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REFLECTIONS ON THE 1985 INTERNATIONAL MICROWAVE SYMPOSIUM — THE MAKING OF A SYMPOSIUM



by Fred J. Rosenbaum

The International Microwave Symposium has a way of setting the annual microwave calendar. Authors are now beginning to think about getting work together for the upcoming December deadline for submission of abstracts to the 1986 Symposium in Baltimore. Exhibitors are following up on prospects generated in St. Louis and making commitments for the 1986 Microwave Exhibition. Prospective attendees are thinking about travel plans for 1986. And you can be sure that the Baltimore Steering Committee has its calendar arranged until June, 1986.

So it was for the 1985 Committee that hosted the St. Louis Symposium. The year "between" San Francisco and St. Louis went by quickly indeed. In fact, planning for 1985 had been going on since 1981; the Committee began meeting regularly in 1982.

So much goes into getting ready for the Symposium. There are the logistics needed to house the four or five thousand out of town participants. A publicity committee must be established to design, print and distribute the calls for papers, the advance program, and all other promotional items. Finance and accounting must be put in place. An extensive social program must be created. A technical program must be organized, and publications such as the Digest and the 1985 Transactions Special Issue must be published. The Historical

Exhibit must be prepared. And all these arrangements must be coordinated with the Microwave Exhibition so that exhibitors' needs are accommodated.

The Advance Program is a wonderful casebook to study the "Making of a Symposium." When you get the 1986 Advance Program look it over carefully, not only for what it contains, but for what it means. Each paragraph represents arrangements made, details attended to. Hotels, room rates, conference airlines, guest program, banquet, special workshops, other meetings, the technical program, all the rooms assigned, a message center phone number, and on and on. Every statement in the Advance Program means that somebody had to do something to make it happen.

And who are these somebodies? They are volunteers who got involved for a multitude of reasons. Think of it. They are typical individuals with a connection to the microwave community: engineers, researchers, managers, marketers, reps, etc.; people who count on themselves and who can be counted on to carry out this major responsibility.

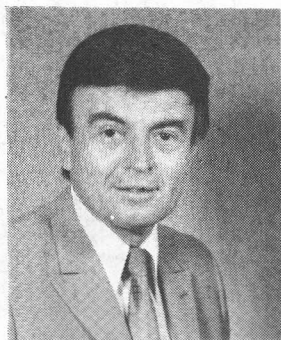
And what do they get out of it? A sense of accomplishment, a chance to do something very different from their usual jobs, and a lot of fun. Believe it or not, it is really fun to put something as complex as this together and have it work. The satisfaction involved is hard to describe. At this point, the St. Louis Committee feels it a privilege to have been able to participate in such a grand undertaking.

And what was accomplished was grand indeed. Some 4,190 people registered for one or more of the activities in St. Louis. The technical meetings drew only slightly less than the attendance in San Francisco. Two hundred and eight exhibitors took three hundred twenty-one booths in the Cervantes Convention Center, down slightly from 1984. The most significant reduction from past Symposia in Boston (1983) and San Francisco (1984) was in local attendance at the Exhibition. Certainly when the Symposium is held in areas of intense microwave activity more local attendance is to be expected. However, the exhibitors seemed pleased by the quality and numbers of those who did come. Detailed statistics are shown in Table 1.

The attendance results demonstrate that there is a core of technical workers numbering some 1,500, on

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ADCOM HIGHLIGHTS



by Reinhard Knerr

The June, 1985, ADCOM meeting in St. Louis took place, of course, during our International Microwave Symposium. At this meeting we have traditionally a number of visitors attending, which is always appreciated by all ADCOM members. This gives an unfortunately rare opportunity to get direct membership input. We do encourage attendance of interested MTT-S members.

Obviously, the agenda of our ADCOM meetings is always full, and there never seems to be enough time to discuss everything. A lot of the agenda items are strictly administrative matters, and other items are covered separately in this Newsletter and elsewhere.

One topic of general interest, which was discussed again at this meeting, relates to the question of what articles should be published in the Special Issue of our MTT Transactions covering the MTT International Microwave Symposium. This issue usually is published in December. The guest editor of this issue is always faced with the conflict of duplicate publication between the Symposium Digest and the before-mentioned special issue of the MTT Transactions.

For the record ADCOM again stated:

The material published in the Digest constitutes an official publication, which can be referenced and is retrievable through your library system.

Papers submitted for publication in the special issue of the MTT Transactions shall be rejected if:

They are identical to the material published in the Symposium Digest.

They do not contain significantly more information than the Digest material. Significant means more important data and, if appropriate, the theoretical background material.

In my mind, this position is reasonable because, by definition, the extended abstract in the digest condenses the material of the oral presentation. (There are exceptions where some authors read their paper verbatim from the Digest. This should be discouraged.) Therefore, most authors have enough material to expand the abstract of the Digest into an article. I can only speculate why they should submit the identical material for publication in the MTT Transactions. One obvious reason could be a lack of a clear policy statement. I hope my short note will provide this clarification.

