fabric. While this remains a major problem area without easy solutions, encouraging examples of favorable change are available and they tend to stimulate further industrial progress in NICs without undesirable consequences. Entrepreneurial initiatives appear particularly promising in this respect.

The lecture will conclude with suggestions for improved approaches to sorting out and supporting the deserving initiatives in NICs. These include more cooperative domestic frameworks, more effective use of academic R&D, and improved forms of cooperation between domestic decision-makers and foreign lenders and business partners.

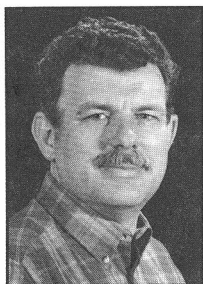
MTT Goes Video!

(continued from page 11)

wave technology. This series was organized, managed, and "championed" by last year's Publications Chairman, Martin Schneider, and administered by Peter Wiesner of the IEEE Educational Activities Department. This year's effort is primarily a matter of follow-through and of giving these video tapes the appropriate exposure and availability to our membership. Your feedback and comments on your experience using these tapes are invited. Please direct comments to Jim Crescenzi (Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 95014, telephone: (415) 813-2506).

ARFTG Highlights

Fall 1991



by John T. Barr, IV

The Automatic RF Techniques Group (ARFTG) is an independent professional society that is affiliated with MTT-S as a conference committee. ARFTG's primary interests are in computer-aided microwave analysis, measurement and design. ARFTG holds two conferences each year, one in conjunction with the MTT-S International Microwave Symposium and a second later in the fall.

Measurement Accuracy Issues—39th ARFTG Conference

The 39th ARFTG Conference will be held in conjunction with the 1992 IEEE MTT-S Symposium in Albuquerque, NM, on June 5, 1992. This allows easy attendance for those attending the MTT-S or MMIC Symposiums earlier in the week. Technical sessions and manufacturers' exhibits will be held in the Pyramid Plaza Hotel, located conveniently near the Convention Center where the MTT-S technical sessions and exhibits will be held.

The theme of the 39th ARFTG Conference will be *Measurement Accuracy Issues*. As both the performance of microwave technology and the ability to measure that performance continues to advance, the subject of how to best measure a device's performance while achieving sufficient accuracy becomes less trivial. To address this issue, this conference is soliciting papers on measurement accuracy limitations, measurement accuracy needs, appropriateness of a technique for determining a specific device's performance, metrology considerations and related cost/time/performance trade-offs. Those interested in participating should contact Conference Chair: Mike Little, RL/OCTP, Griffiss AFB, NY 13441-5700, phone (315) 330-4381; or Conference TPC: John Rooks/ RL/OCTP, Griffiss AFB, NY 13441-5700, phone (315) 330-4381. Deadline for paper submissions is March 15, 1992.

In addition to the technical presentations, the attendees will have ample time for informal discussion among themselves during the breaks and during the provided lunch. There will be time for discussion with vendors and viewing of exhibits to see the latest in automation and measurement products. The registration fee includes technical sessions, exhibits, and all meals and break refreshments, one year membership in ARFTG and a post-conference digest of the presented papers.

37th ARFTG Conference Wrapup

The 37th ARFTG Conference was held in conjunction with the 1991 IEEE MTT-S Symposium in Boston, MA. The theme of the 37th ARFTG Conference was *Validation of Design by Measurement*. The objective of experimental validation is to provide unbiased, quantitative data on the quality of design or the accuracy of design software with respect to a specific criteria. Desired are appropriate papers on validation mea-

surement methods, experimental techniques and approaches, performance criteria and residual error metrics. In other words, how do we measure "good" in our designs and in our models. The presented papers included:

Electromagnetic Simulation of Microwave Components, D. Swanson

Simple Microwave Structures Calculated vs Measured, B. Oldfield

A Resonant Mode Dielectrometer for Substrates, G. Kent
IEEE Standards Committees on Scattering Coefficients & Connectors, B. Oldfield

Modeling Precision Connectors with a High Frequency Structure Simulator, J. Dunsmore

A Novel Technique for Vector Measurement of Microwave Network, D. Brunfeldt

Selected "Best Paper of the Conference"

Modeling of Low Noise Millimeter-wave Amplifiers, U. Rohde

A Gigahertz Test Fixture for Two Port Passive Devices, M. Cavin

Automated On-Wafer Noise and Load Pull Characterization Using Precision Computer Controlled Electromechanical Tuners, M. Tutt

Pulsed Bias-RF Power GaAs MMIC Testing, W. Pribble

Error Correction and Power Calibration of Active Load Pull Measurements Systems, D. Teeter

Using a Package FET to Transform Between Measurement Media, R. Lane

Measuring Resistive Sheets in Free Sheets, H. Steinhelfer

Matched Filter Detection Adds Versatility to a Spectrum Analyzer, S. Mukherjee

A conference digest is available, contact: Henry Burger, ARFTG, 1008 East Baseline Road, No. 955, Tempe, AZ 85283-1314. Cost is \$20.00 for an ARFTG Member and \$35.00 for a non-member. An additional \$9.00 is requested for airmail outside the USA.

What Happened at the 38th ARFTG Conference?

As you receive this newsletter, ARFTG will have held its 38th Conference in San Diego, CA, on December 5 and 6, 1991. The topic was *On Wafer Measurement III*, a follow-on to our previous conferences on the same subject. Recent advancements in On-Wafer Testing Techniques was presented including: invasive and non-invasive probing methods, calibration techniques for S-Parameter, noise and power measurements, methods for decreasing measuring time and a status update on traceability. Contact the Conference Chair, Allen Rosenzweig, Microwave Technology, 4268 Solar Way, Fremont, CA 94538, (415) 651-6700, for more information. Post-conference digest will also be available from Henry Burger, as described for the 37th Conference.

Join ARFTG

We will be looking forward to discussing the latest in measurement automation and accuracy with you in Albuquerque. ARFTG brings you the latest in RF, Microwave and Millimeter wave analysis, design and measurement. State-of-the-art papers are presented twice a year. If you are involved in automated techniques, come and join your peers and keep current with our ever-evolving technology. For more information on ARFTG or future conferences, write: John Barr, Network Measurements Division, Hewlett-Packard, 1400 Fountaingrove Parkway, Santa Rosa, CA 95403.

1992 MTT-S Awards



by Reinhard Knerr
Chairman, Awards Committee

It is my pleasure to thank Dr. Fred J. Rosenbaum, the outgoing Chairman of the Awards Committee, for his outstanding efforts over the past 3 years. He, as well as I, recognize the importance of this assignment. We both feel that no nonmonetary, professional recognition is more important than recognition from our peers! This is what our awards program is all about and I am committed to handle it in a fair and professional way. I am fortunate to be able to work with an outstanding team which shares my views:

Awards Committee

Chairman: Reinhard H. Knerr
Vice-Chairman: Louis N. Medgyesi-Mitschang
Fellow Nominations: Harold Sobol
Microwave Prize: George L. Heiter

On behalf of this team, I would like to make a plea:

There are many deserving candidates for our MTT-S Awards! (For a detailed description see the companion article by Louis Medgyesi-Mitschang.) BUT, for them to be recognized, somebody has to nominate them! NO NOMINATION—NO AWARD! It's that simple.

There is some paper work involved but it's minimal. Louis Medgyesi-Mitschang has Awards Kits available which contain all the nomination forms. He will be glad to send you one upon your request.

All nominations will be evaluated by a committee of our peers and all applications will be kept on file and automatically reconsidered each year, unless they are withdrawn.

Let me emphasize again: These are OUR awards. WE give them to OUR peers. We, the Awards Team, are here to administer our awards, in the fairest way possible.

At the October 1991 AdCom Meeting, the following awards, which will be presented at the 1992 IMS, were approved:

Microwave Career Award: Theodore S. Saad

"For a Career of Meritorious Achievement and Outstanding Contributions to the Field of Microwave Theory and Techniques."

Microwave Pioneer Award: Robert M. Barrett

"For Pioneering the Development of the Strip Transmission Line."

Microwave Applications Award: Dr. Bernard Hershenov

"For the Introduction of the Microstrip Ferrite Circulator."

Microwave Prize: R. Majidi-Ahy, C. K. Nishimoto, M. Riazat, M. Glenn, S. Silverman, S. Weng, Y. Pao, G. A. Zdasiuk, S. G. Bandy and Z. C. H. Tan

"5-100 GHz InP Coplanar Waveguide MMIC Distributed Amplifier," *IEEE Transactions on Microwave Theory and Techniques*, Vol. MTT-38, pp 1986-1993, December, 1990.

Distinguished Service Award: Richard A. Sparks

"For His Outstanding and Dedicated Service to the Society."

N. Walter Cox Award: Dr. Barry E. Spielman

"For Exemplary Service Given in a Spirit of Selfless Dedication and Cooperation."

The following members were evaluated by the Microwave Theory and Techniques Society and elected to the grade of IEEE Fellow: Krishna K. Agarwal, Norman R. Dietrich, Carl H. Durney, S. Jerry Fiedziuszko, Hans L. Hartnagel, Joseph Helszajn, Terence H. Oxley, Marian W. Pospieszalski, Ayre Rosen, Steven E. Schwarz, Craig P. Snapp, Hua Quen Tserng, Kikuo Wakino, Jerald A. Weiss.

Progress and Change in Microwave Radio Communications

MTT-S Distinguished Lecture
by Ferdo Ivanek

Radio Communications continue to represent the major microwave market segment, but the application variety has greatly increased since the 1982 MTT-S National Lecture "Microwave Communications Technology." That lecture covered only terrestrial point-to-point microwave radio applications which predominated at the time and were undergoing a major transition from analog to digital transmission.

The subsequent large-scale introduction of lightwave transmission and the growing diversification of communications services caused major changes in radio applications, which stimulated interest in revisiting the subject of microwave communications a decade later. These changes require substantial broadening of the subject to include the following applications and the corresponding microwave technologies:

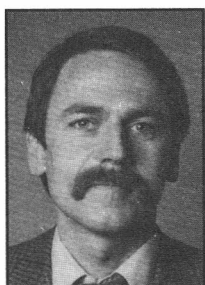
- terrestrial point-to-point and point-to-multipoint radio
- cellular radio
- "personal" radio
- wireless PBX
- VSAT
- satellite-based mobile radio

To make the lecture more informative I have solicited and started receiving up-to-date inputs and original projection material from a number of major telecommunication companies around the world. I am hereby soliciting additional relevant inputs from others in a position to contribute to the content of this lecture.

The multidisciplinary nature of the subject suggests a flexible presentation framework in order to best serve the different needs and interests of the MTT-S Chapters worldwide, which include Joint Chapters with related IEEE Societies. This should allow both to concentrate on the topic(s) of particular interest to the host Chapter, and to select the most suitable presentation form which may range from a one-hour lecture to a half-day seminar. Another possibility would be to incorporate the lecture into a topical workshop sponsored by the IEEE Section or by the MTT-S or Joint Chapter.

Every effort will be made to accommodate the preferences of the host Chapters. Early notification of interest will facilitate planning and scheduling. Please write to P.O. Box 60862, Palo Alto, CA 94306, or fax to 415-328-8751.

Region 8 MTT-S Chapter News



by Rolf H. Jansen
Transnational Committee, MTT Society
Region 8 Chapter Coordinator

Region 8 Chapter Activities and Workshops in Late 1990 and 1991

This contribution continues a regular information service for our membership that was started with the Fall 1990 *MTT-S Newsletter*. It summarizes recent technical activities conducted by our Region 8 chapters and indicates some planned for the near future. We can look back with satisfaction onto a level of activities within our MTT membership that is not only high by the number of meetings and workshops held but also with respect to technical standards, and this still seems to be growing. Among the chapters reporting here, there are well-established ones and young ones like Hungary and Poland. In addition, we provide brief information here on countries where activities have been started with the goal of forming a chapter, which is the case in Greece, Czechoslovakia and Bulgaria.

Benelux

Chairman: Prof. A. Van De Capelle, K.U.L., Leuven

During 1990/91 two meetings have been organised related to the MTT Society:

April 25, 1991

Lecture by Prof. V. Rizzoli at K. U. Leuven, Belgium, on "Simulation and design of nonlinear microwave circuits."

October 30, 1991

Study-day organized by Dr. M. Guglielmi at ESTEC, Noordwijk, the Netherlands, on "Microwave active and passive circuits" with two tutorial lectures, one by Prof. C. Dalle on "The physics of HBT-transistors" and one by Prof. R. Sorrentino on "Computer-aided design of microstrip circuits using the planar circuit approach."

Bulgaria

Prof. H. D. Hristov/Dr. S. V. Savov, ARCL, Varna

The key event this year for the microwave community in Bulgaria was the Symposium "Electronics '91" (23-27 September), organized by the Institute of Electronics at the Bulgarian Academy of Sciences. The Symposium included two traditional International Schools, namely VEIT '91 (Vacuum Physics, Techniques and Applications) and MwS '91 (Microwave Devices and Systems) held simultaneously in parallel sessions.

In the MwS '91 International School invited speakers both from Bulgaria and abroad reviewed and highlighted the following topics:

Microwave Devices and Measurements

- Automatic Mirror Distance Control of Mechanically Tunable Fabry-Perot Resonator for mm-waves—Prof. H. Groll, Techn. University of Munich, Germany.
- New Solid State Devices and Circuits for mm-wave Applications—Prof. E. Kollberg, Chalmers University of Technology, Sweden.

- HEMTS Modelling—Dr. I. Angelov, Inst. of Electronics, Bulg. Acad. of Sciences, Sofia, Bulgaria.
- Trends in Measurement Devices in the mm-wave Range—Prof. H. Groll, Techn. University of Munich, Germany.
- The Application of Optical Processes in MW Radios—Prof. T. Berceli, Research Inst. of Telecommunications, TKI, Hungary.
- Trends in Ferrite Devices in the mm-wave Range—Dr. St. Alexandrov, Sofia University, Bulgaria.
- Garnet Heterostructures for Optical-Magnetostatic Wave Devices—Prof. D. Stancil, Carnegie Mellon University, Pittsburgh, USA.
- From Passive to Active Cavity Antennas—Prof. H. D. Hristov, Techn. University of Varna, Bulgaria.
- Performance and Applications of UHF Surface Transverse Wave Based Resonant Devices—Dr. I. D. Avramov, Inst. of Solid State Physics, Bulg. Acad. of Sciences, Sofia, Bulgaria.

Ferrite and High-Tc Superconducting Materials and Devices

- Nonlinear Magnetisation Waves in Ferromagnetic Films—Prof. B. Kalinikos, Electr. Engineering Institute, St. Petersburg, USSR.
- Problems and Trends in MW Applications of High-Tc Superconducting Thin Films—Prof. O. Vendik, Electr. Engineering Inst., St. Petersburg, USSR.
- Artificial Grain Boundary Weak Links and DC SQUIDS—Dr. Z. Ivanov, Inst. of Electronics, Bulg. Acad. Sciences, Sofia, Bulgaria.
- Ferrite Structures and Materials—Dr. X. Oudet, Lab. of Magnetism and Magnetic Materials, Meudon Cedex, France.
- New Ceramic Materials—Dr. I. Nedkov, Dr. V. Kojuharov, Inst. of Electronics, Bulg. Acad. Sciences, Sofia, Bulgaria.

Active and Passive Remote Sensing of Earth and Sea

- Design of MM Radiometer Systems—Dr. N. Skou, Technical University of Denmark, Lyngby, Denmark.
- Spectral Characteristics of Mixed Classes of Natural Objects—Prof. D. Mishev, Solar Terrestrial Lab., Bulg. Acad. Sciences, Sofia, Bulgaria.
- Detection of Oil Pollution at Sea by MW Radiometers and Side Looking Radars—Dr. N. Skou, Techn. University of Denmark, Lyngby, Denmark.
- Investigations and Results in Optical Radiometry—Prof. E. Ferdinandov, Inst. of Electronics, Bulg. Acad. Sciences, Sofia, Bulgaria.

Apart from the invited lectures, 18 poster contributions were solicited in the areas relevant to the above topics.

Working language of the Symposium was English.

All invited lectures and poster papers will be published by World Scientific Publishing Co., Singapore.

Central and South Italy

Chairman: Prof. P. Lampariello, "La Sapienza" University of Rome

Four meetings were organized, since July 1990, by the Central and South Italy MTT-AP Chapter, namely:

March 14, 1991—Roma

Prof. Vittorio Rizzoli (MTT Distinguished Lecturer), University of Bologna, Italy: "Simulation and design of nonlinear microwave circuits."

May 2, 1991—Perugia

Prof. Wolfgang Menzel, University of Ulm, Germany: "Integrated millimeter-wave circuits."

May 2, 1991—Perugia

Prof. Albert Papiernik, University of Nice-Sophia Antipolis, France: "Wideband printed antennas with high polarization purity."

July 5, 1991—Roma

Prof. John W. Bandler, McMaster University: "Nonlinear microwave CAD innovations."

The attendance was, on average, 50 people each meeting. Each meeting was also the occasion of an informal meeting among Chapter members. The attendance of university students was high.

As a present activity, the Chapter is also co-organizing the 3rd International Workshop on Millimeter Waves, which will be held in Orvieto (Italy), on 22-24 April 1992.

First steps have also been taken in organizing the "Microwaves in Medicine '93," which follows the one held in Belograd last spring. This international workshop will be held in Rome in 1993.

Czechoslovakia

Petitioner: Dr. Franticek Hrnicko, TESLA Company, UVR Opocinek

There have been some efforts to pave the ground for the formation of an MTT chapter in Czechoslovakia. Before a petition can be organized, a sufficient number of MTT members in this country has to be established first. The petitioner has worked on this in cooperation with the Region 8 MTT chapter coordinator and is finding interest in the Czechoslovakian microwave community. The authorities at TESLA company have been convinced to finance enrollment of 4 TESLA staff members into IEEE membership. There are the usual currency conversion and payment problems regarding IEEE dues along with the membership applications. However, these have been resolved so far and IEEE membership services has given a helping hand in achieving this. There is a good chance to have a sufficient number of MTT members in Czechoslovakia in the near future, so that it is hoped that chapter formation can be initiated.

Egypt

Chairman: Prof. Osman L. El-Sayed, Cairo University, Nasr City, Cairo

In the second half of 1990 the Egyptian Chapter conducted one meeting on November 11 with a contribution of Prof. S. F. Mahmoud of Cairo University entitled "A Coaxial Optical fiber for Telecommunication Systems."

In 1991 the following three meetings were organized:

- February 6, 1991—A presentation by Dr. Ibrahim A. Salem, Former Director of the Military Technical College, entitled "Microwave Military Applications."
- May 5-6, 1991—A 2-day seminar by Prof. Nader Engheta from the Moore School of Electrical Engineering, University of Pennsylvania, on "Electrodynamics of Chiral Materials and their Applications in mm Wave and Optical Integrated Circuits."
- October 21—A presentation by Professor Osman L. El-Sayed from Cairo University entitled "Application of Optical Fibers in Modern Communications."

Finland

Chairman: Prof. A. V. Raisanen, Helsinki University of Technology, Espoo

The Chapter activities consisted of organizing six technical meetings with invited presentations by experts in the fields of antennas, propagation, or microwave engineering. These are summarized below. For each meeting, advertizing to students and research people in the industry was directed. Coffee and donuts were served; for the meetings, no fee was asked. The normal attendance number has been around 30-40, with about half of the number being IEEE members.

- August 23: Professor David C. Chang, President of the IEEE AP Society, University of Colorado, Boulder, CO; Computer-aided design of microstrip antennas and arrays.

- October 8: Professor Vittorio Rizzoli, University of Bologna, Italy; Simulation and design of nonlinear microwave circuits.
- January 23: Mr. Morris Engelson, Tektronix, USA; Oscillator phase noise measurements using a spectrum analyzer.
- May 28: Professor Om P. Gandhi, University of Utah, Salt Lake City, UT; Advances in dosimetry of RF radiation. Numerical methods and measurement techniques.
- June 10: Professor Dwight Jaggard, University of Pennsylvania, Philadelphia, PA; Fractal electromagnetics and its applications.
- June 17: Dr. Richard J. Wylde, Queen Mary and Westfield College and Thomas Keating Ltd., UK; Three examples of physics and manufacturing in quasi-optics for plasma diagnostics, remote sensing, and astronomy.

In addition, the Chapter was partly involved in organizing the annual URSI/IEEE National Meeting (URSI—the International Union of Radio Science). In 1990, the conference was held in Kuopio, eastern Finland, on November 5-6, and the topics of the sessions were (a) optoelectronics and photonics, (b) remote sensing and image processing, (c) spread spectrum techniques, (d) biological effects of electromagnetic fields, (e) discrete signal processing, and (f) measurement techniques and electromagnetic interference. There were two invited talks: Professor Martti Hallikainen (Helsinki University of Technology), *Remote sensing of forest*, and Dr. Kjell Hansson Mild (National Institute of Occupational Health, Umeå, Sweden), *Electromagnetic fields from video display terminals*. The attendance to the meeting was 104.

Germany

Chairman: Prof. H. L. Hartnagel, Technische Hochschule Darmstadt, Darmstadt

The technical activities of the German MTT/AP chapter in the period since mid 1990 focused on 4 workshops.