EDITOR'S NOTES



*by Reynold S.
Kagiwada*

Many thanks to Fred J. Rosenbaum and his committee for making the 1985 International Microwave Symposium at St. Louis a memorable occasion. In reading Fred's reflection I sensed that the committees seemed to have emotional highs in preparing for the symposium. They all worked hard and most of all enjoyed every minute of it. This symposium will be a hard act to follow. I'm sure that Ed Niehenke's committee will rise to the challenge, they have been marshalling the troops in Baltimore for over three years. The 1986 International Microwave Symposium in Baltimore should be great fun.

John Horton's Special Articles are now an established part of the Newsletter. The articles add a good balance between microwave technical information and microwave community news. The article by Karl Stephen and Tatsuo Itoh on "Quasi-Optical Microwave and Millimeter-Wave" give both historical background and the state of the art review. I'm sure that you will enjoy reading it.

The microwave community mourns the loss of one of its leading statesmen. On June 19, 1985 Bill Mumford passed away peacefully. Bill Mumford was one of the early organizers of MTT-S, and served on several key ADCOM positions. Ted Saad refers to the loss as losing "Mr. Microwave". Kiyo Tomiyasu remembers him for his exemplary deeds, his highly professional attitude and his strong avocation toward microwave. I think it was only fitting that Kiyo referred to a few lines in William Saragan's novel; "As long as there are any two of us to remember him together he will never be gone", "We do not mourn for him but rather for ourselves, because of the treasure we have lost." Truly the microwave community mourns his loss and extends its deep sympathy to Bill's wife Elizabeth, his son William W. Mumford, his daughter Joan Sturtz and his grandchildren.



PRESIDENTS REPORT



by Harlan Howe, Jr.

During the past few months the MTT society has continued to grow financially, in terms of membership, and in terms of influence in the technical arena. As everyone knows we have just completed an extremely successful symposium in St. Louis, our educational scholarship programs are falling into place, and we continue to operate on a sound financial footing.

Of particular significance, however, has been the work done by the ad hoc committee to Promote National Microwave Standards (PNMS). The two part article in "Microwaves & RF" describing "The Impending Crisis in Microwave Metrology" and the role of the PNMS committee was particularly gratifying. Unfortunately they failed to give MTT-S any credit for supporting the PNMS committee. Nevertheless the articles were well written and it outlines some of the work which has been done. Of equal or greater significance is a letter received by Dr. Bruno Weinschel from Doug Walgren, Chairman of the US House of Representatives Committee on Science and Technology, in which he points out that the process and quality control initiative in the National Bureau of Standards budget is the only new initiative not to be cut or eliminated in the house passed version which froze NBS's authorization to current levels. He goes on to say that since the House and Senate are in agreement, the initiative is certain to be contained in the NBS authorization bill when it is cleared for the President. The specific language of the reports says in part "The committee urges the NBS to review its list of priorities for new initiatives to meet measurement needs in process and quality control technology in light of the March 1985 position paper of the Committee to Promote National Microwave Standards of the IEEE and other recent industrial statements of calibration needs and to make any necessary additions or adjustments." Furthermore the Committee urges NBS, the Department of Commerce, and the Office of Management and Budget to give serious consideration to the merits of a sizable increase in these efforts taking into consideration the defense and trade implications of this important work." It is very clear that through its hard work and diligence, the Committee to Promote National Microwave Standards has had a far reaching impact. All of the committee members and its chairman, Doug Rytting deserve our congratulations and thanks for a job that is being very well done.

DIVISION IV DIRECTOR'S REPORT



by Kiyomi Tomiyasu

I was deeply saddened to hear that Bill Mumford passed away on June 19, 1985. Having worked with Bill Mumford on several MTT-S functions since the fifties, I feel that the society has lost one of its strongest supporters and models. His high level of professional attitude and his strong avocation toward microwaves were beneficial to all members of the MTT-S. Bill served on all key positions as MTT-S TRANSACTION Editor, Awards Chairman, Secretary, Treasurer, Vice Chairman, Chairman and etc. Because of his exemplary deeds, he was elected an Honorary Life Member of MTT-S in 1964. It was only fitting that he was the first recipient of the Microwave Career Award in 1974.

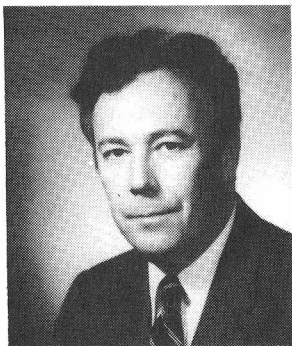
In the tribute to Donald D. King, Bill wrote some touching thoughts that seem quite appropriate for himself at this tragic loss.

"As long as there are any two of us to remember him together he will never be gone" . . . "We do not mourn for him but rather for ourselves because of the treasure we have lost." We will all remember Bill for his exemplary service to microwaves.