In October 1990, the "International Workshop on Integrated Nonlinear Microwave and Millimeter-Wave Circuits" at Duisburg University attracted about 150 attendees, with strong international participation. This points out the importance of reliable modeling approaches and design tools for the nonlinear parts of today's high-frequency systems. The titles of the workshop papers may give an idea of the various aspects covered:

- "Physical MESFET models and nonlinear microwave CAD"
- "CAD of nonlinear microwave circuits"
- "Statistical design/yield optimization of nonlinear microwave circuits"
- "On applications of Hopf bifurcation to oscillator analysis"
- "Considerations on the analysis of mixers with arbitrary topology including signal and noise properties"
- "Modeling MESFETs and diodes for intermodulation calculations"
- "Nonlinear analysis of quantum devices"
- "Large signal analysis of nonlinear microwave circuits using modified Volterra series"
- "Simulation and design of nonlinear microwave circuits"
- "Integrated microwave oscillators in design and simulation"
- "Numerical analysis of microwave oscillators"
- "Designing active FET mixers"

At the end of February 1991 then, a two day workshop, "HBT Technology and Applications," was held at the Technical University of Darmstadt. Even though it was announced only two months before the response was great, with more than 40 attendees, not only from Germany but also from the US, the Soviet Union and Western European countries. The workshop took place in an informal atmosphere and thus

stimulated many interesting discussions among the participants.

The 21 contributions treated advantages and specific problems of the different HBT material systems (GaInP/GaAs, AlGaAs/GaAs, InP/InGaAs) as well as questions of modeling. Also, power transistors, HBT applications in connection with optical transmission, and those in space were discussed.

Following the 1991 EuMiC/MIOP, a workshop on field-theoretical methods and CAD ("CAD Oriented Numerical Methods for the Analysis of Microwave and MM-Wave Transmission-Line Discontinuities and Junctions") was held at Stuttgart (50 participants).

The technical program featured both tutorial presentations on the different methods and those focusing on state-of-the-art results. The following 3D techniques were treated:

- Mode matching techniques
- Spectral domain approach
- Finite-Difference in time and frequency domain
- Finite-Element (frequency domain)
- Transmission-Line method (TLM)
- Moment and integral equation methods including radiation effects

There was a strong international participation regarding both audience and speakers (e.g., from the US and Canada: N. G. Alexopoulos, Z. J. Cendes, T. Itoh, P. B. Katehi, M. Ney; from Italy: R. Sorrentino; from Switzerland: J. Mosig; and from France: P. Saguet).

On Oct. 10/11, 1991, a two-day workshop on "Microwave Measurement Techniques" was held at Ratingen, sponsored by the Hewlett-Packard Company, Ratingen. This was under an agreement with HP as in recent years. The total number of participants was 44 with about 25% coming from various European countries. The workshop included a total of 16 technical contributions covering a wide range of different microwave measurement techniques like for example on-wafer noise measurement, modern NWA calibration techniques, group delay evaluation, automatic large signal measurements, etc. The main purpose of the workshop was to give an overview and to report on recent advances in microwave measurement methodology. As usual there was a good portion of time available for discussion which took place in a relaxed and informal atmosphere.

In October/November 1991, two more workshop meetings were conducted by the German chapter, one on "Discrete Time-Domain Modeling" held at the University of Munich and a second one on "Heterostructure Technology" conducted near Ulm. Thus, the year 1990/91 has been quite successful regarding our German workshop activities. It is planned to spend continuous efforts on that area which seems to be of vital interest to our members.

Greece

Petitioner: Prof. G. Kiriakidis, Foundation for Research and Technology-Hellas (F.O.R.TH), Heraklion, Crete

A petition was organized with the goal to form a joint ED and MTT IEEE Greek chapter. A total number of 16 signatures for the chapter formation has been brought together and on August 10, 1991, the formal petition has been sent for approval to the IEEE Greek Section Chairman, Professor Papadias. The petition is now on the way through the Region 8 Directory to IEEE Headquarters and the affected ED and MTT Societies.

Hungary

Chairman: Prof. István Frigyes, Budapest

A joint Chapter of Societies MTT, COM, AP and ED has been formed within the Hungary Section of IEEE. The meeting declaring the founding of this Chapter was held on Sep-

tember 12, 1990, as a satellite meeting of the 20th European Microwave Conference, organized this time in Budapest, Hungary. There are about 20 members of this Chapter, which is quite reasonable, taking the rather small number of IEEE members in this country into account.

Besides the Chapter members, Prof. Tatsuo Itoh, president of IEEE MTT/S; Prof. Kurt Richter, director elect of IEEE Region 8; Dr. Steve Adam, IEEE Fellow, member of MTT/S AdCom; and Prof. André Vander Vorst, Chapter-activities officer of Region 8, were present. In their short talks addressed to the members they pointed out the significance of IEEE in East-European countries, among others in helping their efforts to join to the international scientific community, and the significance of chapter activities.

Prof. István Frigyes, chairman of the new Chapter, has briefly summarized the work which preceded the founding of the Chapter. He also pointed out the reasons which have led to this rather extravagant joining of various IEEE Societies within one Chapter. *Microwaves* are the common background of the activity: there is a rather significant microwave community in Hungary, active either in the field of microwave communications or in that of microwave devices; of course, the adherence of experts working in other than microwave communications or other than microwave devices is also encouraged. Some points were also given, foreseen in future work.

The main events organized by the chapter in 1990/91 are listed below:

- 7 Sept. 1990—A full-day Seminar on Optical-Microwave Interactions. The chairmen were Dr. Steve Adam, Adam Microwave Consulting Inc., Los Altos, CA, USA; and Prof. P. R. Herczfeld, Drexel University, Philadelphia, PA, USA. In the morning about 15 presentations were given by researchers of 6 countries (Hungary, the USA, Germany, West Germany at that time, Japan and Iran); in the afternoon laboratory demonstrations have shown the activity of the Department for Microwave Telecommunications of the Budapest Technical University and the Research Institute for Telecommunications in this field. A rather vivid discussion followed the demonstrations where a fellow, several senior members and members of the IEEE took part.
- 19 Nov. 1990—In a Technical Meeting Dr. Ferdo Ivanek, President, MTT, gave a lecture on Topics in Microwave Communications, followed by a vivid discussion. Particular points of digital microwave radio in the era of optical technology and also in the era of the Synchronous Hierarchy were dealt with.
- 10 April, 1991—With the cooperation of the Chapter, European, African and Middle-East Committee of ComSoc had a meeting on the problems of intensifying the activity of IEEE in general and of Communications Society in particular in Eastern-Central European countries. Delegates from Hungary, Czechoslovakia, Poland and Romania did attend.
- On the same afternoon the activity of the Department of Microwave Communications of Budapest Technical University has been presented. Short talks and laboratory demonstrations have been held on several topics, such as microwave circuit and antenna techniques, microwave communication systems, microwave remote sensing, optical-microwave interactions, etc. Besides Hungarian participants, most of the delegates of the morning EAMEC meeting did attend.
- 11 April, 1991—In a Technical Meeting a talk was given by Dr. Federico Tosco (CSELT, Italy) on various aspects of optical communications with the main emphasis on the application of fiber optics in the *distribution network*.
- 16 September, 1991—MTT Distinguished Lecturer Prof.

Vittorio Rizzoli (University of Bologna, Italy) gave a lecture on the modeling and design of nonlinear microwave circuits. This was one of the 1991 Distinguished Lectures, a first as such given in Hungary. It was of great interest for the microwave community.

Poland

Chairman: Dr. Z. H. Czyz, Przemyslowy Instytut Telekomunikacji, Warsaw

The effective date of the AP/AES/MTT Joint Chapter formation in the Poland Section is August 15, 1990. At the end of the year four technical meetings were organized during which the following papers were presented by scientific workers of the Telecommunications Research Institute/P.I.T./:

- Dr. W. Klembowski, "Survey of desirable features for multifunction radar antennas."
- Prof. S. Pogorzelski, "New methods of designing linear passive antenna arrays."
- Dr. Z. H. Czyz, "Theoretical foundations of radar polarimetry."
- Mr. A. Tyrowicz, "Meeting of performance/cost ratio demands in electronically steered array-fed reflector antennas."
- Dr. E. Sedek, "Microwave ferrite devices for multifunction radars."
- Mr. A. Wronka, "Advances in mechanical constructions of microwave components."
- Mr. M. Kostrzewa, "New facilities and modernization of the antenna elevated open range."
- Mr. W. Rodziejczak, "Superwideband horn antenna."

During the first half of the year 1991 the following papers were presented at five technical meetings:

April 1991

- Prof. A. Jelenski, Institute of Electron Technology, Warsaw, Poland, "Schottky's diodes for millimeter and submillimeter waves."

May 1991

- Dr. B. Stec, Military Academy of Technology, Warsaw, Poland, "Microwave Thermography in biology and medicine."
- Prof. J. Costa Freire, Instituto Superior Technico, Lisboa, Portugal, "Microwave Active Circuits Design."
- Dr. S. L. Johnston, International Radar Directory, Huntsville, Alabama, USA, "The modern doppler meteorological radar."

June 1991

- Prof. N. N. Voitovich, IAPMM, Lvov, USSR, "An antenna synthesis method for desired magnitude pattern."

The key event in the Chapter was the International Microwave Conference MIKON '91 co-sponsored by P.I.T., Polish Academy of Sciences, and this Chapter, organized in Rydzynacastle, May 20-24, with 132 participants. Over 100 papers were presented: 25 during plenary sessions, among them 15 invited papers, and over 80 as posters. The topics of plenary sessions were:

- Advances in microwave electronics
- Microwave monolithic integrated circuits
- Antennas & Propagation
- Radar Polarimetry
- Active devices & circuits
- Field Theory
- Physics & Microwaves
- Biomedical applications of microwaves

Among others, invited papers were presented by the IEEE Societies representatives:

- Prof. T. Itoh, "New trends and ideas in the field of microwave technology."

- Prof. Y. Rahmat-Samii, "Large antenna measurement and compensation techniques."
- Prof. W. M. Boerner, "Basic equations of radar polarimetry."
- Prof. G. Galati, "Signal processing in modern radar systems."
- Prof. H. L. Hartnagel, "New semiconductor technologies for microwave electronics."
- Prof. A. Vander Vorst, "The interaction of EM fields with the nervous system, using microwave acupuncture as a stimulus."

South Africa

Prof. Carl W. I. Pistorius, University of Pretoria, Pretoria

The South African AP/MTT chapter has about 70 members, which is approximately a tenth of the total number of IEEE members in South Africa. Chapter activities comprise chapter meetings on a variety of technical and non-technical topics, as well as the annual national symposium, which is jointly organised by the IEEE and the SAIEE. In addition to the annual symposium, two technical and one non-technical meetings were held in the period stated above, the details of which are given below:

October 1990

- Dr. J. C. Olivier, Aerotek, CSIR, "The finite difference time-domain analysis of multiport waveguide junctions and discontinuities."
- Dr. D. J. Janse van Rensburg, LGI, "Improvements in the numerical analysis of conducting thin-wire radiators."

November, 1990

- Prof. E. Barnard, Dept. Electronic Engineering, University of Pretoria, "Neural Networks: An Introduction"
- Mr. J. Joubert, Dept. Electronic Engineering, University of Pretoria, "The analysis of radiating slots in the broad wall of a rectangular waveguide inhomogeneously loaded with a dielectric slab."

July, 1991

In view of the changing political climate in South Africa, a colloquium on the future of the South African electronics industry and electronics engineer was arranged. The speakers were:

- Mr. Sybrand Grobbelaar, Managing Director of Grinaker Electronics Ltd., one of the country's largest electronics companies.
- Ms. Madeleine Rose, Editor of *Electronics News*, a leading newspaper on the South African electronics industry.
- Prof. Calie Pistorius, Head Dept. Electronics Engineering, Univ. Pretoria.

The general consensus was that the growth of the future South African economy would heavily depend on continued development of technology and industry, but concern was expressed that a future government might not recognize this need.

August, 1991

Approximately 45 papers and posters were presented at the annual SAIEE/IEEE AP/MTT symposium, which was attended by more or less 150 people. The invited speakers were Dr. D. E. Baker, director of the antenna division, Electromagnetics Laboratory, and Prof. P. W. van der Walt, Dept. of Electronics Engineering, University of Stellenbosch, who talked on the South African *status quo* of antenna development and microwave components, respectively.

Spain

Chairman: Prof. Manuel P. Sierra, Ciudad Universitaria, Madrid

In late 1990 and up to the end of September 1991 the

Spanish chapter organized quite a range of short courses, symposia and technical meetings. The various events are summarized here as follows:

- September 17 to 20, 1990—Short course on computing and measuring techniques of radar cross-section, 60 attendees. The range of speakers contributing to this short course included well-known researchers from US universities and the US industry as well as scientists from Spanish universities and research institutes.
- September 26 to 28, 1990—5th National URSI Symposium with a number of 200 attendees. Prof. A. D. Olver of Queen Mary and Westfield College of London presented an invited lecture entitled: Millimeterwave systems, a review. The AP/MTT-chapter contribution to the symposium was to invite and support this lecture.
- October 29, 1990 and October 30, 1990—Prof. A. VanderVorst of the Université Catholique de Louvain, Belgium, presented lectures on microwave biomedical applications and on millimeterwave atmospheric propagation. During the two technical meetings held, the number of attendees was about 30 for each meeting.
- November 29, 1990—Prof. V. Rizzoli of the University of Bologna, Italy, was invited as one of the Distinguished Lecturers of the MTT Society. He gave a presentation of the simulation and design of nonlinear microwave circuits.
- December 17, 1990—A technical meeting with a presentation by Prof. Jiri Polivka of the PTT Research Institute of Prague, Czechoslovakia, was held. The topic was Microwave active Radiometers: Applications.
- March 15, 1991—The Spanish chapter had Prof. Tapan K. Sarkar of Syracuse University as a guest and speaker. The title of Prof. Sarkar's talk was "Accurate computation of wide-band response using narrow-band information. Application of the matrix pencil approach to linear time-invariant electromagnetic systems."
- April 10, 1991—Prof. Ingo Wolff of Duisburg University, Germany, gave a presentation entitled "Three-dimensional field analysis techniques for applications in planar microwave circuits." This technical meeting had 35 attendees.
- September 25 to 27, 1991—The 6th National URSI Symposium was held in Spain and included again an invited lecture organized by the Spanish chapter. The invited speaker was P. H. Pathak with a contribution on "Asymptotic high frequency techniques for EM antenna and scattering analysis." This specific contribution attracted an audience of 60. As a general remark, the National URSI Symposium allows to meet around 500 people during the 3 day technical presentations meeting. The number of technical papers is around 300 in the areas of electromagnetics, antennas, microwave circuits and communication systems.

Sweden

Chairman: Dr. T. Lewin, Ericsson Radar Electronics, Molndal

During the time between August 1990 and May 1991 the Swedish chapter conducted a number of meetings and in addition a Mini-Symposium on commercial microwave applications. The meetings along with the engaged speakers and the titles of the contributions presented are listed here as follows:

- August 22, 1990—Prof. David C. Chang, Univ. of Colorado, Boulder, USA: "Computer-aided design of microstrip antennas and arrays." Prof. S. R. Rengarajan, California State Univ. Northridge, USA.
- September 27, 1990—Prof. R. J. Frew, N. Carolina State University, Raleigh, USA: "MESFET models for nonlinear microwave CAD."

- October 10, 1990—Prof. V. Rizzoli, Univ. of Bologna, Bologna, Italy: "Simulation and design of nonlinear microwave circuits."
- April 11, 1991—Raymond Pengally, Compact Software Inc., New Jersey, USA: "The design of MMIC circuits through CAD simulation."
- April 12, 1991—Prof. Michael J. Howes, Univ. of Leeds, Leeds, England: "Microwave research projects at Leeds University."
- May 2, 1991—Prof. F. T. Ulaby, University of Michigan, Ann Arbor, USA: "Radar Polarimetry: Measurement techniques and calibration approaches."

In addition to these contributions, the mentioned Mini-Symposium on commercial microwave applications was held on April 25, 1991. There were a variety of contributions from Swedish companies and from Chalmers University of Technology in Gothenburg. The topics treated included microwave links, microwave related measurement techniques, cable TV and weather radar as well as radiometry and short distance communication. Scientists of Chalmers University reported on their research as far as related to microwaves. Finally, the Mini-Symposium included a panel discussion.

United Kingdom/Ireland

Chairman: T. H. Oxley, "TREMONT," Newark

Some reorganisation of the MTT/ED Chapter in November 1990 was followed by the inclusion of AP-S. The MTT/ED/AP Joint Chapter became effective on 28th March 1991.

An MTT/ED/AP Chapter Administrative Committee (AdCom) has been formed, which has established Chapter administration (member listing, mailing facilities, etc.), self accountability, chapter bylaws, etc.

The Chapter Dec. '90 to Dec. '91 Technical Programme has included eight events. These are briefly described below:

- 19th December '90—An evening "invited talk" on "Radar Signature Control Through Measurement and Prediction" was held at King's College London. Presented by Mr. Brian Jackson, Chief Scientist, Wells Sensors Division, Thorn EMI, the talk described radar modeling techniques to provide realistic signature data by building spatial or temporal images of actual or potential targets.
- 27th March '91—A One-Day Colloquium on "Millimetre-wave Transistors and Circuits," co-sponsored by the IEE PG E12 and the Chapter, was held at Leeds University. This presented twelve papers, ten from the UK and two from Germany, covering semiconductor material and device aspects of MESFETs and HEMTs at millimetre-waves, and their circuit applications.

The Colloquium was followed by an evening "invited talk" on "Microwave Subsystems for E.W. Applications," presented by Professor J. David Rhodes, Chairman and Chief Executive of Filtronic Components and Industrial Professor, University of Leeds. The talk discussed many subsystems, including detector log video amplifiers, digital frequency discriminators, switched multiplexers, high speed synthesizers and self-adaptive channelisers.

- 27 June '91—An evening "invited talk" on "Technology Development in Digital and Microwave Systems," organised by the Chapter in cooperation with the IEE PG E12, was held at King's College London. Presented by Dr. John R. Forrest, Executive Chairman of National Transcommunication Ltd., the talk discussed the impact of satellite broadcasting direct to the home, together with the technical advances of this programme delivery method and plans for new services.
- 23-27 September '91—A Five-Day Summer School organised by The University of Leeds in cooperation with the Chapter was held at Leeds University. An annual

event since 1984, the course on "Microwave Subsystem Design" provided a view of microwave engineering based on solid-state devices with emphasis directed towards microwave integrated circuits in both hybrid and monolithic form. Consideration was given to two- and three-terminal devices, relevant aspects of circuit theory, issues of characterization and evaluation, and application to the design and realization of essential subsystems. Lecturers were drawn from both University and Industry, UK and USA. Participants from the UK, Netherlands, Sweden, Switzerland, Italy and the USA attended.

- 25th September '91—An evening "invited talk" on "Microwave and Millimetre-Wave for Vehicle Control," organised by the Chapter in association with the Leeds University Summer School, was presented by Dr. Andrew Stove of Philips Research Laboratories. A good attendance enjoyed a discussion on aspects in which microwaves can help with the control of road vehicles in the areas of radar collision avoidance, radar speedometry and microwave road pricing.
- 2nd October '91—A One-Day Technical Meeting comprising European papers presented at the 1991 IEEE MTT-S International Microwave Symposium Boston, organised by the Chapter in cooperation with the IEE PG E12 and supported by the MTT-S USA, was held at King's College London. Approximately twenty papers, grouped broadly in four sessions on Measurement Techniques, CAD & Modeling, Microwave Circuits & Systems and Optical Communications, provided an opportunity for UKRI engineers who were unable to attend the Symposium in Boston to hear some of the papers and participate in discussion. Participants enjoyed a well presented programme including speakers from UK, Germany, France and Denmark.
- 18th December '91—The final meeting of the 1991 Chapter technical programme, an evening "invited talk" on "Radiolocation: The Slide Rule Days" will be held at King's College London. This will be presented by Professor Alex L. Cullen, OBE, of University College London, who will be talking about the development of microwave radar during the second world war from a personal recollection basis.

The Chapter is currently planning its 1992 Technical Programme; this will be publicized in Region 8 News. The programme will include "invited talks," One-Day Technical Meetings and/or Workshops. It is anticipated that a similar event to the 1991 One-Day meeting on the MTT-S Int. Mic. Symp. will be held.

An MTT/ED/AP Chapter membership promotion booth was organized for the MM92 Conference 14-15 October '92 at Brighton.

France

Dr. Victor Fouad Hanna, France

Three meetings were conducted by the French Chapter in the period from September 1, 1990, to August 31, 1991, namely:

- September 1991 with a contribution by Mr. John Magarschack, Thomson Composants Microondes, entitled "MMIC Activities in Europe."
- The MTT-S France Chapter organized a workshop on "Microwave Measurements" that was held on November 22 and 23, 1990, at Carcassonnes, which is a small city that lies in the south of France. An important number of participants of 80 was registered. There were 22 participants from government agencies, 29 participants from universities, and 29 participants from private industries. Thirty-four papers were selected by a technical committee. The topics treated in the workshop were: network analysers (analysis and techniques), characterisation of passive com-

ponents, noise measurements, linear and non-linear characterisation, MMIC measurement techniques and industrial applications.

- April 12, 1991, a half-day technical meeting was organised by the Chapter. It included the MTT-S Distinguished Lecture: Simulation and Design of Non-linear Circuits given by Prof. Vittorio Rizzoli (Bologna Univ.), a lecture on "Electric Models for FETs for CAD of Non-linear Circuits" given by Prof. R. Queré (Limoges Univ.) and a round table. The number of participants was 49.

The Benefits of MTT-S Membership

by Dan Swanson
Membership Development Chairman

By the time this message appears many of you will have renewed your MTT-S membership, some may be undecided and a few may have chosen not to renew. I would like to address the latter two groups with a reminder of the benefits of MTT-S membership.

The chief business of the MTT-S is to disseminate technical information through publications, symposia, workshops and chapter meetings. We have added a new publication, the *Microwave Guided Wave Letters Journal*, to the services provided to members. The addition of the *Microwave Guided Wave Letters Journal* makes timely publication of recent research results more available to our members. The dues increase seen this year was largely to cover the cost of this new journal. But even with the dues increase, the cost to the MTT-S to produce the *Transactions*, the *Letters Journal* and the *Newsletter* is nearly double the individual dues rate.

Our International Microwave Symposium held in Boston this past June set records in nearly every category. The quality of papers remains high due to the efforts of MTT-S members on the Technical Program Committee. The workshops held in conjunction with the symposium are another forum to explore rapidly developing technologies. These workshops are often organized by one of the 18 MTT-S Technical Committees. Of course, MTT-S members receive a substantial registration discount at the symposium and workshops.

At the local level the MTT-S helps chapters develop their technical program with the Speakers Bureau and the Distinguished Lecturer Program. New chapters are now forming in Eastern Europe and Asia. Although non-members are certainly welcome at chapter meetings, you should show your support for this vital activity by renewing your membership. For many engineers, MTT-S activities offer the best opportunity to meet and interact with engineers of competing companies and institutions—always a broadening experience!

Film Bulk Acoustic Wave Resonator Technology

by S. V. Krishnaswamy
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Abstract

Thin Film Bulk Acoustic Resonators (FBARs) formed by sputter deposition of piezoelectric films such as ZnO or AlN on Si or GaAs substrates offer a unique possibility for complete monolithic integration of high Q circuit elements with semiconductor devices, leading to small size and low cost. These resonator processing techniques are fully compatible with semiconductor processing methods. FBARs serve as tuning elements in the rf circuitry of oscillators and filter banks at UHF and low microwave frequencies. When integrated on the same chip with active circuit elements such as switches, attenuators, amplifiers, etc., FBARs offer wide applications in the EW, radar and communications area.

Introduction

Small, low-loss microwave filters have become increasingly desirable for radar, communications and electronic warfare. The performance requirements of front-end filters, particularly those operating above 1 GHz, are increasingly difficult to meet with traditional approaches of lumped element, dielectric, or surface acoustic wave filters. The advantage of acoustic over electromagnetic filters is generally recognized as their small size resulting from the approximately five orders of magnitude reduction in the acoustic phase velocity. This property is utilized in the fabrication of SAW filters. However, for these filters size and weight must be compromised if low insertion loss is desired. Bulk acoustic resonator filters (figure 1) offer unique advantages since they are at least an order of magnitude smaller than dielectric resonators or lumped elements, and possess much lower insertion loss than surface wave devices.

During recent years, work has been progressing toward the development of UHF acoustic resonators that can be fabricated and utilized as stable, high Q, monolithic microwave integrated circuit (MMIC) elements.¹⁻⁶ The aim of these efforts is threefold: (1) circuit simplification and performance improvement associated with stable signal generation and narrowband signal sorting directly at UHF, (2) resonator volume reduction, and (3) fabrication in 100% monolithic form. The FBAR is the only truly miniaturizable, low-loss monolithic filter available for microwave application. We review in this paper recent developments in miniature monolithic filters based on film bulk acoustic resonators.

Film Bulk Acoustic Resonator (FBAR)—Current Status

Film Bulk Acoustic Resonators (figure 2) are fabricated by sputtering of thin films of piezoelectric material such as aluminum nitride or zinc oxide onto semiconductor substrates such as silicon or gallium arsenide. These resonators are referred to variously as TFRs (thin film resonators), SBARS (semiconductor bulk acoustic resonators), or FBARs. The latter term will be used throughout this article to refer to these

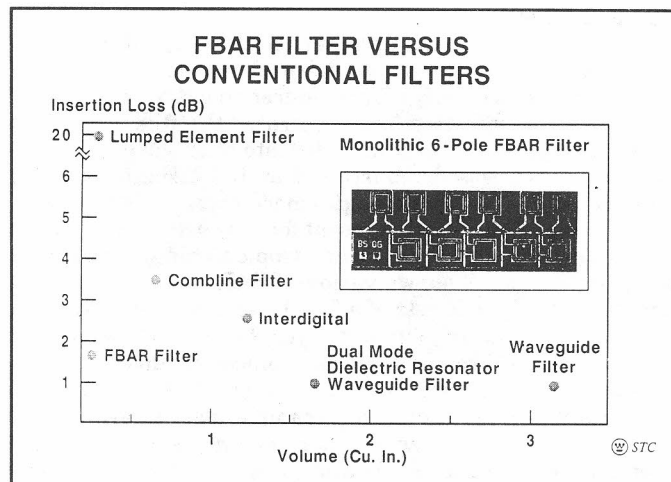


Figure 1.
Achievable size of conventional filters and their relative insertion loss (based on a six-pole filter configuration) performance compared with the FBAR filter.

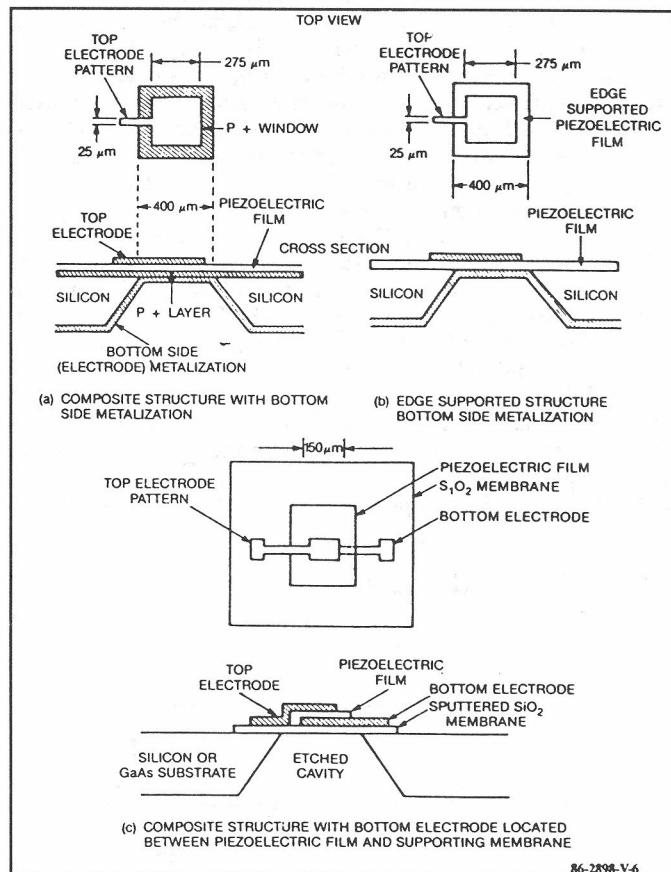


Figure 2.
Schematic showing different FBAR configurations.

devices. This section summarizes FBAR materials requirement, temperature compensation schemes and FBAR applications. For details we refer the reader to more comprehensive articles on these subjects. Filter approaches are described in the next section.

FBAR Device

The concept of FBARs derives from the original composite crystal resonator of Sliker and Roberts⁷ in which a thin film of evaporated CdS served as a transducer on a resonant piece of bulk quartz crystal. Page⁸ demonstrated that the quartz can be replaced by a thin (75 μ m) substrate of single crystal silicon. Resonance was demonstrated at 104 MHz, albeit with very low Q. Lakin and Wang^{2,9}, more than a decade later, fabricated the FBAR in its present form by using a thin (6 μ m) silicon membrane obtained by anisotropic etching of the silicon substrate. Figure 2 shows various FBAR configurations. In general an FBAR consists of a four layer composite structure in which a membrane support layer, for example sputtered SiO₂, is used to provide both mechanical rigidity and temperature compensation. A thin layer (1200 Å) of crystallographically ordered metal, for example gold, is evaporated over the membrane layer that acts as a nucleating layer for oriented piezoelectric (ZnO) film growth and serves as the bottom electrode. The piezoelectric layer is deposited by magnetron sputtering technique. The top electrode is the fourth layer and consists of a ~1200 Å evaporated gold or aluminum film.

The FBAR equivalent circuit shown in figure 3 is identical to that used for conventional single crystal quartz bulk resonators. A figure-of-merit (FOM) can be used as a measure of resonator usefulness in oscillator and filter circuitry. The FOM is defined as $Q/(C_0/C_m)$ where C_m is the acoustically generated motional capacitance. In other words, FOM is the ratio, at the FBAR resonant frequency, of reactance of the static capacitance to the series resistance. For the FBAR, achievement of high FOM values is dependent on a number of parameters including piezoelectric film quality (orientation), film/membrane/electrode material properties, thickness, device topology, harmonic mode, and degree of energy trapping.

We have demonstrated Pierce type oscillators operating at 300-700 MHz^{5,10}. The FBAR stabilized oscillator phase noise performance (~10 dBc/Hz at 10 KHz from the carrier) agrees with predicted values based on FBAR flicker noise and is comparable to that of SAW resonator oscillators. Tuning sensitivities of 800 KHz/volt with good linearity have been achieved. Burns and Ketchum¹¹ have demonstrated a similar oscillator using ZnO/Si FBARs. Burkland et al.¹² have integrated ZnO FBARs with bipolar junction transistor on silicon fabricating a 257 MHz oscillator which exhibits a phase noise of -90 dBc/Hz and a temperature stability of -8.5 ppm/°C for

5 to 60°C. Satoh et al.^{4,13} have fabricated a fully integrated 400 MHz oscillator on a silicon chip using air-gap type FBAR with a phase noise of -90 dBc/Hz. Kushman et al.¹⁴ have fabricated AlN/GaAs stacked resonator structures and monolithically integrated an FBAR filter with HBT amplifier.

Filter Approaches

Multi-pole bandpass filters using FBARs can be grouped into three categories: a) monolithic crystal filters, b) conventional ladder filters, and c) stacked filters. Figure 4 shows the three arrangements schematically. The ladder filter, consisting of resonators electrically coupled to each other, has the advantage that all the resonators can be made identical to one another. Non-identical frequency (anharmonic) spurious responses are rejected by the cascade of resonators. The monolithic crystal filter (MCF) relies on acoustically coupling the resonators which are positioned so that there is an overlap of evanescent field regions. Thin film versions of the MCF support both shear and longitudinal mode propagation. In the stacked filter arrangement the two FBARs are deposited one over the other with a common ground plane separating them. We describe here the recent results obtained for both ladder and stacked filters.

Ladder Filters

Figure 5 shows two generalized schematic diagrams for bandpass FBAR ladder filters. The inductorless configuration shown in figure 5a is the ideal one. It is a configuration that can make a symmetrical pass band if the fractional bandwidth (at 3 dB point) $\Delta f_3/f < 1/5(C_m/C_0)$. This requires that FBAR FOM values be greater than 40. Since the capacity ratio limits bandwidth, one simple approach (figure 5b) is to use a tuning inductor that cancels out C_0 over a limited bandwidth and thus achieves better filter selectivity even for

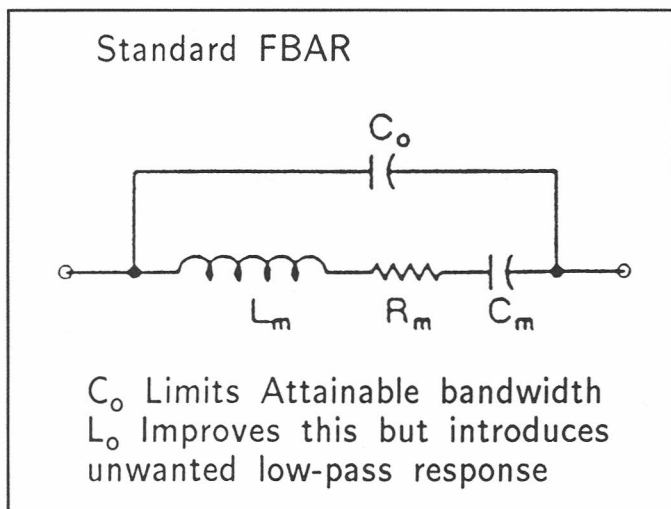


Figure 3.
Simplified FBAR resonator equivalent electrical circuit.

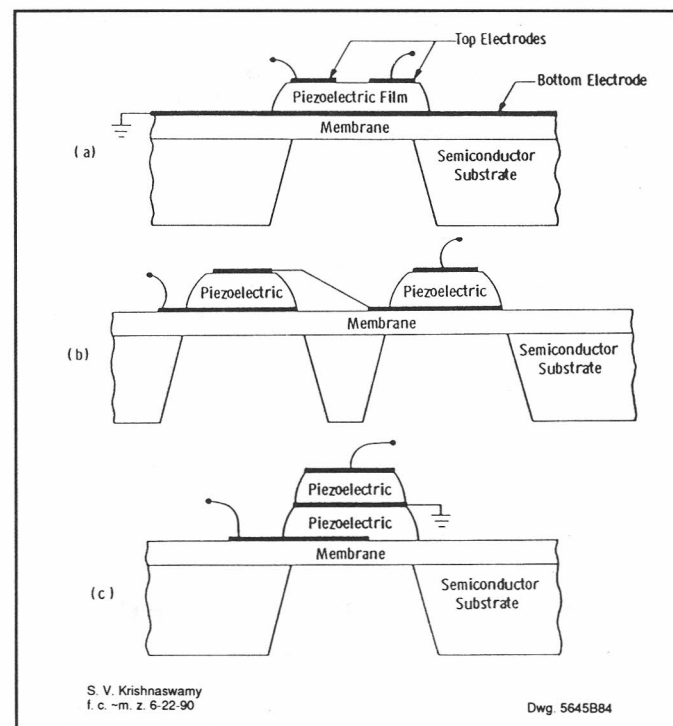


Figure 4.
Typical monolithic FBAR filter configurations:
 a) monolithic crystal filter,
 b) ladder filter, and
 c) stacked FBAR filter.

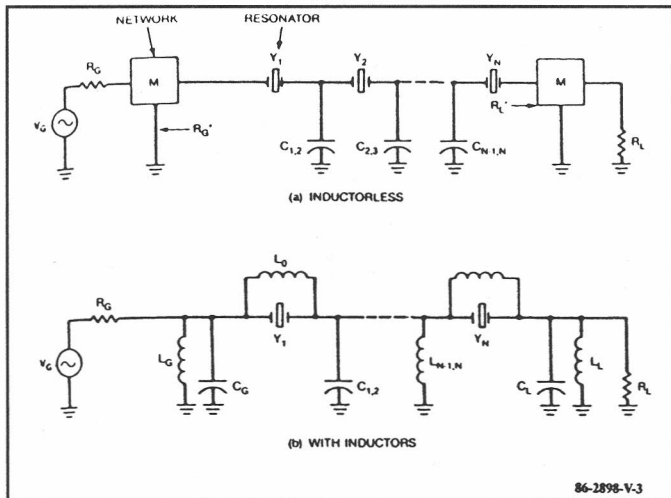


Figure 5.

Multi-pole filter topology using reactively coupled film resonators.

to use a tuning inductor that cancels out C_0 over a limited bandwidth and thus achieves better filter selectivity even for low FOM FBARs. Two- and three-pole bandpass filters based on this approach were designed and fabricated using packaged FBARs together with discrete component chip inductors and capacitors whose values are compatible with those implementable in monolithic form¹⁵. Figure 6 shows the measured response for a two-pole filter.

Recently we fabricated a completely monolithic version of a two-pole filter, shown in figure 7, that employs ZnO/SiO₂/Si FBARs. Details of this filter are described elsewhere^{6,16,17}.

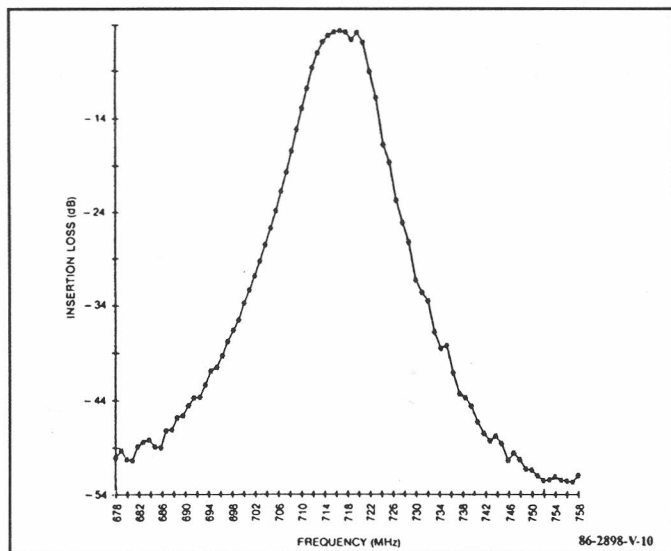


Figure 6.

Response for a hybrid three-pole bandpass filter using ZnO/SiO₂/Si FBARs.

Here we present only a summary of the fabrication and performance details. The membrane layer is first deposited on a silicon (3") wafer, then the bottom electrode for the capacitor and FBARs are delineated. This is followed by magnetron sputter deposition of ZnO piezoelectric film on an oriented gold bottom electrode. Spiral inductors referred to as the "neutralizing inductors" are then fabricated. The inductors and coupling capacitors are fabricated using standard

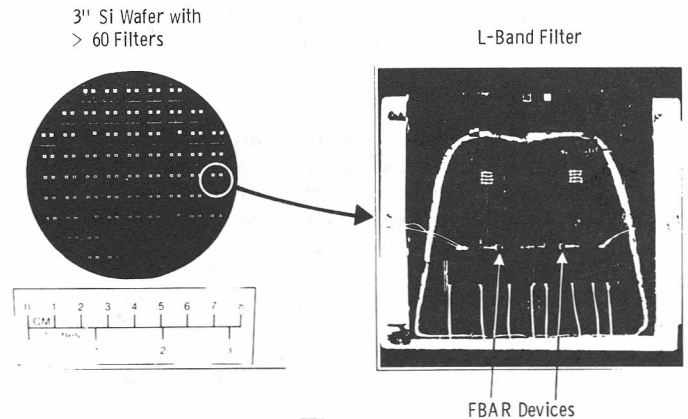


Figure 7.

**L-band monolithic ladder filter showing:
a) filters in a 3" Si chip, and
b) device layout for a single 2-pole filter element.**

microelectronic processing techniques. The capacitor dielectric consists of 0.25 μ m of plasma enhanced chemical vapor deposition (PECVD) silicon nitride. The spiral inductor elements were defined photolithographically from a 4 μ m thick e-beam deposited gold film. After the FBAR top electrode is formed, the backside of the substrate is selectively etched using reactive ion etching (RIE) to remove the silicon completely and form a membrane under the resonator. The filter chips are then diced, packaged and evaluated. Figure 8 shows a typical S_{21} response for a two-pole filter. As can be seen from the figure the filter, operating at 1.093 GHz, has an insertion loss of 1.14 dB and a bandwidth of about 3%. Although the insertion loss is extremely low and the filter response has deep stopbands we observe some spurious responses in the

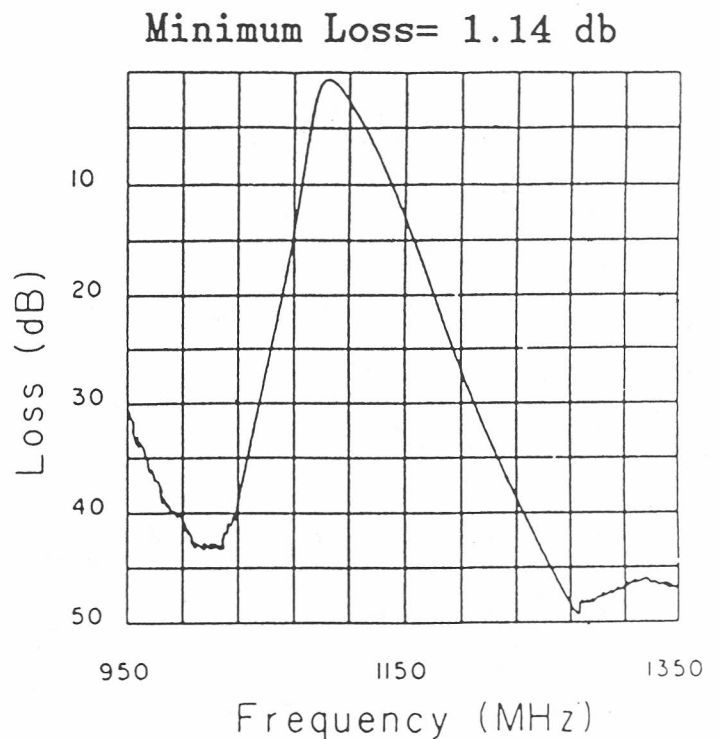


Figure 8.

Typical response for a low-noise two-pole monolithic FBAR filter.

filter by cascading two two-pole filters. This filter showed a phenomenal 100 dB stopband rejection and less than 4 dB insertion loss.