At its meeting on June 2nd and 3rd, 1985, the IEEE Board of Directors approved that the IEEE Sonics and Ultrasonics Group would change its name to IEEE Ultrasonics, Ferroelectrics and Frequency Control Society, with an accompanying field of interest change. The change will become effective on January 1, 1986. TAB approved a guideline allowing Society/Council President to designate representatives at TAB meetings with voice and vote. Bylaw revisions should be generated to complement the guidelines. TAB informally discussed the proposed revisions to IEEE bylaw 105.2 which would waive the five year membership requirement for election to Fellow Grade under certain specific conditions.

IEEE senior members now have a greater opportunity to become IEEE Fellows. At a recent meeting in Philadelphia the Board of Directors unanimously approved an increase in the number of IEEE Fellows who can be elected. This decision means that roughly 200 members, instead of 140, may be elevated to the highest IEEE grade next year. About 400 nominations for Fellow grade have been received in each of the past two years. The move was enthusiastically welcomed by Board members. This decision will make it easier for qualified persons to become Fellows and could result in more nominations from the grass-roots membership.

TAB HIGHLIGHTS



by Harlan Howe, Jr.

At the May 31, 1985 TAB meeting a number of actions were taken. The most significant of these and its effect on the MTT-S was the approval of the guideline allowing for society and council presidents to designate representatives in TAB meetings with a voice and a vote and to request that an appropriate IEEE by-law revisions be generated to implement the guideline. This is a change from the past where a representative other than the president had a voice but no vote. This does not imply that we can have a permanent representative to TAB since the intent is that the president of the society remain as the principle representative. It does allow us to have a temporary representative if the president is unable to attend without being disenfranchised on our vote.

TAB also endorsed in principle, the concept, of holding an IEEE annual convocation and endorsed funding to proceed with its planning for 1986. In addition, a 1987 annual convocation was endorsed provided that it has broad membership participation. An additional action at the TAB meeting canceled the August TAB meeting with the understanding that division committee meetings may be held instead. The third and final TAB meeting will be on November 22, 1985. Several other actions were taken by the TAB OPCOM. Among these was the continuation of the membership incentive program which has been so effective during the past year, the endorsement of a statement that the IEEE will no longer hold closed sections on unclassified matters and the endorsement of a centennial publication which will include a record of TABs activity during the centennial year, which will be based primarily on the papers presented at the IEEE centennial technical convocation, which was co-sponsored with the Franklin Institute. It is expected, due to the cancellation of the August meeting that the November TAB meeting will be an extremely busy one.



MEMBERSHIP SERVICES



by E. C. Niehenke

In conjunction with the 1985 IEEE MTT-S Microwave Symposium, the Annual Chapter Chairmen's Meeting was held Tuesday evening, June 4, 1985. The meeting was productive and well attended with representatives from 23 of the 46 MTT-S Chapters throughout the world (see the meeting report by T. Nelson which includes the Chapter activities).

The 1984/85 Distinguished Microwave Lecturers, Dr. Paul Greiling and Dr. Sander Weinreb, have collectively given their lectures to 77 organizations with an audience of 3029. Mr. Kenneth Carr, the 1985/86 Distinguished Microwave Lecturer, has already prepared and has given his lecture on "The Application of Microwave Technology to the Detection and Treatment of Cancer."

The number of active MTT-S Chapters has increased to 46 to serve the MTT-S members throughout the world. The San Fernando Valley Chapter was just formed and is under the chairmanship of Harry Pomeranz. The Tucson MTT-S Chapter has recently been reactivated by Howard Kohlbacher, who is serving as Chapter Chairman. Manuel P. Sierra is the Chapter Chairman of the newly formed joint AP/MTT Chapter in Spain. The West Germany MTT-S Chapter, recently formed, held its first election. Mr. Adelseck and Professor Jansen are the new respective chairman and vice chairman respectively. Nigel Keen was active in the formation and start up of the West Germany Chapter. A few new prospective chapters are in the process of being formed. MTT-S welcomes the new chapters and wishes the best to the chapter officers.

A chapter, either MTT-S or jointly with another society, can be formed by having at least 12 Society members above the Student grade in the area sign the petition and have it approved by the local IEEE Section and respective Society. Please contact me if you need assistance. In forming the chapter, it may be helpful to have the names, addresses, and telephone numbers of Society members in the new chapter's area. This information, as well as the petition or any other pertinent information, can be obtained from the IEEE Services Center, (201) 981-0060. The address is:

IEEE Services Center
445 Hoes Lane
Piscataway, NY 08854

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1985 IEEE MICROWAVE AND MILLIMETER-WAVE MONOLITHICS SYMPOSIUM



by Roger W. Sudbury

The 1985 IEEE Microwave and Millimeter-Wave Monolithics Symposium was held on June 3 and 4, 1985 in St. Louis, MO in conjunction with the IEEE MTT-S International Microwave Symposium. A total of 697 attended as this the fourth Microwave and Millimeter Wave Monolithic Circuits Symposium continued to enjoy a high level of interest from the technical community. This was reflected in the quality of submissions to the Technical Program Committee and the high attendance for all the Symposium sessions. The Technical Program Committee worked diligently to carefully review the papers submitted and provided a quality program.

This year's technical program had twenty two papers divided into four sessions held both morning and afternoons on Monday, June 3 and Tuesday, June 4, at the Cervantes Convention Center. The sessions on Tuesday, June 4 were held jointly with the 1985 IEEE MTT-S International Microwave Symposium.

The technical program opened with a session on switching and control circuits which included in addition to papers on amplitude and phase control circuits, papers on a periodic Schottky slow wave structure for multipliers, an A/D converter, and a four channel digital time switch. The microwave amplifier session on Monday afternoon was principally devoted to monolithic power amplifiers and two papers described critical process parameters and production technology.

On Tuesday following the opening of the 1985 MTT-S International Microwave Symposium the first joint session covered monolithic receiver circuits using FETs in amplifiers and mixer circuits. The closing session on Tuesday afternoon was on the topic of millimeter-wave circuits where, although three terminal devices are becoming available, the papers reflected the continuing use of two terminal devices for the higher frequencies.

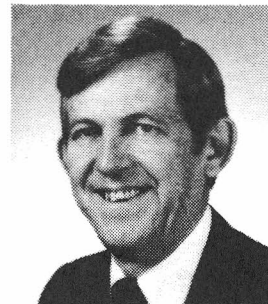
Time was provided for discussion of each paper, which contributed to a feeling that there was a strong sense of involvement by those attending the Symposium. The growth and future of this technology can be found in the papers presented and the interest of those in attendance. The promise and potential of monolithic circuits for microwave and millimeter wave circuits will be realized through their efforts. The complexity of the designs is increasing and many of the circuits presented represent refinements in design indicating their

development is nearing production.

Dr. William Wisseman served as general Chairman of Symposium Steering Committee and deserves thanks for organizing and running a very successful Symposium. He had the support of a competent and hard working Steering Committee. The cooperation of the 1985 IEEE MTT-S International Microwave Symposium under the chairmanship of Fred J. Rosenbaum is greatly appreciated especially the support of William E. Hord and Stephen Honickman, Co-Chairman of their Technical Program Committee. I would like to thank the members of the Technical Program Committee of this 1985 Symposium for a job well done.



LOOKING BACK - THE 1985 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM TECHNICAL PROGRAM



by William Hord

Microwave week in St. Louis was a rousing success even if the weather was most uncooperative. The quality of the technical program was outstanding and the program proceeded quite smoothly from beginning to end with, in general, only minor difficulties.

The format of the technical program is well suited for a Society as diverse as ours. The ninety minute session length allows for more homogeneous sessions which tends to reduce traffic between sessions. The use of the short paper as well as the regular length paper allowed the Session Chairmen maximum flexibility in structuring their Sessions.

The Open Forum was very successful and the use of this means of presentation should be continued and expanded when necessary. Authors are becoming proficient in these presentations and the give-and-take in this less formal setting results in some lively encounters.

I would like to acknowledge the efforts of Steve Honickman who served as Co-Chairman of the Technical Program Committee. We thank the authors for their contributions, the Session Chairmen for their efforts and the TPC for reviewing the papers. We are indebted to the other members of the Steering Committee and to the MTT-S Ad Com for their encouragement and support.

AWARDS



by Don Parker

1985 MTT-S AWARDS

The following awards were presented at the Annual Symposium Banquet by MTT-S President, Harlan Howe, Jr.

| | |
|----------------------------------|------------------|
| Microwave Career Award | Nathan Marcuvitz |
| | Harold M. Barlow |
| Microwave Prize | Karl B. Niclas |
| | Brett A. Tucker |
| Microwave Application Award | James Cheal |
| Distinguished Service Award | G. P. Rodrigue |
| Distinguished Microwave Lecturer | Paul Greiling |
| | Sander Weinreb |

In addition to the above awards, Bruno Weinschel, IEEE President-Elect, presented Fellow awards to two members of MTT-S. President Howe also presented the Past President's pin to H. George Oltman. Certificates of Meritorious Service were given to Steven Adam and Fred Rosenbaum for their many years of service to the Society. Certificates of Recognition were given to Tatsuo Itoh, past editor of the *IEEE Transactions on Microwave Theory and Techniques* (1983-1985), Steven Adam, Steering Committee Chairman and Ferdo Ivanek, Technical Program Chairman for the 1984 MTT-S Symposium. Norman Dietrich and Eikichi Yamashita were given Certificates of Recognition for their contributions as Associate Editor, Transactions Patent Abstracts, and Associate Editor, Transactions Asian Abstracts respectively. Three retiring ADCOM members were also given Certificates of Recognition for their past service, James Degenford, Robert Hicks, and James Roe.

Because of his age and severe arthritis, it was not possible for Dr. Barlow to attend the symposium. He was presented the award earlier in the year in England. He wrote, "I cannot tell you how sorry I am that I was unable to attend the award banquet and to receive my prize there. As you know, I value enormously the honor you have done me and I appreciate particularly the recognition you have so kindly given to my early work on microwaves at the University College, London . . . With the \$2,500 as part of the award, I have in mind to ask University College, London, if they would agree to set up a MTT lecture to be given perhaps every second year in my old department. Please accept . . . my warmest thanks for this most prestigious award, which I very deeply appreciate. With kindest regards, Harold M. Barlow."