Stacked Filter

The electrical equivalent circuit of an FBAR is shown in figure 3. When FBAR is used as a series element in a filter, the interelectrode capacitance limits the attainable bandwidth. With an inductor used as a neutralizing element there is an unwanted low-pass response.

An alternate structure which has none of these characteristics and thus the potential of higher frequency operation is the stacked FBAR, shown in figure 4. The primary difference is in the electrical equivalent circuit, shown in figure 9. The center electrode is connected to ground. The advantage gained by introducing the middle ground plane is that the input and output are not coupled electrically. The so-called clamped (electrical) capacity of the resonator still exists but appears from input to ground and from output to ground and does not connect input to output. The coupling between the input and output is through motional parameters R_m , L_m , and C_m and is purely acoustic. The ground plane provides high off-reso-

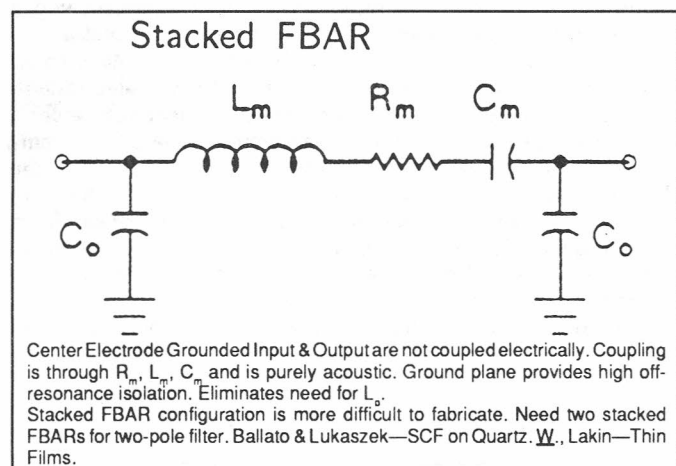


Figure 9.

Electrical equivalent circuit for a stacked FBAR filter.

nance isolation. The resonator in this two-port configuration provides better filtering action than a one-port device because electric elements connecting input to output are absent. Further, the two-port arrangement eliminates the need for inductors to tune out the parallel capacitance, C_0 . These inductors are typically an order of magnitude larger in area than the FBAR and dominate the monolithic filter chip. Thus the two-port arrangement significantly reduces the filter size and also eliminates an unwanted low-pass response that would otherwise be present as a result of these neutralizing inductors. While the stacked filter configuration offers the advantage of smaller size it is more difficult to fabricate because two oriented piezoelectric layers have to be grown one over the other. Of course, the stacked configuration shown in figure 4 represents only a single resonator; two stacked resonators would be required to realize a two-pole filter.

The first experimental stacked filter work was that of Ballato and Lukaszek¹⁸ who demonstrated novel features of this type of filter by bonding two quartz plates. However, only recently a thin film version of this filter was demonstrated. Lakin et al.¹⁹ have fabricated stacked filters using AlN/Si and AlN/GaAs FBARs operating around 1 GHz. We have recently fabricated a two-pole stacked filter operating in an overtone mode using ZnO/SiO₂/Si FBAR structure. Figure 10 shows a typical filter response. The insertion loss for this

filter at 1.98 GHz (second harmonic) is 6.5 dB. This is high and needs to be improved but the out-of-band responses are clean as expected of the stacked filter. The filter bandwidth is about 50 MHz (2%). Filter responses for 3 filters positioned close to each other in the wafer were identical, indicating producibility of these filters in quantity. Also, figure 10b shows the simulated filter response using one dimensional Mason modelling. These results are encouraging, particularly because the structure uses an amorphous SiO₂ layer; low-loss single crystal membrane layer should improve the performance considerably. Figure 10, a wide frequency scan, shows high overtone responses up to 5.5 GHz for our stacked filters.

Acknowledgements

The author thanks J. Rosenbaum, S. Horwitz, C. Vale, and M. M. Driscoll, who have contributed a great deal in this work; and J. D. Adam, K. A. Leahy, B. R. McAvoy, R. A. Moore, and H. L. Salvo for many discussions during all the phases of FBAR technology development at Westinghouse. We also wish to thank T. J. Smith, W. A. Hester, J. C. Kotvas, N. J. Doyle, and P. Largent for their help in the deposition

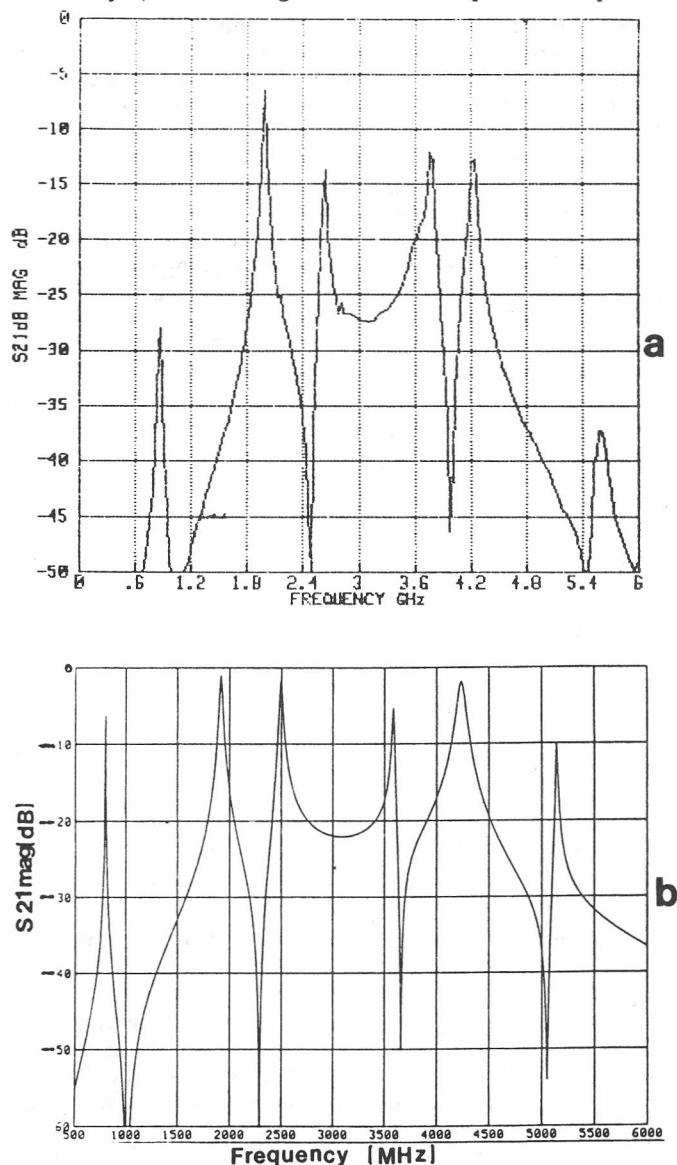


Figure 10.

Typical response for a stacked overtone driven FBAR.

N. J. Doyle, and P. Largent for their help in the deposition and characterization of films, and fabrication and evaluation of filters and oscillators.

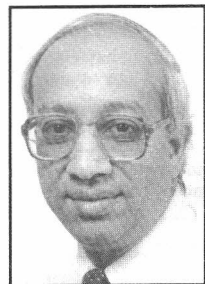
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Editor's Note: This article was submitted through MTT-2, Microwave Acoustics, Bruce McAvoy, Chairman.

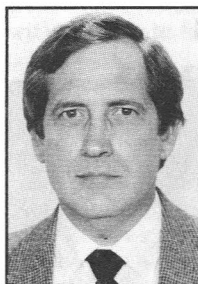
Dr. S. V. (Krish) Krishnaswamy

Dr. Krishnaswamy has over 20 years of experience in the fields of thin film and applied surface science. He has extensive experience in thin film preparation and characterization of wide range of materials and wide range of applications that include photovoltaic, photothermal, microwave acoustics & magnetics, infrared and superconducting applications. His current interests are in the study of thin film materials and processes for microwave acoustic and magnetic applications and include the investigation of ion bombardment effects in controlling the properties of thin films. In the area of applied surface analysis he was responsible for improving the resolution of the Atom Probe Field Ion Microscope by tenfold and utilizing this instrument to study gas-solid surface interactions at atomic scale.



Dr. Krishnaswamy has published over 75 papers in a number of journals and presented more than 100 papers at different meetings. He is a member of the American Vacuum Society, member of the American Physical Society and a Life member of the Indian Vacuum Society. He has served in the executive committee of the thin film division of the AVS as a member (1985-87), Secretary & Treasurer (1990), and currently as the vice-chair. He has been a member of the programming committee of both AVS (1988, 1989-chairman TFD Prog. Comm., 1990) and IEEE Sonics & Ultrasonics society (1988 & 1989). He is currently the Chairman of the Western Pennsylvania Chapter of the AVS and is the General Chairman for the 1992 International Conference on Metallurgical Coatings and Thin Films.

MTT-II Microwave Measurements



by Ron Ham, Co-chairman

A quick review of journals and conference proceedings shows the hottest topic in measurements to be on-chip testing and characterization. The most difficult aspect of this task is construction of probes and the de-embedding of parasitic components to arrive at the true characterization of the chip performance. The development of chip calibration standards and calibration techniques is also essential, requiring the metrologist to be conversant with the technology being measured.

The second most popular topic in measurement is probably automatic test equipment (ATE) system architecture. Progress in this area is evidenced by improvement of the GPIB hardware interface standard (IEEE 488.1), development of the VME bus Extensions for Instrumentation (VXI bus), the introduction of Hewlett-Packard's Modular Measurement System (MMS) and the Air Force's Modular Automatic Test Equipment (MATE) program. The general trend is towards very flexible open architecture systems and is in keeping with modern computer based electronic system concepts. Synergism appears to be developing among system houses, instrument manufacturers and users.

Software is keeping pace with hardware and system architectural advances. Most noticeable of these developments are command language standardization in Tektronix's Analog Data Interchange Format (ADIF), Hewlett-Packard's Test and Measurement System Language (TMSL), the IEEE 488 protocol standard improvement (IEEE 488.2) and the Air Force's Control Interface Intermediate Language (CIIL) for MATE.

The point of the above monologue is that, in general, test and measurement technology is driven by the requirements of hardware designers. Seldom does the development of a measurement technique lead to a new hardware design or method of fabrication; therefore, measurement technologies cannot live in isolation from the remainder of the microwave community. Conversely, measurement techniques are absolutely necessary to researchers, designers and manufacturers. Measurement technologists therefore provide a service to the technical community.

Considerable discussion has taken place recently among the members of the Measurements Committee and with measurement "clients": What is the role of this committee within the MTT-S? The first obligation is naturally to further the state of the art in concert with the Society; however, as a has-been university professor, I wonder if the role of a service technology committee can be stated that simply.

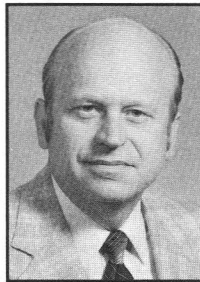
I will not argue that the University is where our art should be taught. Unfortunately, in most cases it isn't. Add to that the fact that practitioners in areas such as MIC's, MMIC's, ferrites, acoustic waves, field theory, antennas, and a myriad

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MTT-3—The Application of Lightwave Technology to Microwaves



by P. R. Herczfeld
Co-chairman, MTT-3



and N. R. Dietrich
Chairman, MTT-3

The purpose of this article is to review some of the recent developments in the application of lightwave technology to microwave devices and systems and to project some future developments in this area. The last few years have witnessed an explosive growth in lightwave technology and photonics, and with it, their applications to microwave systems. For the present discussion, we will limit ourselves to two areas: the applications of high speed fiberoptic links to microwave systems and hybrid microwave-photonic semiconductor devices. Such very important areas as optical generation of microwaves and optical diagnostics of microwave circuits, particularly MIMICs, will be covered at a later time.

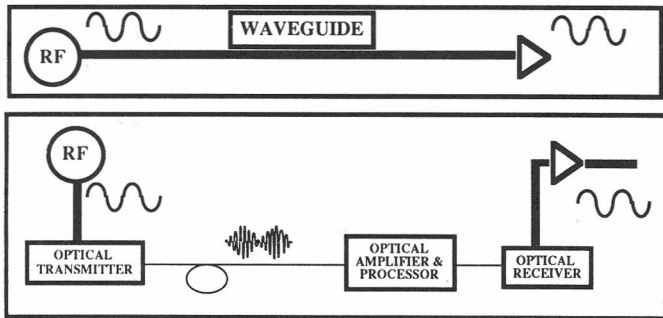


Figure 1.

Metallic transmission system and its replacement by high speed fiberoptic link. The fiberoptic link is an active system that may include optical amplifiers and processors.

High Speed Fiberoptic Links for Microwave Applications

One of the most promising areas of the application of lightwave technology to microwaves is the replacement of metallic waveguides and coaxial cables by high speed fiberoptic links. The basic concept is shown in Fig. 1. The main elements of the high speed fiberoptic link are the optical transmitter, the optical receiver, and the fiber itself. The advantages of high speed fiberoptic links are well known, such as small size and weight, immunity to interference such as EMI and EMP, good electrical isolation, low attenuation, and high bandwidth in the fiber.

Two configurations for optical transmitters are commonly used such as a direct modulation of semiconductor lasers and external modulation using integrated optics devices. In the first instance, shown in Fig. 2, the microwave signal is superimposed on the DC bias of a semiconductor laser diode. This

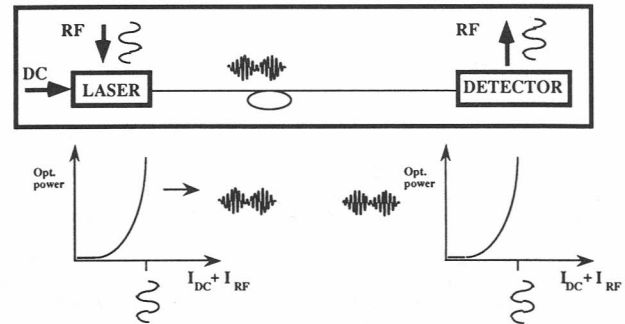
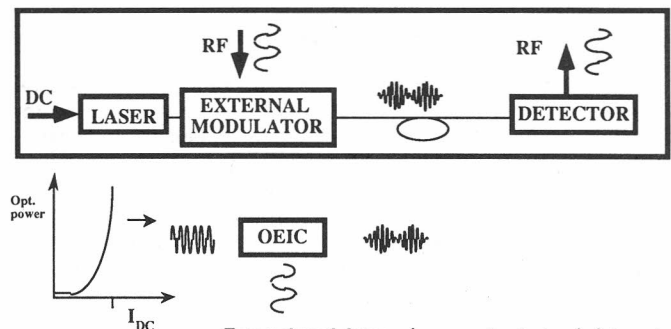


Figure 2.

High speed fiberoptic link using direct modulation of a semiconductor laser. The microwave signal is superimposed on the laser bias constituting a modulated optical carrier. The detector demodulates the optical carrier and reproduces the microwave signal.

produces modulated light intensity which is then transmitted through the fiber and detected by a PIN photodiode. The external modulation scheme, Fig. 3, utilizes either a semiconductor diode laser or a solid state laser (NDA YAG) as a source followed by an external modulator, an optical circuit utilizing of a Mach-Zender interferometer. The RF signal is applied to one arm of the Mach-Zender which by virtue of the electrooptic effect modulates the velocity of the optical carriers in this branch and thus produces a modulated optical signal at the output of the interferometer. Key issues determining the performance and applicability of high speed fiberoptic links for microwave systems are maximum modulation bandwidth, RF to RF gain, noise figure and dynamic range.



External modulator using an opto-electronic integrated circuit (OEIC) device (Mach-Zender Interferometer)

Figure 3.

High speed fiberoptic link using an external modulator. The microwave signal is applied to one arm of the interferometer producing a modulated optical carrier.

Table 1 contains representative results for these parameters for the recent past (circa 1985), present (1991) and expected results (1995 and beyond). The massive improvements in fiberoptic links, as illustrated in the table, are due to several factors. We are continually improving the photonic and electrooptic devices with higher modulation bandwidths and lower noise. Particularly promising are, for example, the new quantum well lasers which are ideally suited for microwave applications. A very important new development is the high performance optical amplifiers which can be fabricated from semiconductors or rare-earth doped fibers. They can be optimized to operate in low-noise or high-power modes providing functions similar to those of the microwave RF amplifier. We have made significant advances in designing and fabricating better interfaces between the microwave circuits and

the electrooptic transducers (laser and detector). Since the semiconductor laser is virtually a short, while the PIN diode detector is essentially open, optimum impedance matching is extremely difficult but most rewarding in terms of enhanced performance. In addition, we have made great gains in coupling the light between the electrooptic devices and the fiber. With improved devices and better matching circuits, we have already realized RF to RF gain through the fiberoptic transmission lines at lower frequencies and we expect even better results in the near future, particularly with the external modulators. For most communication applications, fiberoptic link with the emergence of optical amplifiers perform favorably but for radar applications, the noise figure and dynamic range needs to be improved.

Table 1. Performance of high speed fiberoptic links

	Past 10 GHz	Present† 40 GHz	Future 94 GHz
Frequency (Max)			
RF to RF Gain (10% bandwidth)			
@ 1 GHz	-45 dB	+6 dB	+30 dB*
@ 10 GHz	-60 dB	-10 dB	0 dB*
Noise Figure			
@ 1 GHz	60 dB	30 dB	20 dB**
@ 10 GHz	60 dB	45 dB	30 dB**
Spurious-Free Dynamic Range			
@ 1 GHz	40 dB·MHz ^{3/2}	70 dB·MHz ^{3/2}	90 dB·MHz ^{3/2}
@ 10 GHz	35 dB·MHz ^{3/2}	60 dB·MHz ^{3/2}	90 dB·MHz ^{3/2}

*External Modulation

**Solid-state laser

†Results by D. Kassamset, S. Wanuga and Ed Ackerman of General Electric E-Labs.

It would be a mistake to think of the fiberoptic link as a direct replacement for waveguides. Evolving optical signal processing techniques become accessible when operating in the optical domain. It is possible to introduce true-time delays and phase shifts in the optical domain which can be used to steer microwave phased array antennas or to reroute signal flow via optical switches.

Some of the most important utilizations of high speed fiberoptic links are signal distribution in phased array antennas and antenna remoting. One interesting application under development is the fiberoptic memory loop as shown in Fig. 4. Here an incoming radar pulse is delayed and subsequently

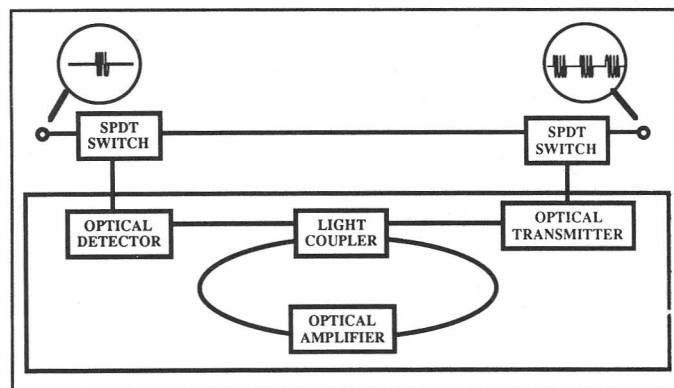


Figure 4.

Recirculating fiberoptic memory loop; an example of optical processing of microwave signals. The detected radar pulse is recirculated in a fiberoptic delay line to produce a pulse train. The bandwidth (up to 18 GHz in the near future), the time delays (10 msec or more) as well as the number of recirculation (1000 or more) make device a good example of the potential of fiberoptic links for microwave applications.

recirculated to generate a pulse train. Using the fiberoptic delay line with the optical amplifier, both very short and very long (tens of millisecond) delays and hundreds of recirculations are achievable. Small, compact, low power and low cost units with instantaneous bandwidth of 2 to 18 GHz are foreseen within three to four years.

Hybrid Microwave-Photonic Devices

As the applications of lightwave technology to microwave systems mature, the need for chip level integration of microwave and photonic functions becomes increasingly evident. The basic motivation for this activity is depicted in Figs. 5 and 6. The future work is intended to merge photonic and microwave componentry (or devices) on an MMIC substrate. We can thus address MMICs by optical means to control various microwave functions or, alternatively, we can retrieve information from MMICs by optical means and route them via fibers to other microwave circuits.

Since the primary interest is the application of photonics to microwave devices and systems, the underlying unit must remain the MMIC, and research needs to focus on adapting photonics to it. One idea is to partition a section of the standard MMIC chip for the photonic devices, detectors, and modulators while leaving the rest of the MMIC in its normal configuration. This concept also implies the constraint that the incorporation of photonic devices on the MMIC chips require minimal deviation from accepted MMIC design and processing procedures. This point is critical to keep costs in line and to maintain compatibility with present design and fabrication practices.

The optical control of hybrid and monolithic microwave circuits such as switches, attenuators, phase shifters, and mixers, has been investigated and proven feasible. One approach is to incorporate a PIN diode optical detector on GaAs MMIC substrate for the optical control of a phase shifter. However, the fabrication of the PIN diode on the MMIC requires additional processing steps and thereby increases the complexity and the cost. The metal-semiconductor (MS) photodetector, which performs similarly to the PIN diode, can be fabricated readily on the MMIC chip. However, for many applications, such as the optical injection locking of local oscillators, the illumination of an active device is required.

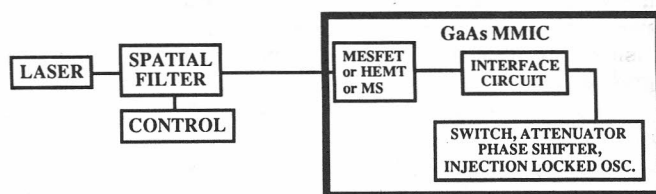


Figure 5.

Control and data signal inputs to MMIC via optical fibers. Standard MESFETs and HEMTs act as optical ports.

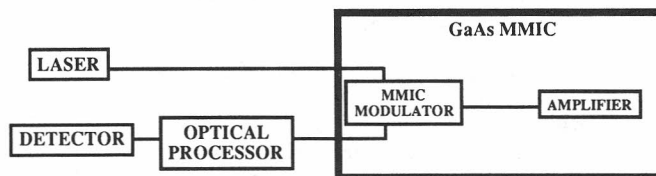


Figure 6.

Data and carrier signal outputs from MMIC via optical fibers. MMIC based optical modulator is under development.

Therefore, exploiting the GaAs MESFET or HEMT as an optical port on an MMIC chip represents an attractive alternative to the PIN or MS diode.

Results show that at lower frequencies (below 200 MHz), the MESFET has a significantly larger response (gain) than the PIN diode which makes it desirable as an optical port on the MMIC for the detection of control signals. Improving optical coupling by altering the geometry of the device (shorter but larger number of gate fingers), by providing an elliptical optical spot size (cylindrical lens) and by an antireflection coating, boosts the MESFET photoresponse. This can be achieved without adversely affecting the routine MMIC processing. Further optimization in the frequency response of the MESFET can be obtained by modifying the doping profile to reduce the barrier capacitance. This, we estimate, when combined with improved coupling efficiency, will result in an excellent MMIC photodetector up to 10 GHz and possibly beyond.

The complementary problem of bringing information out of the MMICs by optical means is shown in Fig. 6. The concept illustrated is that of dispatching an optical carrier via a fiber to the MMIC, then modulating (coding) the light by the microwave circuitry, and finally bringing the coded optical carrier out of the chip for processing and routing it onward as necessary.

Commonly used external modulators are based on the principle of electrooptic effect to "slow down" the photons. Unfortunately, the electrooptic effect is very small; therefore, large fields and/or long interaction lengths are required to introduce substantial phase modulation. Most devices use an interferometric layout to convert the phase (velocity) modulation into amplitude modulation. The choice of material is LiNbO_3 which is not a semiconductor and therefore not suitable for chip level integration with electronics.

An alternate avenue for the index modulation is the use of carrier injection or depletion (i.e., the photo-refractive effect) in a semiconductor like GaAs or other III-V material. The dielectric constant, and hence the index of refraction, is a function of the plasma frequency which is a function of the carrier density, that can be changed by injection or depletion of electrons or holes. Therefore, the prospect of fabricating optical modulators on MMIC chips is clearly feasible.

Experiments directed toward chip level integration of MMIC and photonic devices are being pursued in the US, Europe, and in Japan. The potential application of such new devices in microwave electronics and in lightwaves is indeed considerable and the commercial payoffs could be equally significant.

Editor's Note: This report of Technical Committee MTT-3 was submitted to Features Editor John Eisenberg and summarizes the position of MTT-3 as reported by Peter Herczfeld in the Emerging Technologies Workshop organized by Kris Agarwal at the 1991 IMS in Boston.

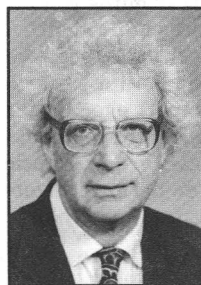
MTT-II Microwave Measurements

(Continued on from page 25)

of other specializations, do not have time to track developments in peripheral areas.

Is there a need for remediation in measurement theories and techniques within the Society? I don't wish to start any arguments but I would like to begin a dialogue with MTT-S members having opinions either way. If such a need exists and it can be tolerated within the Society, the Measurements Committee is prepared to support it by providing a speakers list on both remedial and topical subjects.

Report of the Division IV Director



by Martin Schneider

"Everything is at its acme, especially the art of making one's way in the world. There is more required nowadays to make a single wise person than formerly Seven Sages, and more is needed nowadays to deal with a single person than was required with a whole people in former times."

Balthasar Gracian
The Art of Worldly Wisdom
Huesco, Aragon, Spain, 1647

New Technology Directions

The September 1991 report of the IEEE New Technology Directions Committee identifies key technologies which are expected to play a crucial role in this decade. The committee reports to the Technical Activities Board and is chaired by Bernard Yokelson. Its mission is to anticipate and determine the direction of new emerging technologies and to spearhead their investigation and development by the IEEE. The emphasis is on new, emerging technical areas which are not adequately covered by existing IEEE Societies and Councils, or which overlap the fields of interest of the existing Societies and Technical Councils.

As a member of the committee I made a number of suggestions on how to fulfill our mission. A survey was conducted in which the Society Presidents were asked to provide us with a list of "Key Emerging Technologies." The survey was divided into two areas: "Technologies Offering Solutions to Problems" and "Problems That Need a Technological Solution." The results of our survey were as follows:

Technologies Offering Solutions to Problems

Rank	Technologies
1	High Performance Computing
2	Superconductors
3	Sensors and Signal Processing
4	Manufacturing Technology
5	Parallel Processing
6	High-Speed Digital Computer Network
7	New Materials
8	Robotics
9	Expert Systems
10	Microelectronic Circuits and Chip Capacity

It is to be noted that about half of the above topics (Rank Numbers 1, 3, 5, 6, 8 and 9) are related to computers which are needed to process, store and transmit data and to crunch numbers. The problems and priorities are substantially different if we look at the next table:

Problems That Need a Technological Solution

Rank	Technologies
1	Energy
2	Environmental Issues
3	Quality & Reliability in Manufacturing

- 4 Education
- 5 Information Access
- 6 Writing Software
- 7 Health Care
- 8 Software Reliability
- 9 Measuring—Improve Productivity & Quality
- 10 Testing of Complex Systems

The consensus of our New Technology Directions Team was to proceed as follows:

- Focus action on the top-ranked problems which need a technological solution.
- Create steering committees for each topic after the model of the IEEE Steering Committee on Environmental, Health and Safety Issues pioneered by Diana Bendz.
- Encourage organizing "Emerging Technology Workshops" at IEEE Regional Conferences.
- Support the ongoing production of IEEE Videotapes on Emerging Technologies.

Our committee is interested in suggestions from the members of the Microwave Theory and Techniques Society on ways to expand our activities and meet our mission. We are specifically interested in hearing about areas and topics which are not yet covered by the Societies and which may require the creation of a new entity, such as a forum for inventors or consultants. Please feel free to send any communication by mail, phone, fax or electronic mail to:

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IEEE Colloquium 1992

The year 1992 will mark the birth of the European Economic Community which will consist of 12 countries with a total population of 330 million. The event is not only of political and economic significance, but is also a challenge and opportunity for the IEEE to enhance the services offered to our members in Region 8 and at the same to increase the IEEE membership in the EEC and surrounding countries. The following special events are being planned:

EUROCON '92

IEEE Conference on European Electrotechnology in a Worldwide Market. This conference is sponsored by the IEEE Region 8, the Communications Society, Computer Society and the Switzerland Section of IEEE. It will be held from May 18-21, 1992, at the Congress Centre in Zurich, Switzerland. The first day will be reserved for tutorials, followed by workshops on the second day, and talks by industry leaders on the last day of the conference.

IEEE Colloquium '92

The purpose of this program is to offer the IEEE Sections in Region 8 the opportunity to invite a lecturer of their choice to present a one-day or two-day tutorial on a topic which will benefit the members. The events will take place throughout the year and will be sponsored by the IEEE Societies which are active in the Region, the IEEE Technical Activities Board, and IEEE Region 8.

I am working actively with our Society President, Ferdo Ivanek, to ensure that the Microwave Theory and Techniques Society will be fully represented in this activity by suggesting

speakers and topics which will interest our members and stimulate the technical activities in our field of interest. We plan to make good use of existing resources such as our Distinguished Lecturer Program which could be enhanced by additional experts who are already located in Europe. A meeting was held with Georgio Molinari (University of Genova, Italy, and Region 8 Education Chairman) at the IEEE Service Center in Piscataway to work on some of the details of this program.

The Colloquium '92 organizing committee is co-chaired by Kurt Richter, Director, Region 8; Troy Nagle, Past Vice-President of TAB; and Ed Parrish, Director, Division V.

The Joys and Sorrows of Plagiarism

Since the beginning of this year I have been serving as chairperson of the Ethics Committee of the IEEE Technical Activities Board (TAB). Its mission is to investigate and recommend action to TAB and its entities (35 Technical Societies and 2 Technical Councils) on ethical issues. As part of our assignment we contacted a number of IEEE editors and members of TABAC (Technical Activities Board Administrative Council) and asked them to let us know about recent occurrences of plagiarism and related ethical problems in publishing. Here are some of the horror stories which were brought to our attention:

- Jan Brown, President of the IEEE Ultrasonics, Ferroelectrics and Frequency Control Society, reported that a paper was referred to a reviewer who recognized that it was a replica of an article he himself had published ten years earlier. The referee rejected the paper, stating only that the work was not new.
- Steve Maas, editor of the *IEEE Transactions on Microwave Theory and Techniques*, wrote me a letter with a long list of problems related to publication ethics. In one case an author had published the same paper in the *European Microwave Conference Proceedings* and *IEEE Transactions*. In addition, one co-author was omitted in the *Transaction* paper.
- Leda Lunardi, Associate Editor of the *IEEE Electron Device Letters*, informed me that an author had published the same paper in her journal and in the *Applied Physics Letters*. The author subsequently offered an apology, stating that he had been under physical and mental stress and was in ill health. It turned out that the paper had been submitted to two journals on the same date.

I would like to add my own work has been copied (including the figures) on two occasions. As an author I felt flattered at the time because it indicated to me that my contributions were not only correct, but also relevant.

My committee on TAB Ethics has come up with the following preliminary recommendations to resolve these problems:

1. Raise the awareness of potential authors that CD-ROM databases (publications stored on read-only compact disks) are a powerful tool to find plagiarized contributions or repeated versions of the same work.
2. Attack the "publish or perish" syndrome by encouraging and emphasizing the value of poster sessions and workshops at technical conferences.
3. TAB is requested to appoint a task force to propose specific actions which will discourage unethical publication practices.

Ed.: "Adam was the only man who, when he said a good thing, knew that nobody had said it before him." Mark Twain as found in Peter's Quotations by L. J. Peters.

TAB Highlights

Ferdo Ivanek

As usual, only a smaller portion of the agenda of the October 4-6, 1991, TAB meeting was of interest for *Newsletter* reporting. Most agenda items belong in the "house-keeping" category which I shall not cover. Those interested in a more detailed account of the TAB meeting can obtain the information from the TAB Secretariat (see TAB Highlights on page 23 of the Number 129 *MTT-S Newsletter*).

I selected to highlight the 1992 TAB Strategic & Operating Plan which consists of seven strategic objectives and thirteen goals. I recognize in these much of our own objectives and action items. Since we do not have a summary document of this kind I decided to quote TAB's document verbatim and to briefly comment on its relevance to our Society. The strategic objectives are:

- A. Monitor the changing technical interest of IEEE members and accommodate them by identifying technology areas for increased emphasis.
- B. Maintain and enhance excellence in IEEE fields of interest and promote IEEE's leadership and responsiveness to developments in these areas.
- C. Evaluate TAB's performance in accomplishing its mission.
- D. Continue the globalization process and enhance IEEE's transnational activities.
- E. Improve the effectiveness of the TAB volunteer and staff structures.
- F. Promote Society membership among IEEE members.
- G. Improve TAB's financial situation by both cost containment and revenue enhancement and preserve the financial integrity of individual Societies.

We can endorse all of the above objectives, because we are already translating them into practice. Nevertheless, AdCom may want to formally endorse TAB's Strategic Objectives and to recommend them for MTT-S guidance.

TAB's list of 1992 goals applies to the above objectives and references them in parentheses:

1. Establish measures of performance for evaluating the fulfillment of TAB's mission. (A, B, C)
2. Identify entities and organizations with interests and activities that overlap with those of IEEE and develop strategies of cooperation with them. (B, D)
3. Actively campaign to increase industry support and participation. (A, B, C)
4. Consider the development of new applications-oriented publications. (A, B)
5. Coordinate the educational activities of individual Societies and adopt emerging technologies. (A, B, F)
6. Provide technical support of Regional Conferences. (D, F)
7. Promote inter-Society interactions. (A, B, E, G)
8. Consolidate the TAB volunteer structure. (E, G)
9. Establish incentives for Society membership. (E, F)
10. Uniformize Society policies on student issues. (E, F)
11. Assess and improve TAB's international activities, including the Brussels office and the Region colloquia. (D, G)
12. Establish a budget planning and expense review process that includes opportunities for Societies to participate. (G)
13. Develop a clear and informative format for presentation

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Publishing with the IEEE PRESS

by K. K. Agarwal
MTT-S Liaison to IEEE PRESS

Here is some news about the IEEE PRESS. A strong effort is underway to revitalize the PRESS and establish an effective link between Societies and PRESS to mutual advantage. The appointed Society Liaison to the PRESS would coordinate book sponsorships, reviews during sponsorship evaluation, and assist in publicizing books to interested members.

The IEEE Publishing activity has moved to Piscataway, NJ, under the new leadership of Managing Editor, Dudley Kay, who comes to IEEE with 17 years of Editorial and Marketing experience at such world renowned publishing houses as Macmillan & Co., W. B. Saunders, and Prentice-Hall. He has a staff of experienced Production Editors, and has a number of freelance people in illustration, cover and page design, indexing, etc., to produce higher quality broad interest IEEE members' books more rapidly than one can expect from commercial publishers. This is a break from the past where IEEE produced the usual *Transactions*, *Letters*, *Journals*, and the well known "reprint" book volumes.

The mission of the PRESS is to be of "service to IEEE members" and "enhance broad technology education" and be a "source of up-to-date information." To accomplish these goals, greater efforts are underway in marketing and sales to generate a financial surplus and be profitable, attract quality authors, and return a portion of the surplus to the sponsoring IEEE societies to foster additional publication activities. Marketing effort is headed by Jonathan Dahl, Director of Marketing, formerly a VP at Simon and Schuster and at McGraw-Hill. Advertising and promotion is directed by John Lewis, formerly of Pergamon Press, Gordon and Breach, and ASME.

There is a new IEEE office in Brussels serving the European region for direct book sales. All this effort at IEEE PRESS is to rapidly expand and compete in book publishing activity with the likes of John Wiley and McGraw-Hill's and, needless to say, this is an excellent commitment by IEEE to take advantage of the opportunity and be a leading publisher of not only technical journals and transactions, but also of technical books by leading authors.

PRESS is making serious efforts in establishing closer and better ties to the Societies and trying to increase the effectiveness of Society sponsorship of a PRESS book. A workshop was hosted in Arlington, Virginia, on October 26 and 27, 1991, by the IEEE PRESS Staff and Editorial Board. PRESS Liaison of all societies were invited to attend this workshop and most of the liaisons did attend. The staff discussed details of the "author's guide to publishing with today's IEEE PRESS." This covers such topics as expanded IEEE PRESS, editorial expertise, author support network, marketing and sales strategy, competitive terms and if you are a prospective author. This guide and author's kit is available free from IEEE PRESS or by contacting your society liaison. Also discussed were new policies, standards, financial rewards to authors and reviewers for selected reprint and original monographs/books. The workshop was lively and informative.

PRESS is taking a more businesslike approach to the publication. Sponsoring society liaisons will be required to

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President's Column

(Continued from page 1)

needs of the MTT-S membership with our annual symposium and the associated events. The task is not trivial because we seem to be reaching the limit of what can be "squeezed" into a single week, whereas the number of papers, sessions, workshops, panels, etc., shows the tendency of continuous growth. The Ad Hoc Committee chaired by Barry Spielman is off to a good start. This is obvious from the fact that they have already addressed the highly important yet sensitive question of how to manage the technical program in such a manner as to assure due coverage of the emerging technologies which have to compete for session slots with the established and more mature technologies.

Second, we systematically increased sponsorship of other events in MTT's field of interest, which have been organized outside of our Society, but are known to attract substantial attendance by our members. In some cases we responded to the organizers' request. Examples include cooperative sponsorship of the Second International Symposium on Space Terahertz Technology (February 27-28, 1991, Jet Propulsion Laboratory, Pasadena, California), and full sponsorship of the Topical Meeting on Electrical Performance of Electronic Packaging (Tucson, Arizona, April 19-22, 1992).

In the case of the annual GaAs IC Symposium we took the initiative to upgrade our involvement from cooperative sponsor to co-sponsor with the Electron Devices Society (ED-S). What motivated us was the fact that the microwave content of this Symposium has grown to about 50% and to approximately 50 specialized microwave papers, which makes it a major microwave event that complements very well our own Microwave and Millimeter Wave Monolithic Symposium. As I was writing this column I received word that the Executive Committee of the GaAs IC Symposium has voted to support our initiative at the forthcoming meeting of the ED-S AdCom in December, 1991.

It seems to be in the best interest of MTT-S membership to continue developing and strengthening partnerships of this kind with IEEE Societies, other organizations and groups

which organize technical meetings with a high enough microwave content that consistently attracts substantial attendance by MTT-S members. Some of the sponsorship arrangements include publication of expanded meeting papers in our *Transactions*, which is an additional mutual benefit. Of course, to be fully effective, we must practice this "outreach approach" in all IEEE Regions, in order to profit from the transnational character of the IEEE and MTT-S. It is satisfying to note in this context that the MTT-S has a larger part of transnational membership (approx. 1/3) than the entire IEEE (approx. 1/4).

Furthermore, technical partnerships of this kind open up new opportunities for intensifying and expanding the activities of our Technical Committees which represent the backbone of our Society. This applies in particular to the emerging technology areas, and to the development of closer working relationships with the most closely related IEEE Societies, which are among MTT's major objectives.

The natural question to ask at this point is whether the MTT-S itself should initiate and sponsor additional technical meetings outside of the "MTT-S Week." My personal answer is that the apparently excessive worldwide proliferation of technical meetings should not discourage us from evaluating the need for additional MTT-S meetings to better serve our membership. Looking for a good example of a worthwhile initiative I suggest considering an annual Workshop on Emerging Technologies, preferably held in conjunction with the IMS Technical Program Committee meeting. This could be a natural outgrowth of the successful series of working meetings on emerging technologies, which the Technical Coordinating Committee started in 1990.

These developments and the follow-up opportunities reinforce my optimistic outlook on the future of our Society. I conclude with my best wishes to the 1992 AdCom under Reynold Kagiwada, and I invite all of you to join forces in making MTT-S an even better and more successful IEEE Society.

Publishing With the IEEE PRESS

(Continued from previous page)

provide three written technical reviews of a book proposal and similar detailed reviews of the final manuscript. This would weed out marginal projects and ensure high quality products. Liaisons will be assisting in promotion planning and marketing. This increased effort and partnership of PRESS and societies is expected to result in an increase and escalation of the financial reward to the sponsoring societies. PRESS is willing to offer special 40-50% discounts off list prices to societies in some cases of volume purchases. Rather than a book, book-series is an attractive way for the societies and PRESS to attain goals beneficial to both. Series may be original or reprint books with an editor.

MTT-Society is considering two such series:

1. Selected volumes of Radiation Lab Series, a classic reprint series. IEEE PRESS is following the project with the assistance of MTT-S Liaisons.
2. Emerging Technology Series with topics such as Supercon-

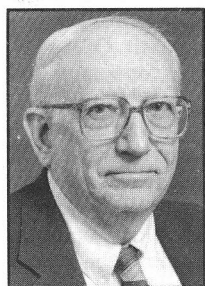
ducting Microwave Technology, Optical-Microwave Systems and Technology, Microwave Packaging and Manufacturing.

Proposal efforts are underway, working with the technical committee chairmen of the corresponding MTT-S committees to identify authors and explore the viability of these projects.

There are two ongoing book projects past the proposal review stage: Quasioptical Systems by Goldsmith and Planar Microwave Circuits by Gupta/Abouzahora. Authors are busy completing the manuscript for final critical review and sponsorship by the MTT-Society. A new topic suggested by Martin Schneider and Dudley Kay is "Soliton Waves and Optical Communications" for a monograph with its author possibly Dr. Mollenaur of Bell Labs, Holmdel.

Authors and interested members are encouraged to contact Kris Agarwal (214-205-8563) or Dudley Kay (908-562-3967) for more detailed information on IEEE PRESS publications and opportunities to publish.

Report on the IEEE Publications Products Council Meeting



Chester L. Smith
Division IV Representative

The final meeting of the IEEE Publications Products Council for the year 1991 was held at the Headquarters Building in Piscataway, New Jersey, on Tuesday, 24 September. The formal and detailed minutes may be obtained from IEEE TechPubs in Piscataway. This report is to highlight some of the issues that may be of special interest to the Societies of Division IV.

CD-ROMs

For some time IEEE has been negotiating with University Microfilms, Inc. (UMI) to put *IEEE Transactions* and other documents onto CD-ROMs. The plan is to grant UMI exclusive marketing rights for three years, after which the rights are to revert to IEEE. Evidently, there is (or was as of 9-24-91) some technical legal flaw in the arrangement as there was no contract as of the meeting date.