MTT-S HONOR ROLL

There has been some discussion that the Society

needs a mechanism to recognize posthumously certain members who made significant contributions to microwave technology and the Society, yet were not so recognized while living. For example, an individual may have been a possible candidate for the Career Award, but died before being selected by the Society. It is IEEE policy that major Institute and Society awards not be given posthumously. H.G. Oltman has suggested that MTT-S have an Honor Roll which lists recipients of the Society's major awards or otherwise made significant contributions to the profession and Society.

Those individuals selected by the Society would be recognized posthumously and would be added to the honor roll. A letter and a certificate would be sent to survivors of the deceased informing them that the deceased's name has been added to the honor roll. At the June meeting, ADCOM agreed with the need to provide some recognition to worthy deceased members and with the general concept of an honor roll. The award committee will proceed with submitting a formal proposal for the establishment of a MTT-S Honor Roll at the October meeting.

GOAL ORIENTED AWARD

The concept of a goal oriented award was presented to ADCOM over a year ago. We have had some difficulty in getting this new award definitized and established. This spring, V.G. Gelnovatch was asked to chair an AdHoc committee to write-up a proposed description for this award for ADCOM's review. Below is a description of the proposed award.

The Society shall present an award known as "The Goal-Oriented Award." The award shall be presented to the first individual or group of individuals satisfying the objectives of the goal. It shall be the responsibility of the awards committee to formulate goals which in turn are ratified by MTT-S ADCOM. The term of the award shall be until the goals are satisfied and a recipient determined, or the goals are repealed. No restrictions are placed on the recipient; he or she need not be an IEEE member.

The recipient will be selected by the MTT-S awards committee and approved by the MTT-S ADCOM at its annual meeting. Any potential recipient who believes that he or she has satisfied the goal may petition the awards committee. The awards committee chairman will appoint an AdHoc committee (Verification Committee) to verify that the goal has been realized. The verification committee may utilize the services of an independent consultant. It is the responsibility of the candidate to provide evidence to prove that the goal has been met. This goal attainment shall be documented in a professional journal and the results verified by demonstration.

The award shall consist of a cash award (the amount determined by the difficulty of the goal), a suitable certificate, a bronze plaque, and a featured publication in the *IEEE Transactions on Microwave Theory and Techniques*.

After reviewing this proposal by Walt Gelnovatch, ADCOM voted 16-3 to proceed further with the institution of the Goal Oriented Award.

TABLE 1. SYMPOSIUM STATISTICS*

| | BOSTON 1983 | SAN FRANCISCO 1984 | ST. LOUIS 1985 |
|-----------------------------|----------------|-----------------------|-------------------|
| MTT-S Symposium MW & MMW | 1523° | 1556 | 1466 |
| Monolithic Symp. | 592° | 693 | 697 |
| ARFTG | — | 110 | 143 |
| Workshops | 580° | (6)420 | (4)571† |
| Exhibitors | 1920° | 2639 | 1903 |
| Prepaid Exhibits Only | 1418° | 1058 | 497 |
| Exhibits Only | 192° | 206 | 195 |
| Banquet | 766** | 449 | 439 |
| Extra Digests Sold | | | |
| MTT | — | 414 | 557 |
| MW & MMW | — | 237 | 278 |
| ARFTG | — | 77 | 82 |
| Hotel Room Nights | 4773** | — | 7738† |
| Exhibit Booths | 264** | 360** | 321† |
| Companies Exhibiting | 241** | 263** | 208† |

Sources:

- * LRW Associates (Registration Data)
- † St. Louis Steering Committee
- ** D. McQuiddy
(MTT-S Meeting and Symposium Chairman)
- ° P. Staecker (Boston Steering Committee)

the average, who will travel to the Symposium as a technical event, no matter where it is held. Likewise, the exhibitors will support this event whether it is held in Boston or Baltimore, San Francisco or St. Louis, Dallas or Las Vegas.

Table 2 shows some additional statistics. Attendance from overseas was high. We are, after all, an international symposium.