Books

IEEE is actively pursuing the publishing of new technical books, but the program has not progressed as fast as some had hoped. The Council, on the whole, seemed satisfied with the results. The problem seems to be that the financial end of the business is somewhat behind expectations. The Council, however, took the view that the purpose of the Institute's activities is primarily to serve the membership, not necessarily to promote the finances. Of course, it is nice if the book program can break even or show some surplus. The prospects are good that it will do so in time. Mainly, the book program is in need of authors.

Official Language

The comment was made by someone that "English is the 'Official Language' of the IEEE." This is interesting, since at one time some *Transactions* papers were published in French. I asked if Bilingual Conference Records were under the interdict and was told that they were. This rule, it seems, would apply to the EMC Conferences in Wroclaw, Poland (Russian and English) and to Geneva, Switzerland (English and French). In both of these, simultaneous translation of oral presentations is made and all papers have abstracts in both languages. IEEE has been an active participant in these Conferences as well as others where English and another language are used.

Prices

As usual there was a lively discussion of future changes in the pricing of IEEE publications. The All Transactions Package (ATP) has been losing subscribers as the recession deepened. There was some talk of allowing some subscribers to purchase a smaller set of publications more, presumably, in line with their interests. This idea may be pursued further if customers are interested. As it is, their only recourse is to drop ATP and buy only those publications of most value as determined by user activity. No action was taken.

IEEE TechPubs at Conferences

The thirty plus Societies in the IEEE hold a large number of Symposia/Conferences each year. These draw a good showing of non-IEEE participants. At the recent IEEE Symposium on EMC the Book Program had a booth in the Exhibits area, but the IEEE Membership booth was in the hotel lobby. There was some book activity, but one of the lessons learned was that TechPubs should be co-located with the Society Membership booth and that Society personnel should be briefed on what TechPubs has to offer.

Some Societies offer non-members an incentive to join IEEE such as paying the Society dues for the first year. It was suggested that IEEE books be sold at 20% discount to members with 5% to go to the sponsoring Society. Of course, non-IEEE attendees would pay full price for books, unless they stepped next door and signed up!

CD-ROM/Optical Disk Standard

Because of a Society project I enquire as to what the IEEE Standards on Disk were since we have the well known IEEE 488 bus. At the present time there are no IEEE Standards on these devices, but I understand the Computer Society has some committees hard at work on them.

Fax Copies of IEEE Papers

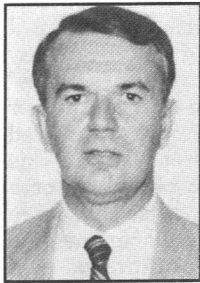
This is another of those areas where the law enforcement is a few megaparsecs behind the technology. The United Engineering Center (UEC), New York, provides a fax service. UEC will fax a copy of any paper they have on hand to a customer within about 20 minutes for a fee of \$24, \$3 of which is paid to IEEE as a royalty. This is fair and legal.

The problem, however, concerns some of those notorious "beltway bandits." Evidently the practice is to send "some kid in tennis shoes" to some library and dry photo copy the paper for 3 to 10¢ per page and then fax it to the "customer" for a suitable fee, usually within 24 hours. The view at IEEE is that this does not fall within the "fair use" provision of the copyright laws. Sooner or later this one will end up in court and it will be interesting to see how it goes.

Other Topics

There were a number of other topics and issues discussed. Among these were new publication products on electronic media and also some problems involving the production of abstracts. Inquiries on this report or the full minutes should go to Piscataway.

News From the United States Activities Board and PACE



by L. N. Medgyesi-Mitschang
MTT-S PACE Chairman

In this column I want to highlight some of the significant activities underway that can impact our profession. Unfortunately space limitations preclude a full discussion of these items.

Pension Legislation Introduced on Capitol Hill

IEEE-USA's Pensions Committee is backing legislation introduced in the U.S. House of Representatives by Representative Sam Gibbons (D-Florida), the second-ranking Democrat on the House Ways and Means Committee. **H.F. 2390, the Pensions Coverage and Portability Act**, will expand pension coverage, improve the portability of benefits when workers change jobs, and increase individual savings for retirement. The legislation addresses such problems as lack of coverage, failure to vest, lack of portability from defined benefit plans, and consumption of pre-retirement lump-sum distributions.

The Pensions Committee worked closely with Representative Gibbons in developing the bill, which represents a significant step for IEEE-USA's efforts. Pension and U.S. competitiveness issues constitute the two components of its Legislative Initiative, begun in 1990. Upon introduction of the bill, George F. McClure, IEEE-USA's Pensions Committee Chairman, emphasized that "Federal legislation is needed to resolve pension coverage and portability problems and to encourage individuals to save for their retirement years." IEEE-USA also supports **H.F. 1406 and 612**, bills that would restore universal eligibility for making tax-favored IRA contributions.

Global Competitiveness Symposium

Through its Committee on U.S. Competitiveness, IEEE-USA was associate sponsor of a symposium on **Technology Policy for Global Competitiveness: Forging a National Consensus for the Twenty-First Century**. The symposium, sponsored by the National Center for Advanced Technologies (NCAT) and the American Institute for Aeronautics and Astronautics, was held on September 5-6 in Washington, D.C.

Featuring nationally and internationally known speakers, the symposium addressed basic policy issues related to technology development and focused on charting a course to keep American business competitive in the global marketplace. Dr. William D. Phillips, Associate Director of Industrial Technology at the White House Office of Science and Technology Policy, delivered the symposium's keynote address on "A National Technology Policy."

WISE Interns in Washington

IEEE-USA and TAB have selected two students to participate in the 1991 Washington Internship for Students of Engineering (WISE) program. They are Steven J. Ebel, an electrical engineering major at the University of Minnesota in Minneapolis, Minnesota, and Robert J. Lasser, an electrical engineering major at Temple University in Philadelphia, Pennsylvania. The WISE program brings engineering students to Washington, D.C., to learn about the relationship between engineering and public policy. The program's long-term goal is to enhance the engineering profession's ability to contribute to public policy decision-making on technology issues.

Steven Ebel's project, "SEMATECH: America's Answer to the Japanese Semiconductor Challenge: An Assessment," will focus on SEMATECH as an R&D consortium, as a public policy initiative, and as a possible model for consortia expansion. Robert Lasser will examine legislation and technology issues in telerobotics, specifically focusing on NASA's Flight Telerobotic Servicer.

Congressional Testimony

During the 102nd Congress, the IEEE-USA's staff and members of USAB provided key testimony on the following budget and policy deliberations. A sampling of these activities is listed below:

- FY 1992 National Science Foundation Budget
- FY 1992 National Aeronautics and Space Administration Budget
- FY 1992 Department of Defense Budget
- National Energy Strategy
- Research and Experimentation Tax Credit
- Employer Provided Educational Assistance
- Technology Transfer Improvements Act
- Patent and Trademark Policy
- Comprehensive Counter-Terrorism Act of 1991
- Criminal Sanctions for Violation of Software Copyright Act of 1991
- Trademark Protection Act of 1991
- Copyright Amendments Act of 1991
- Civil Rights Act
- Women's Equity Act
- Telecommunications Infrastructure
- Radio Frequency Spectrum Allocations
- High Performance Computing
- Education Legislation
- Defense Production Act Amendments of 1991 (H.R. 378)
- Advanced Technology Program (ATP)
- Legal Immigration Reform
- Individual Retirement Accounts
- Portability of Private Pension Benefits

Some of these items will be discussed in more detail in future columns as space permits.

Report of the Division IV Representative on the TAB Periodicals Council

by Ronald Pogorzelski

The TAB Periodicals Council and the Publications Board met in Raleigh, North Carolina, on November 9 and 10, respectively. As your Division IV Representative, I attended both meetings. A number of items of interest were discussed and several actions were taken. I will try to describe some of the highlights for you here; however, the detailed minutes will be available shortly should you wish to study the issues and actions in more detail.

The Periodicals Council meeting began with the usual adoption of the agenda, approval of minutes, Chairman's remarks, and remarks by the VP for Publication Activities (Tom Cain). Under information items, Pat Walker described the plan for evolving her Magazines Department to a point where it will at least break even financially. IEEE is providing a declining subsidy over the next five years as the department converts to electronic publishing and solicits additional business. This is viewed as a vast improvement over the previous situation in that area. Another information item which may be of interest is the intent of the Communications Society and the Computer Society [possibly in collaboration with the Association for Computing Machinery (ACM)] to begin publishing a new *Transactions* on Networking (of computers, I presume). Although a formal proposal will be brought before the next meeting of the Council and PUB, this preliminary announcement provides an opportunity for any who may perceive an overlap or conflict in area of coverage to come forward at this time so that any issues of this nature can be resolved prior to approval.

Among the action items were a number of interesting proposals and projects. The Neural Networks Council which is concerned with "biologically based computing paradigms" (neural nets, genetic algorithms, and fuzzy systems) is proposing to establish a new *Transactions* on Fuzzy Systems. The Periodicals Council endorsed the proposal. Later, when the issue was proposed to PUB, the preliminary minutes indicated that the motion to approve "sort of passed." (Get it? Fuzzy Systems sort of passed? Yuk, Yuk, Yuk!) But seriously folks . . .

There has recently been a concern about the rather cumbersome process required to begin a new periodical within IEEE. This has hampered the societies in their efforts to respond quickly to emerging areas of research and technology. Saj Durrani of Division IX, having chaired an ad hoc committee on the subject, proposed the establishment of a special standing committee to aid in the start-up of new publications. The reasoning is that this committee would be composed of people very experienced in the approval process and who would thus be in a position to help reduce the time between first proposal and approval to publish. This was endorsed by the Council.

A worthy project which has been underway for some time now is the creation of a set of manuals for editors. A manual for Magazine Editors was circulated at the meeting and approved by the Council. A similar one for Newsletter Editors will be submitted at the next meeting. Finally, a preliminary draft of the Manual for Transactions Editors was accepted by the Council. As a former Transactions Editor, I read this draft with interest. While not providing any earthshaking revelations, it does collect in a convenient volume much of the

information of which such editors must be cognizant. In particular, matters of IEEE policy and ethical principles are crucial. Reviewers should note that IEEE considers 30 day turnaround to be the norm and 90 days to be the maximum! It is my understanding that these manuals will be available to the respective editors shortly.

PUB gave its final approval for the Antennas and Propagation Society to publish its magazine using vendors outside IEEE and this relates to an item on the Periodicals Council agenda concerning IEEE Policies and Procedures which may be of interest to some of you. When a periodical "goes outside" it is still required to pay an administrative charge to cover copyrighting, archiving, etc., as well as "its fair share of fixed department costs at headquarters." It was proposed that this fixed cost component would be levied for a period of three years only (instead of indefinitely) on the premise that three years is sufficient time for the publications department to adjust its operations to accommodate the withdrawal of a publication. The following day the PUB Board endorsed appropriate amendments of the Policies and Procedures. Approval of the Executive Committee is required.

In addition to the above, a large number of rather routine items were disposed of including declaration of several periodicals to be of "general interest" as described in my last column, acceptance of the reports of various periodical review committees and ad hoc committees, and a number of discussions on various aspects of the various IEEE publishing operations. Details of these are available in the minutes for those of you who wish to obtain more information.

Until the next meeting then, "Happy reading, publishing, and editing!"

The IEEE Heinrich Hertz Medal

The IEEE Awards Board established the Heinrich Hertz Medal as a major IEEE annual Award in 1987 under the sponsorship of Industry in Region 8 (Europe). It consists of a gold medal, a bronze replica, a certificate and an honorarium of \$10,000. The distinguishing feature of the award is:

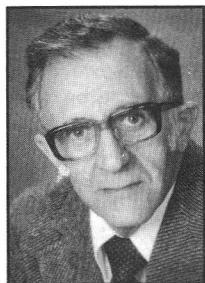
"To recognize an individual for outstanding achievements in Hertzian (electromagnetic) waves. The contribution may be theoretical or experimental in nature; desirably it should be both. It must have been reported widely and with clarity, to enable others to make further contributions."

Previous recipients of the award have been Nathan Marcuvitz (1989), John D. Kraus (1990) and Leopold B. Felsen (1991).

The Board wishes to publicize this award more widely and actively seeks the suggestions of all members for potential candidates in future years. These should be communicated to me by letter or telephone at my home address below. If you feel very strongly about a potential candidate you may make the nomination yourself. The proper form and instructions may be obtained by writing or calling the office of the Secretary of the IEEE Awards Board, 345 East 47th Street, New York, NY 10017 (tel. 212-705-7882). The deadline for submitting 1992 nominations is July 1, 1991.

Allan W. Love, Member
IEEE Heinrich Hertz Medal Committee
518 Rockford Place
Corona del Mar, CA 92625
(tel. 714-760-0399)

The M.I.T. Radiation Laboratory 50th Anniversary Celebration



*Ted Saad
Honorary Life Member
of the MTT-S AdCom*

Background

The date of the 1991 MTT-S Symposium was chosen to coincide as closely as possible with the 50th anniversary of the start of the M.I.T. Radiation Laboratory (RADLAB). Early in 1986 a RADLAB committee was formed, which eventually included Peter Staecker, Dick Sparks, Harlan Howe, Roger Sudbury, Joe White and myself, and for a limited time, George Jerenic and Art Blaisdell. Since I was the only individual on the Symposium Committee who was also an alumnus of the RADLAB, I assumed the role of chairman. In addition, we learned early on, that it would be wise for our committee to contact Dr. Albert G. Hill at M.I.T.

Dr. Hill was a RADLAB alumnus, having served as a Group Leader and as a Division Head. He was an early director of the Research Lab for Electronics at M.I.T. and was also the Director of Lincoln Labs in the early 1950's. He was a Professor Emeritus of M.I.T. His presence on our committee gave us the needed contact and stature with both the RADLAB people and the M.I.T. community.

Although we had informal conversations as early as 1984, our first meeting was in January of 1986, when we began groping for direction—what to do and how to do it. Our first session with Al Hill was in February of 1987.

Since a number of activities prior to the Symposium were operating in parallel, I shall discuss each activity separately, in an effort to keep matters clear and somewhat organized.

The Videotape Project

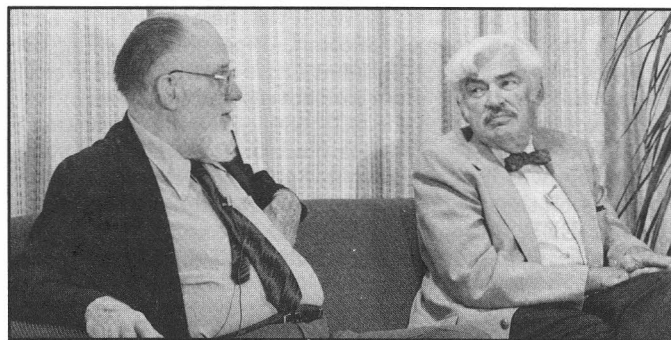
One of our initial thoughts was to videotape a series of conversations with RADLAB alumni and alumnae. To that end, after several meetings, we arranged for a dinner meeting on May 8, 1987, with 14 ex-RADLAB members and spouses, plus members of our committee. We videotaped the discussion portion of the meeting, using MTT-S video equipment. The discussion was of a general nature, focused on the future symposium. The concept of videotaping conversations with ex-RADLAB people seemed to be well received.

Later in September of 1987, using facilities and people provided by M/A-COM, a sample tape was prepared using Al Hill and Bob Pound as the interviewees, with me as interviewer. After viewing the tape, it was clear to us there was much we had to learn in order to prepare tapes of professional/useful quality.

We then decided to discuss the problem with a few professional documentary film makers. One proposal indicated that we would need at least \$150,000 to properly document the RADLAB story. During this period, we also spoke with the



May 8, 1987, Dinner Meeting (clockwise from furthest left): Robert Fano, Herbert G. Weiss, Nathaniel Rochester, Mrs. Rochester, William Allis, Susan Staecker, Peter Staecker, William Schwann, Mrs. Schwann.



Our taping attempt (L to R): Al Hill, Bob Pound.

people from NOVA. After some deliberation, our committee decided that we would prepare a prospectus discussing the film project in detail, including why it would be of interest to the general public, pointing out the historical significance, the impact of the RADLAB on World War II, the companies that were involved, the people of RADLAB, the impact on education and technology, etc. . . . The intent was that we would show the prospectus to NOVA, ask for an encouraging indication that they would consider using it as one of their productions. If such an indication was obtained, we would then plan to go to the next AdCom meeting for endorsement, along with a plan to raise the necessary funds through industry solicitation. This discussion took place in April of 1988.

. . . In the meantime . . .

"Echoes of War"

On March 18, 1987, George Jerenic and I met in my office with a Brian McCormack, an independent film producer who had produced films that had been used by NOVA. We met in my office, since he was planning to do a film on Tesla and he wanted to borrow the Tesla books I had in the Historical Collection, which was still kept in my office at the time. I suggested that he give serious consideration to the RADLAB story—a story that had never been told to the general public. Along with the Tesla material, he took a series of books on the RADLAB. Some weeks later, he returned the books without comment. Later, on October 27, 1987, a young lady from NOVA came by to borrow the RADLAB books. She kept them for a few weeks, then returned them, again with no comment.

. . . Meanwhile—back to April 1988 . . .

Peter Staecker and Harlan Howe assembled the prospectus and Peter called NOVA to find out to whom the document should be directed. It was in that phone conversation that we learned that Linda Garman, of the NOVA staff, was already embarked on a project to write, direct, and produce a NOVA film on the RADLAB.

At that point, we abandoned our prospectus and all it implied and focused our efforts to helping Linda Garman and

the staff at NOVA. We had several meetings with Linda. We introduced her to a number of RADLAB alumni, gave her the latest mailing list, suggested people to call, people to visit, etc. . . . We also suggested she visit the Historical Electronics Museum in Baltimore.

While at the Baltimore Museum, she noted the SCR-584, which at the time was non-operating. She asked us to help in finding people to revive it to working condition for purposes of filming. Through the museum in Baltimore and retirees at Westinghouse, with the help of Bob Dwight, Warren Cooper, Ernie Farkas and others, the 584 was brought to life and eventually trucked to Massachusetts. Through Roger Sudbury at Lincoln Lab, arrangements were made to have the 584 placed at the Lincoln Lab Millstone Hill Field Station in Westford, MA, for filming. With the help of Roger, Dick Sparks, and a number of Lincoln Lab people, including Leo Sullivan, who operated the 584 at Anzio during World War II, the system was put in place and successfully operated.

The actual filming of the SCR 584 in operation tracking a World War II vintage P51 took place on November 3, 1988.

The film was finally shown at 8 p.m. on October 24, 1989, on NOVA on the national network of the Public Broadcasting System. IEEE, through the MTT, ED, AP, and AES Societies and the IEEE Foundation contributed \$60,000 to the produc-

tion. For that, at the end of the program, there was a freeze frame acknowledging the contribution.

The M.I.T. Plaque

Another activity that must be mentioned is the presentation of a "Milestone Plaque" to M.I.T., commemorating the establishment of the M.I.T. Radiation Laboratory. The plaque was prepared by the IEEE History Committee at the request of the Boston Section of the IEEE, which, at the time the application was made, was chaired by Harlan Howe. The process required that an application for the plaque be prepared, which Harlan did, and submitted to the History Committee.

The presentation was made on October 9, 1990, by Mr. Eric E. Sumner, President of the IEEE, to Dr. Paul E. Gray, President of M.I.T., at a small reception at M.I.T. attended by a number of former RADLAB people.

The plaque is mounted in the first floor corridor of M.I.T. Building 4, near the original location of the RADLAB.

The Calendar

Another one of our parallel projects was the preparation of the special MTT-S 1990-1991 calendar. Harlan Howe undertook the project, working with the M/A-COM publications department. The calendar covered the period from October 1990 through December 1991. Commemorative photographs were obtained through the courtesy of the M.I.T. Museum, headed by Warren Seamans. RADLAB/World War II historical dates were noted in the calendar, along with MTT-S dates.

The calendar was mailed out to the entire list of potential symposium attendees, along with registration forms for the Symposium. Copies were also mailed to the RADLAB mailing list.

The Mailing List

During one of our earliest meetings, we obtained a mailing list from M.I.T. of the RADLAB members who had attended an earlier anniversary celebration, either the 25th or 35th. Clearly, the list was somewhat dated. Nevertheless, I put the list on my computer as a starting point. Using the list, we began mailing copies of the MTT-S newsletter to RADLAB people to keep them posted on the plans for the Symposium.