TABLE II. MTT-S INTERNATIONAL PARTICIPATION

| | |
|----------------------|-------------------------|
| Australia2 | Israel7 |
| Austria1 | Italy14 |
| Belgium2 | Japan34 |
| Brazil4 | Korea2 |
| Canada44 | Netherlands1 |
| China13 | Norway3 |
| Cyprus1 | Scotland2 |
| England24 | South Africa4 |
| Finland2 | Spain3 |
| France23 | Taiwan2 |
| Hungary1 | Sweden1 |
| India3 | Switzerland1 |
| Iran1 | West Germany . . .15 |
| Ireland2 | Yugoslavia1 |

Countries: 28

Total Participants: 213

Microwave Week began on Monday, 3 June 1985, with the Microwave and Millimeter Wave Monolithic Symposium. A record number of participants (697) heard many of the latest advances in this growing technical area. Also on Monday 37 specialists addressed the topic of Phased Arrays for Hyperthermia Treatment

of Cancer in a workshop session. The Symposium itself was called into Plenary Session at 8:00 AM on Tuesday, 4 June. Some 600 to 800 attendees were greeted by me (Steering Committee Chairman), Harlan Howe (MTT-S President), Dr. William Hord (1985 Technical Program Committee Co-Chairman), and Dr. Bruno Weinschel (President-Elect, IEEE). The Plenary Session was introduced by Dr. Robert Moore (Westinghouse) who is the MTT-S PACE Coordinator.

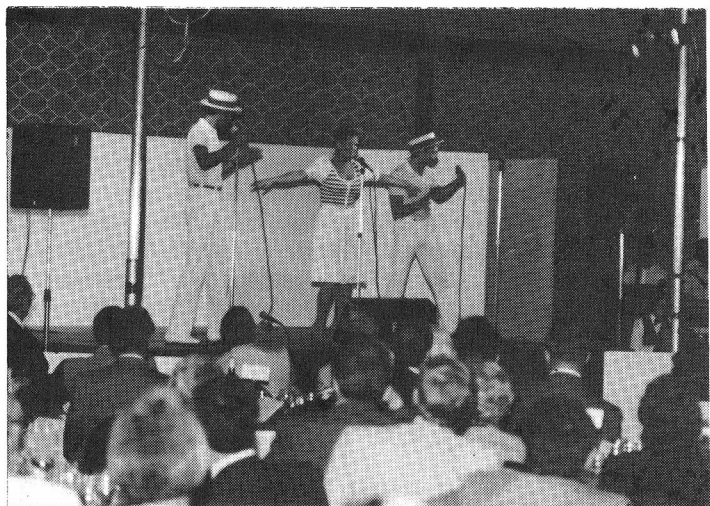
The theme of the 1985 Symposium was "Microwaves: Gateway to the Future." The theme was addressed by three invited speakers. Dr. Merrill Skolnik (Superintendent of the Naval Research Radar Laboratory), asked to comment on the technical future that microwave engineers might encounter, refreshingly and honestly observed that one could see clearly perhaps three to five years out, and then only because the developments needed to support new systems were already in place. Beyond that, he claimed "YGIAGAM" (Your Guess Is As good As Mine). He went on to show how seldom past predictions in the microwave area were realized and how often important innovations were not predicted. Dr. David Leeson (President of California Microwave) addressed the professional and industrial future of microwave engineers by focusing on how young engineers could succeed by applying sound business principles to their careers. His advice is to dominate one's market segment by developing useful skills in at least two related areas of activity (e.g. circuit design, and fabrication). Leeson, a gold medal winning driver, chose examples from the world of amateur auto racing to entertain and enlighten the audience. The session closed with a talk by Dr. Stephen Honickman (President of STG Electrosystems) who explored the financial future of microwave engineers. Honickman, a successful entrepreneur, would foster similar urges of engineers by encouraging the private practice of engineering through the establishment of a line item in the Federal budget. If a means were in place whereby contracting officers of DoD, for example, could support start-up activities, he believes that some engineers could take charge of their economic futures more aggressively.

The talks complimented one another and fit together in an interesting way. The topics must have been close to the mark, because the audience paid close attention for the full two hours; almost no-one left the session before it ended. In fact, discussions continued at a well attended (250) lunch hour session again hosted by Bob Moore. This time the panelists were joined by Dr. Leo Young (Dir. of Research and Management, Office of the Under-Secretary of Defence for Research and Engineering), Dr. George Gamota (Univ. of Michigan), and Dr. Harvey Nathanson (Westinghouse R & D Center). The session was very well received and showed that people wanted to express their views and exchange opinions on the topic.

Also at the lunch hour on Tuesday a new endeavor for the Symposium was launched. Chaired by Frank Walker, (Mgr., Subcontracts, Sanders Associates) a

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1985 IEEE INTERNATIONAL MICROWAVE SYMPOSIUM AWARDS BANQUET





Harlan Howe welcoming IEEE President-Elect Bruno O. Weinschel to present the IEEE Fellow awards.



H. George Oltman, 1984 MTT-S President, accepts the Past President's Pin from Harlan H. Howe, 1985 President.



Fred J. Rosenbaum is awarded a Certificate of Meritorious Service to Ad Com. Harlan Howe makes the presentation.



Stephan F. Adam receives a Certificate of Meritorious Service from Harlan Howe, Jr. Adam also was awarded a Certificate of Recognition for his service as 1984 Symposium Steering Committee Chairman.

Tatsuo Itoh, MTT-S Transactions Editor 1983-1985 is awarded a Certificate of Recognition and a plaque to mark his service.



James Roe receives a certificate marking his retirement from MTT-S Ad Com service.

Norman R. Dietrich receives his Certificate of Recognition for Associate Editor, MTT-S Transactions-Patent Abstracts.



The chairman of the 1984 MTT-S International Microwave Symposium Program Committee Ferdo Ivanek, receives a Certificate of Recognition from Harlan Howe.

Eikichi Yamashita, Associate Editor, MTT-S Transactions-Asian Abstracts, receives his Certificate of Recognition.



(Reflections—Continued from Page 7)

Working Group in Microwave Procurement was formed. Fifty-two people turned out to discuss the make-up of a workshop at the 1986 Symposium. It is intended to provide a forum for marketing and sales managers, CODs, and system house procurement managers to discuss business aspects of the microwave industry. In this activity we are recognizing the intimate relationship between the technology and the business which it supports.

The Symposium Technical Program was organized into 29 one-and-one-half hour sessions. These were presented in three parallel sessions. Of 159 papers accepted, all but two were presented. Submissions came from 22 countries and authors from 17 countries had papers accepted. Both regular length and short papers were featured in each session. Two "Open Forums" were held in which 41 authors discussed their work directly with interested individuals. This format, introduced to the Symposium in 1983 by Dr. Ralph Levy, has proven popular with authors and audience alike. This year the setting for the Open Forum was particularly convivial, with refreshments served at the session. In addition to the MTT-S papers, 22 papers were presented at the Monolithic Symposium, eight in joint session.

The Historical Exhibit has proven to be durable and popular part of the Symposium. It comprises a permanent collection of artifacts assembled by our curator (Ted Saad of Sage Labs) and materials contributed by each Steering Committee. This year Prof. Harold Shipton (Washington University) was responsible for obtaining items pertaining to the early days of radar. Shipton, a WW II RAF veteran, located a vintage RAF training film, material on the role of radar on aerial night fighting, and other information on early radar devices. He also organized a panel session on the "Historical Perspective of Microwaves."

More events were held on Friday. The Oscillator Workshop attracted a massive attendance of 232 and the Automatic RF Techniques Group (ARFTG) 25th Conference drew 143. These are impressive numbers when you recognize that this was the fifth day of Microwave Week. For some of us, Microwave Week began on the prior Sunday when AdCom met. In order to accommodate the many topical interests several evening and afternoon panel sessions were presented.

The meetings were held at the Cervantes Convention Center in downtown St. Louis; a spacious facility that comfortably accommodated the technical sessions and the Exhibition. Headquarters was the Sheraton St. Louis Hotel, directly adjacent to the Convention Center. Six downtown hotels provided lodging for the many participants. The continuous shuttle service that was provided between the hotels and the Convention Center was particularly well received: we had five straight days of overcast skies and on-and-off rain. However people's spirits did not seem dampened by the weather and an upbeat mood pervaded the entire Symposium.

The social program began on Monday evening with the Horizon House-Microwave Journal Reception held in Forest Park at the 1904 World's Fair Pavilion. Straw hats, dixieland jazz, a hot air balloon, and suitable refreshments combined to make this a memorable occasion. The annual Awards Banquet was held on Wednesday night preceded by the Industry Sponsored Cocktail Party. Following dinner and the presentation of awards a lively musical entertainment ended the evening in high style.

Our Guest program included a variety of tours of St. Louis landmarks. Guests congregated in the Hospitality Suite where refreshments, information, and conversation were provided during the day. Films on St. Louis and on the construction of the Gateway Arch were also shown.

A number of innovations were offered at the Symposium this year. VISA and MASTERCARD were accepted at registration as a convenience to the participants. Service was provided so that extra digests and materials from the Exhibition could be shipped home conveniently. Travel expenses for students presenting technical papers were provided this year. Tickets were obtained free of charge by the Steering Committee from the Symposium airline, TWA. Five students attended the Symposium with this assistance. And to remind MTT-S members of the important dates of the microwave year an MTT-S calendar was sent to each. These have proven to be very popular and are much in evidence around the industry. Perhaps this will become an annual item.

No Steering Committee can be effective without help from local organizations, and St. Louis was most fortunate in this regard. Exceptional support was received from Central Microwave Co., Emerson Electric, McDonnell Douglas, STG Electrosystems, and Washington University. The Steering Committee is profoundly grateful for their enthusiastic support. And the Committee Chairman is greatly indebted to his outstanding Committee for their years of effort and their high level of professionalism.

The MTT-S International Microwave Symposium has metamorphosed over the years from a specialist's technical conference to a unique industry gathering where researcher, engineer, marketing specialist, and businessman meet, mingle and merge into a unified whole. Our Symposium is an outstanding event which grows from year to year. St. Louis has done its work. One can hardly wait to see what Baltimore will bring.