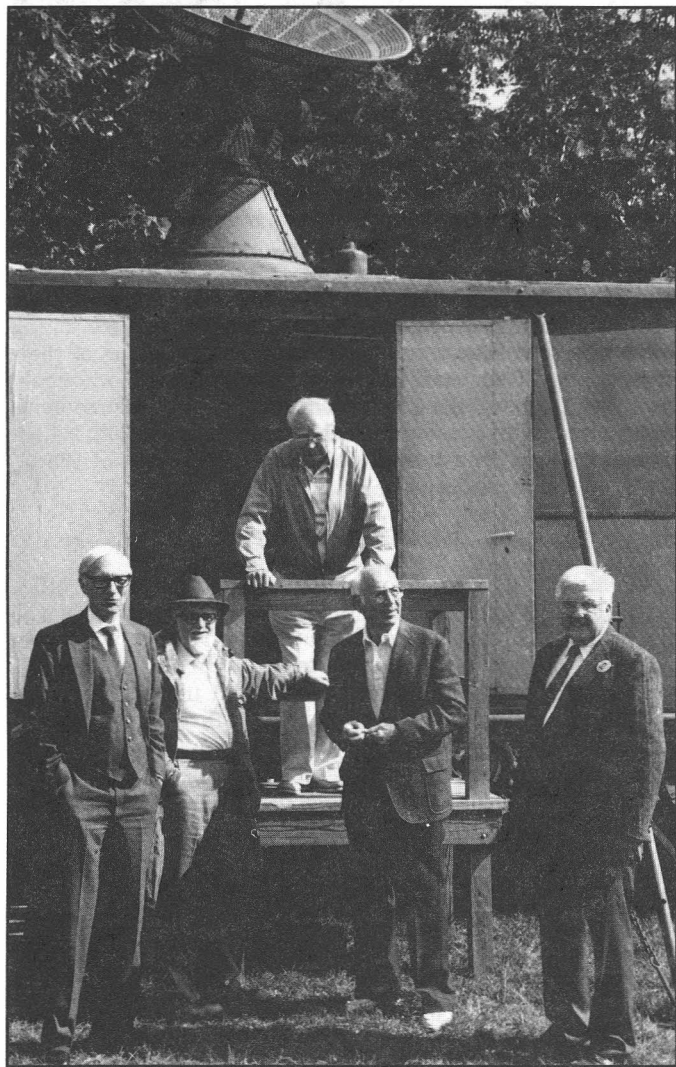
Using the mailing list, a questionnaire was mailed to the RADLAB people in June of 1990. Included with the questionnaire was a letter describing the Symposium, a copy of the mailing list, along with a stamped-addressed envelope. This process began to give us an indication as to who and how many might plan to attend the Symposium. In addition, it provided us with an updating of the mailing list. Some names had to be deleted, some having passed away, others because of the wrong address. Fortunately, more names were added as people who mailed the questionnaires included names that were not on the original mailing list.

Eventually, I heard from 219 RADLAB people—129 who said they were coming, and 59 who said they might come. In addition, about 75% wrote that they were bringing spouses.

The process of updating the mailing list is still going on. The list, which included 163 names to start with, is now at 421 names. The latest copy of the mailing list was supplied to each RADLAB member at the Symposium.

Registration Procedures

In February 1991, two letters explaining the Symposium in detail, along with specially marked (RADLAB) registration forms, plus preliminary programs, were mailed to everyone



The Echoes of War filming in front of the 584. The 584 crew (L to r): Lee Davenport, Leo Sullivan, Ivan Getting, Hank Abajian, George Harris.

on the RADLAB mailing list. Also included was an addressed postcard to indicate whether they planned to attend. The postcards came back, telling us that 185 planned to attend, most with spouses. Later, a final letter with a few more details was mailed to all of those who had returned postcards that they planned to attend.

The registration forms for both the symposium and the hotels were specifically coded, so that the RADLAB members would receive special attention—which they did.

We urged them to stay in the Sheraton Boston Hotel, because of its proximity to the Hynes Auditorium.

At the Symposium, in the registration area, a small space was set aside for RADLAB people. One of the registration desks was designated in part for RADLAB. Registration, for the most part, went smoothly for the RADLAB members. However, when there were small problems, some of us, including Roger Sudbury and George Heiter, stepped in to smooth the registration waters.

The Five Year Book

During the first meetings of the RADLAB Committee we explored at length the matter of supplying a "RADLAB" type gift to attendees at the Symposium. One of our first considerations was to furnish copies of the NOVA tape "Echoes of War." Although there was some initial interest in the possibility, we found that the pricing was a bit prohibitive. In addition, we realized that not everyone would have a VCR, and it was not a coffee table type gift.

We then discussed the possibility of republishing the famous red book, *Five Years at the Radiation Laboratory*. The book had been published at the end of World War II and was given to each RADLAB member. We started with the premise that we would simply reprint the book as it was, and in that context, we began to get quotations. Early on, we realized the pricing was within our budget constraints. We then discussed all the problems associated with reproducing the book. We needed permission from M.I.T.—which we received. We decided to include some material from E. G. Bowen's book, *Radar Days*, in which he describes in detail the delivery of the UK 10 cm cavity magnetron and the formation of the RADLAB. Despite the fact that Dr. Bowen had had a stroke in 1989, we were able to receive permission for publication from his son. We also included in the final edition most of the material that had been deleted in the original version due to security classification.

This was a major effort, but we were again fortunate in having Roger Sudbury handle the entire project. He went beyond the requirements set out by the committee and produced what must be called a classic, a true collector's item.

The book was produced in both soft cover and hard cover by Braun-Brumfield Inc. of Ann Arbor, MI, who also produced the 3 volume Symposium Tome.

The book in hard cover form was presented to RADLAB attendees, the AdCom, the Steering Committee and other distinguished guests. The book in soft cover form was presented to all other Symposium attendees.

RLE Currents and AESS Magazine

In the early days of preparation, the Steering Committee was approached first by the IEEE Aerospace and Electronic Systems Society (AESS) and later by the Research Laboratory for Electronics at M.I.T. (RLE) about magazines they were planning to publish.

In the case of AESS, they planned to publish in October 1990 a copy of their magazine devoted to RADLAB. I was invited (and accepted) to be the editor. They offered to overprint a number of copies at nominal cost for distribution at

the Symposium. We agreed to purchase 2,000 copies.

We had a similar offer from RLE. They were planning a special issue of their *RLE Currents*, again devoted to RADLAB. Here, too, we agreed to purchase 2,000 copies.

The two magazines, along with a hard cover copy of the *Five Year Book*, plus the latest RADLAB mailing list, were given to each RADLAB member at the Symposium. The remaining magazines were placed in the Historical Collection Lounge area for pickup by general attendees.

The Keynote Address

While all these other activities were going on, our committee, with the help of Al Hill, was considering the elements of the Symposium program. We concluded that it would be appropriate to have as the keynote speaker a distinguished RADLAB alumnus. After considering a few possible candidates, we settled on Dr. Norman F. Ramsey. Dr. Ramsey had been the first Group Leader of the Fundamental Development Group of the RADLAB. In addition, he had won the Nobel Prize for Physics in 1989, the IEEE Medal of Honor in 1984, and he was one of the stars in "Echoes of War." His presentation was outstanding in all respects.

We had hoped to obtain a videotaped interview with Dr. Lee A. Dubridge for presentation at the Plenary Session, but unfortunately, poor health made it impossible. However, he was able to send us a beautiful letter, which Peter Staecker read prior to the keynote address.

The Special RADLAB Session

As the main technical portion of the Symposium program devoted to the RADLAB, we organized a 90 minute session. We decided to cover Theory, Components and Systems, in that order. We invited Dr. Nathan Marcuvitz to discuss Theory, Robert Pound to cover Components, and Dr. Ivan Getting to talk about Systems.

The session was a success with only one problem, for which I take full responsibility. Although I had impressed on each speaker that they were limited to 30 minutes each, I noted that there was no session in the same room until an hour after we were scheduled to end. Consequently, when Dr. Getting asked me if he could use a little more time—I said "no problem." And so, he proceeded. Little did we realize that the Hynes management was scheduled to turn on the air conditioning 5 minutes *after* our session was scheduled to end. The net result was that the air conditioner came on on schedule, generating such a loud noise that Dr. Getting had to shout into the microphone to be heard. Eventually, the air conditioner was shut off and things went back to normal, but it came back on again a few minutes later, and again, it took minutes to turn it off. Despite the unfortunate interruption, the hall was nearly full and the session was very well received.

In addition to this special RADLAB session, there were two other sessions of RADLAB interest. The first was a special session during which Professor Robert H. Dicke was honored for his invention of the Microwave Radiometer. At the Awards Banquet Wednesday evening, he received the 1991 MTT-S Pioneer Award for his invention. The second session, which was organized by Dr. Britton Chance, who was a group leader at RADLAB, was devoted to "Time Resolved Spectroscopy and Imaging of Tissue."

Social Activities

To provide a meeting place for RADLAB people, one of the three rooms set aside for the Historical Collection was provided as a lounge with tables and chairs. Along the walls



(L to R): Joseph Helsajn, Heriot-Watt University; Robert H. Dicke, Pioneer Award Recipient, former RADLAB member; Dick Sparks, Raytheon.

where was a series of large *Life Magazine* cover photos depicting the World War II era, along with a juke box and some 1940's records. These latter items were generously contributed by Chuck Swift.

The room was well used, coffee and cold drinks were available. It is a feature that should be repeated in future symposia.

On Tuesday evening, a reception was held in the hall outside the three Historical Collection rooms. Wine and food were provided. Although attendance was presumably limited to RADLAB people, Steering Committee members, AdCom members, distinguished visitors and spouses of all of the

above, no careful screening was made of attendees. There were probably 400 people in attendance and a pleasant early evening was had by all. From the reception, about 100 RADLAB people plus spouses, as well as AdCom and Steering Committee members were bused to Boston Symphony Hall for the usual outstanding evening at POPS.

Summary

There is probably more in this report than people really want to read, and I am sure I have left out some key elements. We have no real hard count on how many RADLAB people attended. My best guess is about 170, plus about 130 spouses.

The mailing list is still in my computer—being updated as required.

Since the Symposium, I have received at least 30 letters thanking all of us (the Symposium Committee) for the outstanding event we put on for their benefit.

I would be remiss if I did not mention how much the celebration was indebted to all the members of the Steering Committee. I personally want to thank my leaders, Peter Staecker and Dick Sparks, the ever competent, ever cool John Putnam, and my favorite wine expert, Joe White. And special thanks must go to Harlan Howe and Roger Sudbury.

Editor's Note:

The above report was submitted as part of the Final Report on the 1991 IEEE MTT-S International Microwave Symposium. Ted Saad, one of the founders of the MTT-S, did his usual fine job in organizing and performing an outstanding and memorable RADLAB celebration.

The Historical Electronics Museum is located at 920 Elkridge Landing Road in Linthicum, Maryland, U.S.A. Further information about the museum and its activities may be obtained by writing to the Director, Robert L. Dwight, at the Historical Electronics Museum, P.O. Box 1693, MS4610, Baltimore, MD 21203 (tel. 301-765-2345). The Museum is a non-profit organization.



(L to R): Seated—Susan Staecker, Fi Saad, Mrs. Norman F. Ramsey, Eloise White, Ms. Shore; standing—Peter Staecker, Ted Saad, Norman F. Ramsey, Joe White, Daniel Shore. At the banquet: Ramsey—Keynote Speaker; Shore—Banquet Speaker.

3rd International Symposium on Recent Advances in Microwave Technology (ISRAMT-91)

*Banmali S. Rawat, EE Dept.
University of Nevada, Reno, NV*

The 3rd International Symposium on Recent Advances in Microwave Technology (ISRAMT-91) was held in Reno, Nevada, from August 18-21, 1991. The symposium was jointly sponsored by the University of Nevada (Electrical Engineering Department, College of Engineering), Desert Research Institute, and IEEE Northern Nevada Section in cooperation with URSI and the Electromagnetic Academy and was supported by Martin Marietta Laboratories. The ISRAMT was started in 1986 at the University of North Dakota, Grand Forks, North Dakota, with a limited number of invited speakers. Within a short span of five years it has grown to a well established international microwave conference which is evident from the papers received from 20 countries of the world. After the success of the 2nd ISRAMT in Beijing, China, in 1989, many international organizations have shown interest in holding future ISRAMT in their countries. The locations for future ISRAMT up to the year 2000 have already been selected.

The 3rd ISRAMT was held under the chairmanship of Dr. William N. Cathey, the Associate Vice President for Academic Affairs at the University of Nevada, Reno. The technical program committee under the chairmanship of Professor Banmali S. Rawat, University of Nevada, Reno, and Dr. Krishna K. Agarwal, E-Systems, Texas, selected 146 invited and contributed papers for the conference. This included 115 regular session and 31 poster session papers. The fine conference arrangements were made under the chairmanship of Professor Bruce Johnson, University of Nevada. The conference was organized in the famous Bally's Hotel in Reno.

The ISRAMT started on August 18 with a complimentary reception in the evening for all the participants and their guests. The atmosphere was very informal and relaxed. The arrangements were superb without any flaw. The Plenary Session on August 19 at 9:00 a.m. started with opening remarks by Dr. William Cathey who presided over the Plenary Session. After these remarks, Dr. Harold Sobol, Associate Dean for Engineering Research at the University of Texas, Arlington, delivered the excellent keynote address. His topic was the "Directions in Microwave Research and Education." He focused on the future industry requirements and type of training the microwave engineers/researchers will be required to go through to meet the industry needs.

After the morning coffee/tea break, the conference was broken into three parallel sessions. The morning sessions were: Session 1—Microwave Solid State Devices; Session 2—Ferrite Components; and Session 3—Transition/Discontinuities. While the Session 1 and 3 were equally shared by U.S. and foreign papers, Session 2 had all the papers from abroad. The Session 1 focus was GaAs MESFET, Schottky Diode Analysis and Computer Modeling. The Session 2 was geared toward finlines, gyrotropic structures and optically controlled resonators. The Session 3 papers discussed the

microstrip to coaxial transition, waveguide to microstrip transition, step discontinuity and HFSS simulation of microstrip T-junctions. The afternoon sessions on August 19 were: Session 4—Computer Aided Design; Session 5—Propagation and Fields; and Session 6—Measurement Techniques. All these sessions were a good combination of U.S. and foreign papers. The CAD Session included the papers on finlines, microwave filters, symmetrical wave guides, broadband microwave circuits, dielectric resonators and active filter design techniques. The Propagation and Fields Session had a good variety of papers on mm-wave propagation window in Indian Subcontinent, scattering and global numerical boundary conditions, multiple scattering by randomly distributed scatters, scattering from a perfectly conducting cylinder with axial infinite slot and scattering by a coated conducting prolate spheroid. Most of the papers in this session were from abroad. The Session 6 was again a good combination of U.S. and foreign papers. The measurement techniques discussed in this session included the simultaneous measurement of complex permittivity and permeability using 6-port technique, nondestructive measurements of permittivity, use of a coaxial microwave sensor for material characterization, noise measurement and de-embedding measurement of microstrip discontinuities using least-square technique. The evening of August 19 was free so that the participants could enjoy the entertainment world of Reno.

On August 20, four morning sessions were scheduled. However, the Session 10 on "Microwave Tubes" had to be cancelled due to the absence of the presenters. All these papers were from a single foreign country and most of them from the same institution. The Session 7 on "Microwave Education" was a very timely and lively session. All the papers were from the U.S.A. and covered the topics from Microwave Laboratory, laboratory applications of modulation domain analysis to microwave devices/circuits graduate courses, option for engineering design education, integration of humanities-oriented skills with technical skills in microwave laboratory and phase noise characterization in the laboratory. The Session 8—"Microwave Circuits" had most of the papers from the U.S.A. and included the topics of simple aided frequency acquisition method for microwave PLL, monolithic 6-bit phase shifter for active phased arrays, MMIC GaAs power amplifier, 2-10 GHz MESFET distributed amplifier, 31 GHz microwave link system and performance and study of SNR requirement at threshold detector input. The Session 9—"mm/Submillimeter Wave Technique" included the topics of submillimeter wave distribution parameter detectors/converters, millimeter wave array antenna with prebeam forming dielectric radiators, THz band development and mechanical resonance stabilization of mm-wave Fabry-Perot resonator using a vector network analyzer. The afternoon of August 20 was devoted to three large sessions. The Session 11—"Antenna Systems" included the papers on microstrip patch antenna, cavity-backed slot antenna, stepped dipole antenna, spherical dipole antenna, Fourier analysis of dipole antenna, scanning of antenna sidelobes and modeling of probe-fed structures for broadband antenna applications. The Session 12—"Transmission Lines/Waveguides" had papers from the U.S.A. and abroad. Due to no-show, very few foreign papers were presented. The presented papers were in the area of solutions in nonlinear transmission lines, leaky surface wave transmission lines, shielded microstrip analysis using modified finite-element formulation, transmission lines for multilayered integrated phase arrays and optimization design for lower conductor loss in microstrip lines. In Session 13—"Industrial/Biological Applications," most of the papers were from abroad. The papers presented included the remote sensing parameters of vegetation by radiometry, open-ended coaxial line

sensors, microwave sensor for continuous monitoring of the tip location of a robot arm, road-condition sensing microwave radar and electromagnetic/thermal modeling of asphalt aggregate mixtures under microwave heating.

The evening of August 20 was reserved for the conference banquet. Again the atmosphere was very relaxed and the dinner menu was an excellent selection by the organizers. Dr. James V. Taranik, President of Desert Research Institute in Reno, was the banquet speaker. He spoke on "Space-Borne Radars for 90's" focusing the radar systems for Magellan and other spacecraft. Dr. Jon Epps, Dean, College of Engineering, University of Nevada, was the master of ceremonies. He gave some background about ISRAMT and microwave activities at the University of Nevada and also introduced the banquet speaker. Dr. Ken Hunter, Associate Vice President for Research and Graduate Dean at the University of Nevada, presented a brief history of research programs in the University. Dr. Bruce Johnson spoke about the conference organization, support from the microwave industry and local community. Professor Rawat thanked all the sponsors/supporters and the University of Nevada, Reno, for this great event.

August 21 was the last day of the conference but was equally important. In the morning, there were three regular parallel sessions and two poster sessions. However, due to some last-minute cancellations, Sessions 15 and 16 were merged together. The Session 14—"Microwave Superconducting Circuits and Systems" included many excellent papers on the emerging field, especially the topics on current and field distributions in superconducting microstrip lines, applications of HTSC thin films in MIC delay lines, hybrid high-T_c superconducting microwave oscillators, microwave properties of highly oriented YBa₂Cu₃O_{7-x} superconducting thin films and HTSC applications in microwave systems. The combined Session 15—"Passive Components"/Session 16—"Optical Fibers/Optoelectronics" consisted of papers on lossy multiport planar networks, Simplified Design of Microstrip Line Combine Filters, HFSS Simulation of Finline Power Divider at Ka-band, Spurious Suppression Bandpass filters, Modeling of Integrated Optical Components and Intensity Modulation Bandwidth in Semiconductor Laser Diodes.

The poster sessions were arranged in the morning and afternoon on August 21, 1991. The 24 poster session papers were on a variety of topics like microwave propagation modes for rapid deep space, dielectric constant measurements, spectral analysis of surface skimming bulk waves, asymmetric coupled cylindrical microstrip lines, interdigitated DC blocks/transformers in amplifier design, 12 channel PCM sound satellite broadcast receivers, microwave applications in electron magnetic resonance, etc.

On August 21, the main highlight of the afternoon sessions was the workshop on "Microwave Superconductivity Applications" organized by Dr. Krishna K. Agarwal from E-Systems, Texas, and Dr. Zhi-Yuan Shen from DuPont, Delaware. This workshop was attended by 21 participants from the U.S. and abroad. Dr. Agarwal introduced the theme of the workshop and discussed the basic physics and concepts of HTSC. Dr. Jim Bybokas from Superconductor Technology, Santa Barbara, CA, spoke about the superconductivity building blocks for microwave systems, while Dr. Shen discussed the power splitters, combiners and other passive devices. After the coffee break, Dr. Don Butler from Southern Methodist University, Dallas, Texas, presented the HTSC micro-bridge mixer techniques, and Dr. Jerry Fiedziuzko from LORAL Space Systems, Palo Alto, CA, discussed HTSC resonators, filters and channelizer. Each speaker was given 20 minutes for presentation followed by 10 minutes discussion. The discussions were very lively and showed the keen interest the

microwave community has in this emerging field. A short booklet about the workshop is under preparation and will be mailed to all the participants.

Besides these technical sessions, the tours of the EE Department facilities and exhibit booths by some well known microwave companies like HP, Tektronix, Wiltron, etc., were also organized. The tours to famous Lake Tahoe and other tourist attractions were arranged through local travel agents. On the evening of August 21, the ISRAMT advisory committee meeting was held to discuss various issues and next ISRAMT in New Delhi, India, in 1993.

Overall the conference was very well received by all the participants and everyone thoroughly enjoyed the relaxed atmosphere of a smaller conference and opportunity to interact with each other. In total there were 111 participants from 13 countries including U.S.A., Canada, Germany, Japan, China, India, Italy, Spain, Austria, Australia, France and Korea.

With the success of the 3rd ISRAMT we are looking forward to seeing more participants from developing countries in the 4th ISRAMT in New Delhi, India, in 1993. The ISRAMT Technical Program Committee has brought out an excellent *Proceedings of 3rd ISRAMT Conference Papers* which can be purchased by writing to: ISRAMT Technical Program Committee, EE Department, University of Nevada, Reno, NV 89557-0153, fax (702) 784-4466, phone (702) 784-6927.

TAB Highlights

(Continued from page 30)

of financial data to Societies, including the charges for services rendered. (G)

Again, it is satisfying to find that we already act in accordance with the relevant goals on this list, and that we are in agreement with those goals that specifically apply to the TAB. AdCom may therefore want to endorse these 1992 goals, as well. We could advantageously use them as frame of reference for our related action items.

I mentioned in my last TAB Highlights that Society reviews are in progress. As a member of the TAB Society Review Committee I participated in two reviews of Division X Societies that took place on October 4. I found these reviews highly profitable for both sides, because they have been conducted in a constructive, non-adversarial way. I am sure that a great deal of most useful information will result from this series of reviews. We may want to consider using the same basic approach and process for MTT-S' internal reviews of the Technical Committees.

Vice President Reynold Kagiwada joined me for two of the three days of the October 4-6 TAB meetings (for their sequence and purpose refer to the first paragraph of my preceding TAB Highlights). This was very favorable for a variety of reasons, such as a smooth transition of presidency, on-the-spot business dealings with representatives of other Societies, and generally better representation of our Society in the highly dynamic multi-party and multi-issue deliberations. I therefore suggest that in the future we systematically send both the President and the Vice President to all TAB meetings.



THE FIFTH IEEE BIENNIAL CONFERENCE ON ELECTROMAGNETIC FIELD COMPUTATION

IEEE

FINAL CALL FOR PAPERS

SPONSORS: The IEEE Magnetics Society and Harvey Mudd College.

COOPERATING SPONSORS: The IEEE Education, Microwave Theory and Techniques, and Engineering in Biology and Medicine Societies, IEE London, IEE Japan, IE Australia, Magnetics Society of Japan, IEEE Canada, The Japan Applied Electromagnetics Society, The Applied Computational Electromagnetics Society, The Electromagnetics Academy, The IEEE Los Angeles Council, The Electric Power Research Institute and IBM's Storage Systems Products Division.

VENUE: Harvey Mudd College, Claremont, CA.

DATES: 3rd to 5th August, 1992.

SUBJECTS: All aspects of electromagnetic field computation.

PUBLICATION PROCESS AND DEADLINES:

- i By **21 Feb., 1992** submit a 2-page digest (emphasizing results to show the completeness of work) to the IEEE CEFC Secretariat. All accepted papers (notification by 6 April, 1992) appear in the Conference Digests distributed at the conference.
- ii All accepted authors are invited to submit their full papers by 1 June, 1992, for review under standards prescribed by the IEEE Technical Activities Board for publication in the special CEFC sponsored March 1993 issue of the IEEE Transactions on Magnetics or the February 1993 issue of the IEEE Transactions on Education, as appropriate.

OTHER MATTERS: A free, pre-conference course on introducing computer techniques in the electromagnetics classroom will be conducted for instructors during 30-31 July, 1992. The conference will be followed by the TEAM/ACES Workshop on field computation code-validation during 6-7 August, 1992. Subsidized on-campus housing and air-travel available.

FURTHER ENQUIRIES: From the CEFC Secretariat, Harvey Mudd College, Claremont CA 91711. Tel. 714 - 621 8019; Fax 714 - 621 8465; E-mail: CEFC@HMCVAX.BITNET.

S. Ratnaveevan H. Hoole
General Chairman - IEEE CEFC

ANNOUNCEMENT AND CALL FOR PAPERS

IEEE AP/MTT-S • Philadelphia Section

TENTH ANNUAL

BENJAMIN FRANKLIN SYMPOSIUM

on Antenna and Microwave Technology in the 1990's • May 2, 1992

The Philadelphia Chapter of the IEEE AP/MTT-S will hold its 10th Annual Benjamin Franklin Symposium on Saturday, May 2, 1992, from 8:30 a.m. to 5:00 p.m. This one-day symposium will consist of:

Morning Session: Plenary Session of Invited papers

Afternoon Session: Parallel Sessions of Contributed Papers on:

- a. Antennas and Propagation: Phased Array Technology, Antenna Design, Radiating Elements and Phase Shifters, Antenna Applications, Imaging and Radiometry, Remote Sensing, Scattering and Diffraction, and Wave Interaction with Complex and Chiral Materials.
- b. Microwave Theory & Techniques: Microwave Networks and Filters, Solid State Devices and Circuits, Millimeter Waves and Monolithic Technology, Ultrafast Optoelectronics, Optical Technologies Applied to Microwave, and Microwave Applications.

PLACE: Sheraton University City, 36th & Chestnut Sts., Philadelphia, PA 19104

PAPERS: Authors are invited to submit papers in either field. Please send a camera-ready summary (one to four 8.5" x 11" pages with one inch margins) by February 23, 1992, to:

Professor Afshin Daryoush
Department of Electrical and Computer Engineering
Drexel University
Philadelphia, PA 19104
e-mail: daryoush@ece.drexel.edu

FURTHER INFORMATION: Please call Afshin Daryoush, Drexel U. (215) 895-2362; Andrew Ochdlick, NADC (215) 441-1993; or Ahmad Hoorfar, Villanova U. (215) 645-7223.

MWE '91

(1991 Microwave Workshops and Exhibition)

Tatsuo Itoh
1990 President

MWE '91, held in Tokyo on September 17-19, 1991, was planned by IEICE APMC National Committee in cooperation with IEICE Microwave Research Group and IEEE MTT-S Tokyo Chapter to keep the momentum gained by the remarkably successful 3rd Asia-Pacific Microwave Conference (APMC) held in Tokyo in September 1990. It is planned that MWE be held every year except for the year in which APMC is held in Japan. As was the case in APMC, Microwave Exhibition and Microwave USA were held concurrently. The venue was also the same as last year at the World Import Mart in Tokyo.

MWE '91 started, after the Opening Ceremony, with the keynote address by Professor K. Miyauchi on High-Speed Digital Transmission Technology in Microwave, Millimeter-Wave, and Lightwave Regions in Japan. The main part of the workshop consisted of three components: Tutorial Sessions, Specialists Workshop Sessions, and Technical Seminars (by companies participating in Exhibition). This composition is in line with the intention of the Organizing Committee to make MWE covering the themes ranging (1) from basic research to applications, (2) from academic to industry, and (3) from

tutorial lectures to the frontiers of science. This philosophy seems to be one of the elements contributing to the remarkable success of the MWE, as mentioned below.

The language used was Japanese. English was used in the sessions participated in by foreign speakers. There were two three-hour tutorial sessions for two days. The workshops contained eight three-hour sessions (Lightwave/Microwave Interaction Devices, Circuits and Systems; Microwave High-T_c Superconductors and Cryogenic Semiconductor Devices; Satellite Communication Technology; Electromagnetic Analysis for Guided Wave Structures; Satellite Broadcast Technology; Remote Sensing; Microwave and Millimeter-Wave Transistors; Circuit Technology for MMIC). Five Technical Seminars by Japanese companies, and another five Technical Seminars by U.S. companies were held. The registration for MWE was free, but the *Proceedings* cost ¥3,000 (about \$22.00). The total number of registrants was 1,295 while the number of visitors to the exhibits (of more than 200 booths) was 2,651. These numbers far exceeded the committee's estimate of 500 and 2,000. All 800 copies of the *Proceedings* were sold out. The committee created a sign-up sheet for later distribution of additional printing. A very typical reception (¥5,000) was held on the evening of the first day and was attended by over 100 people.

1991 Asia-Pacific Microwave Technology and Education Workshop

Tatsuo Itoh
1990 President

The workshop was held on September 24-26, 1991, at National Chiao-Tung University in Hsinchu, Taiwan. The organizer was Prof. S. T. Peng and his colleagues at the same university. This is an activity of the IEEE MTT-S Taiwan Chapter. This workshop was preceded by MWE '91 in Tokyo in the previous week. The first day was devoted to 8 tutorials in two parallel sessions ranging from the solid state devices to mobile communication systems. These sessions were open and attended by 93 participants. The next day was devoted to two workshop sessions, one on Microwave Education in the morning and another on Microwave Technology in the after-

noon. In these two sessions, 6 speakers each delivered their views toward the subjects of their choice with relevance to the Asia-Pacific region. These presentations were followed by heated discussions by the speakers and audience. The speakers were from Taiwan, Japan, Korea, Singapore, U.S. and Germany.

The morning of the third day was used for a wrap-up of the second day. The attendance on the second and third days was about 30 as these sessions were by invitation.

This was the first time that this type of workshop involving people from many Asia-Pacific countries was held in Taiwan in the area of microwaves. It was felt that this workshop was instrumental in creating a momentum toward organizing the APMC in 1993 in Taiwan.

National Science Foundation

The Engineering Directorate of the National Science Foundation is announcing a new focus on innovative, combined research-curriculum development in technological areas of national importance. The objective of this important effort, for which NSF is seeking proposals, is to stimulate classroom involvement of research-oriented faculty. There are two components to this program: one involves research and the other education. The research must include, although it is not confined exclusively to, an electrical and communications systems component and may involve only other disciplines

represented by the Divisions of the Engineering Directorate. Proposals would be expected to show how such research results can be integrated into new or existing curricula. Institutions would be required to commit to the utilization of such curriculum components. The deadline for submission of proposals to NSF is the end of January 1992. Inquiries regarding the education component of the program can be made to Dr. Frank D. Draper (202/786-9634), and to Dr. Albert B. Harvey (202/357-9618) regarding the research topic areas.

Packaging, Interconnects and Optoelectronics for the Design of Parallel Computers Workshop

March 18-19, 1992

Hyatt Regency Woodfield, Schaumburg, IL

Scope:

The use of multiprocessors in computing systems and the need for higher speeds have prompted the advent of advanced interconnect technologies. Presently, the clock rates of high-speed computers are limited by interconnection delays rather than device speed, and interconnect and packaging issues will play an increasingly important role in the implementation of computer systems. More specifically, the choice of a given machine architecture will be strongly determined by packaging and interconnect considerations. Multichip modules (MCM) are emerging as an attractive packaging solution with design advantages such as cost and reliability. Optical interconnections have provided higher speed and connectivity in computing applications. The successful implementation of these technologies into high-performance computers requires an understanding of the fundamental interconnect limitations and their relations to machine architecture.

Workshop Objective:

The objective of the meeting is to convene researchers, manufacturers, technologists and designers involved in packaging, optoelectronics and computer architecture. Invited speakers will address issues pertaining to machine organization, routing, partitioning, electromagnetic compatibility, clock delay, interconnect modeling and simulation, computer-aided design (CAD) tools, optical interconnects, optoelectronic devices and multichip modules. Problems associated with these issues and their effects on machine performance will be assessed, from which research priorities will be determined for the academic and industrial environments. It is expected that this meeting will help increase the communication between the computer, packaging and optoelectronics communities and make available the information critical to future research directions.

For more information contact:

Trevar Riley, IEEE/LEOS, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331
P: (908)562-3894, F: (908)562-1571

Sponsored by the IEEE Lasers and Electro-Optics Society and in cooperation with the IEEE Circuits and Systems Society, the IEEE Computer Society and the Solid State Circuits Council

Committee Members:

Jose E. Schutt-Aine, *Committee Chair*,
Univ. of Illinois, Urbana, IL

David J. Kuck, Univ. of Illinois, Urbana, IL

James Pazaris, Digital Equipment Corp., Andover, MA

Michael Farmwald, Rambus Inc., Mountainview, CA

Resve Saleh, Univ. of Illinois, Urbana, IL

Barry Rubin, IBM T.J. Watson Res. Ctr., Yorktown Heights, NY

Kevin J. Webb, Purdue University, West Lafayette, IN



1951-1991





**The Institute of Electrical and Electronics
Engineers, Inc.
United States Activities**

Announces the 20th Annual Competition for
1992-1993
IEEE-USA Congressional Fellowships

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.

CRITERIA: Fellows shall be selected based on technical competence, on ability to serve in a public environment, and on evidence of service to the Institute and the profession. Specifically *excluded* as selection criteria are age, sex, creed, race, ethnic background, and partisan political affiliations. However, the Fellow must be a U.S. citizen at the time of selection and must have been in the IEEE at Member grade or higher for at least four years. Additional criteria may be established by the selection committee.

AWARDS: IEEE-USA plans to award at least two Congressional Fellowships for the 1992-1993 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-USA Office in Washington, D.C. or by writing:

**Secretary, Congressional Fellows Program
The Institute of Electrical and Electronics Engineers, Inc.
1828 L Street, N.W.
Washington, D.C. 20036**

Applications must be postmarked no later than March 31, 1992 to be eligible for consideration.

VIDEO TAPES ON MICROWAVE TECHNOLOGY

Sponsored by the MTT-S

MTT-S DISTINGUISHED LECTURER SERIES

Some Relations Between Microwaves and Optics (HV0229-5)

by John R. Whinnery
University of CA, Berkeley

The video describes some of the active interrelationships between fields of microwave and optics; in addition to the ties based on field theory, there are important interchanges in circuit concepts. (Booklet of hardcopy visuals included.)
Recorded: February, 1991

Nonlinear GaAs FET Modeling: A Mixture of Art and Science (HV0210-5)

by Walter R. Curtice
W.R. Curtice Consulting

This presentation reviews the nonlinear FET modeling work directed toward development of CAD techniques with emphasis on microwave applications, although FET models for digital circuits are described. (Booklet of hardcopy visuals included.)
Recorded: December, 1990

Quasi-optical System Design for Millimeter Wavelengths (HV0211-3)

by Paul F. Goldsmith
University of MA, Amherst

The videotape reviews the basics of Gaussian beam propagation and the Gaussian optics components which have been especially useful. (Booklet of hardcover visuals included.)
Recorded: December, 1990

CAD of Hybrid and Monolithic Microwave and Millimeter-Wave MICs (HV0115-6)

by Rolf H. Jansen
Industrial Microwave and
RF Techniques, Inc.

This presentation is an overview of existing CAD packages and their features related to the economic design of MMICs. The author discusses the use of look-up tables and treats specific MMIC designs.
Recorded: August, 1988

NEW RELEASES AND ADDITIONAL TOPICS

Microwaves in Medicine: Hyperthermia Treatment of Cancer (HV0243-6)

by Fred Sterzer, MMTS

This presentation is about the effect of hyperthermia in the treatment of cancers of the eye, breast, brain, and prostate. Recorded in a lab, this talk is about the technology used in hyperthermia treatment, including applicators and radiometers. Using slides and videotape footage of patients, the presentation shows that hyperthermia treatments were successful in eliminating certain tumors. The lecture explains how hyperthermia works with other cancer treatments and discusses its usefulness in the treatment of topical tumors and its limitation in the treatment of deep-seated tumors.
Recorded: June, 1991

Noise in Microwave Circuits (HV0242-8)

by Sander Weinreb, Martin Marietta Laboratories

This lecture covers the theoretical basis, engineering application, and measurement of noise in microwave circuits. The topics covered are: thermal noise, noise description of two-port networks, FET noise parameters, frequency dependence of FET noise parameters, network cascading formula, noise measure, the measurement of noise, and additional sources of noise in a microwave system. (Booklet of hardcopy visuals included)
Recorded: January, 1991

Nonlinear Circuit Analysis and Design (HV0241-0)

by Charles Holmes, EEsof, Inc.

This presentation is an introduction to the method of harmonic balance. It is intended for viewers who are acquainted with steady-state sinusoidal analysis but are less familiar with techniques of nonlinear analysis. The fundamental concepts of harmonic balance analysis are related to steady-state sinusoidal analysis. Illustrations are provided to suggest the power of the technique and parenthetically to point out some interesting phenomena resulting from nonlinearities. (Booklet of hardcopy visuals included) Recorded: July, 1991

Anticollision Radars (HV0248-5)

by Madhu Gupta, Hughes Aircraft Company

This talk is an overview of the basic design and the current status of the automotive radar technology. The four types of automotive radars discussed include: vehicle speed measurement, detection of nearby obstacles not visible to the driver, collision anticipation and avoidance, and vehicle guidance and control. The presenter describes its need and motivation of each, the system requirements and constraints, and the design considerations governing the choice of radar architecture. (Booklet of hardcopy visuals included) Recorded: January, 1991

High Performance Modulation Doped Field Effect Transistors (HV0179-2)

by Lauren F. Palmateer, IBM

The speaker describes the advantages of AlInAs/GaInAs/InP MODFETs over the conventional AlGaAs/GaAs MODFETs for use in microwave and millimeter-wave amplifiers. Recorded: May, 1990

SPECIAL SALE

MTT-S Member: \$59.95

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IEEE Member: \$89.95

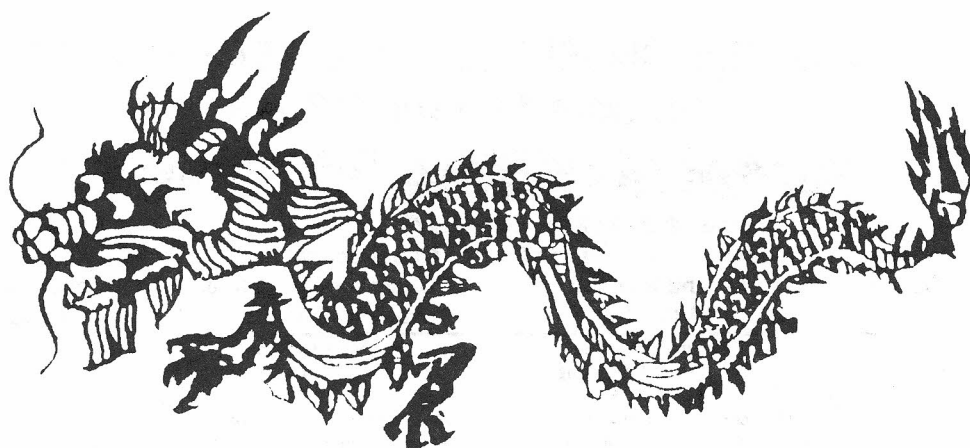
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INTERNATIONAL CONFERENCE ON MILLIMETER WAVE AND
FAR-INFRARED TECHNOLOGY (ICMWFT'92)

Beijing, China, August 1992

First Call for Papers

An International Conference on Millimeter Wave and Far-Infrared Technology (ICMWFT'92) will be held in Beijing, Peoples Republic of China, August 17-21, 1992. The scope of this meeting will encompass technology related to the wavelength range extending from approximately 10 microns to 1 centimeter, and will comprise both invited review papers and contributed papers. This conference will be sponsored by the Chinese Institute of Electronics, the Georgia Institute of Technology, and by other professional organizations in China and the U.S.A.

Papers are solicited in the general subject areas of sources, detectors, mixers, spectroscopy, atmospheric effects, materials, measurements and techniques, high T_c superconductors, and plasma diagnostics. Interested authors outside China are requested to submit four-page camera-ready summaries of their papers to:

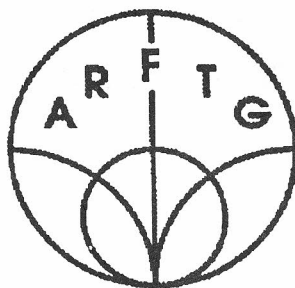
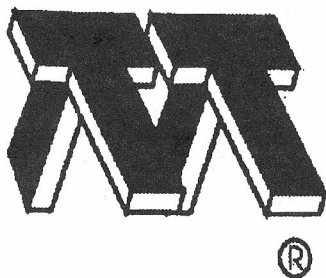
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Georgia Institute of Technology
Atlanta, Georgia 30332 USA
Telephone: (404) 894-3500, Fax (404) 894-5073, TELEX:542507 GTRC OCA ATL

Authors within China must submit their papers to the Chinese Program Committee.

Since these summaries will be included "as is" in the conference digest, they must be typed clearly and sharply, with carefully drawn figures and original photographs. Text and figures must be placed within a border 18 X 25 cm. Submissions not meeting the above standards will be returned for correction. The deadline for submission of these summaries is March 1, 1992, and authors will be notified of acceptance or rejection by March 31, 1992. The official language of the conference will be English.

Important features of this conference will be technical visits to local industries, laboratories, and universities, and tours to cultural and historical sites. In addition, a companion's program will offer opportunities for local shopping and sightseeing. The meeting will be followed by a choice of several post-conference tours of Beijing and other Chinese cities, available at extra cost.

An exhibit of MMW/FIR instrumentation will be held during the conference. Interested exhibitors are urged to contact Gail M. Tucker at the above address.



AUTOMATIC RF TECHNIQUES GROUP

CALL FOR PAPERS

ARFTG 39th CONFERENCE - FALL 1991

ALBUQUERQUE, NM

FIRST CALL FOR PAPERS

JUNE 5, 1992

The Automatic RF Techniques Group will hold their 39th Conference at the Pyramid Plaza Hotel in Albuquerque, NM on Friday June 5, 1992. The conference theme is:

MEASUREMENT ACCURACY ISSUES

As both the performance of microwave technology, and the ability to measure that performance, continues to advance, the concept of how to best measure a device's performance while achieving sufficient accuracy becomes less trivial. The main focus of ARFTG's 39th Conference includes papers addressing measurement accuracy limitations, measurement accuracy needs, appropriateness of a technique for determining a specific device's performance, metrology considerations, and cost/time/performance trade offs. Papers on other RF measurement or computer-aided-design topics will also be considered.

Technical presentations shall be informal twenty-five minute talks using view-graphs or 35-mm slide illustrations. Authors are requested to submit a one page abstract and a 500 to 1000 word summary with attachments containing illustrations, etc., providing sufficient technical content to enable proper evaluation and explaining the contribution's usefulness to the conference attendees. All accepted papers will be published in the post-conference digest. **Two copies of the abstract and summary should be received no later than March 15, 1992.**

Manufacturers interested in exhibiting at the conference should contact the Exhibit Coordinator for information and an application and agreement form.

Submit papers to:

John Rooks
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13441-5700
(315) 330-4381

For exhibit application contact:

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135 Old Cove Road, Suite 203
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