St. Louis, Missouri

(Membership Services—Continued from Page 4)

All active MTT-S Chapters are eligible to receive from our Society up to \$350 this year to subsidize Chapter activities. The financial assistance to the Chapters provided by MTT-S is intended to supplement, not replace, funds provided to the Chapters by the local IEEE Section. The funding can be used to enhance the Chapter's program in one-day symposia, lecture series, technical meeting, tours, and social events. Chapters should prepare a letter requesting a specific amount and should describe how the Chapter plans to use the money. Address letter to:

E.C. Niehenke
Westinghouse Electric Corp.
P.O. Box 746, MS 339
Baltimore, Maryland 21203
(301) 765-4573

The Chapter Chairman fills a vital role in serving the MTT-S membership. The Annual Chapter Chairman Dinner Meeting serves a vital function in bringing together all Chapter Chairmen and the MTT-S ADCOM to exchange ideas and enhance the working of the Chapter. Normally the employer provides funds for the Chairman to attend this meeting, but there are situations where this is not possible. In those instances MTT-S will provide up to \$1,000 for Chapter Chairmen to attend the MTT-S Chapter Chairmen's Dinner Meeting and Microwave Symposium. The annual budget is limited to \$15,000 and Chapter Chairmen should first contact their employer's for financial support. This policy was established at the June 1985 MTT-S ADCOM meeting for the purpose of providing support to the Chairmen and encouraging people to be MTT-S Chapter Chairmen.

Chapter Chairmen should write me a letter demonstrating need to the above address.

THE DEFICIT

Most people, regardless of their economic point of view, would agree that it's desirable to reduce the deficit. The only issue is the methodology. *My view:* The only productive way to reduce the deficit is to slow the rate of growth of government spending. A tax increase, which would slow down economic growth, is highly undesirable. *Perspective:* I wouldn't mind if we could keep the deficit down to last year's figure—\$180 billion—for the next five years. If at the same time we had nominal GNP growth of 7%, 8% or higher (which means perhaps 4% inflation and 4% real growth), then over a five-year period we would have reduced the *ratio* of deficit to GNP by 50%. At that point, a \$180 billion deficit would not look all that big compared with total GNP.

Problem: Cutting government spending is very difficult, and we will just have to keep working at it. I think too many reductions are being made in the military budget. I would prefer cuts in Amtrak and other such social programs. That is a problem of Congressional irresponsibility.

MEMBERSHIP MATTERS



by Patrick A. Green

Significant gains have been accomplished in MTT-S membership. The MTT-S rank in IEEE Society growth has held a solid fourth position. MTT-S has increased with over 650 new members, a 9.2 percent increase as compared to a year ago for the period ending June 30, 1985. If this pace continues we shall achieve a goal of over 8,700 active members by years end.

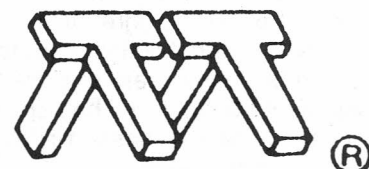
The IEEE MTT-S membership booth also had an outstanding year during the St. Louis MTT-S Symposium. With the help of the St. Louis Chapter and MTT-S ADCOM. MTT-S increased its membership by sixty-one. Thirty-three of these joined the IEEE, the remainder were currently IEEE members. Special thanks to Jeanine Myer of the St. Louis Chapter whose dedication at the booth helped acquire 15 of the 61 members.

Increase your Chapters membership and keep it active by introducing your friends and co-workers to the MTT Society. It's free the first year and they are under no obligation to continue a second year.

Chapter Congratulations

Congratulations are in order to the Milwaukee and Ottawa chapters for their outstanding efforts in promoting MTT-S membership for 1985. Milwaukee did exceedingly well in their efforts and had the highest growth rate with 45 percent, while Ottawa increased its membership by 31 percent. Representatives from these two chapters received Chapter Recognition Awards and two-hundred dollar checks during the Chapter Chairman's dinner at the recent MTT Symposium held in San Francisco.

Each year, the chapter with the largest growth (percentage-wise), from regions 1-6 and another from 7-10, shall receive this award. Good luck to all the chapters for their efforts in promoting membership next year.



MTT-S BIDS FAREWELL TO WILLIAM W. MUMFORD 1905-1985



On June 19, 1985, just two days after his 80th birthday, Bill Mumford's heart gave out and he peacefully passed away.

For many of us he was Mr. Microwave. He was also Mr. Microwave Society. Bill was a member of the first ADCOM. That first year, he served as Treasurer. The second year, he served as Vice Chairman, and the third year, he became Chairman.

In 1964, he was made an Honorary Life Member of the MTT ADCOM.

For those of us who had the privilege of spending time with Bill, he was an individual who had no axes to grind, except those of objectivity, excellence and hard work. It is an acknowledged fact that the MTT Society is one of the most dynamic in the IEEE. It has blazed a trail in many areas. One of the reasons for that has been the leadership that we have received from individuals like Bill Mumford.

Bill served on practically every sub-committee of the Society. He was active in the Society long after he became an Honorary Life Member and in fact he attended many of the meetings, even up until this past year. He took great delight in reviewing the Minutes of the meetings and he would go over them in fine detail by identifying all of the typographical errors and any other errors that he might find in his search. It was generally accepted for many years that the Minutes were not approved until Bill Mumford had spoken his piece. During his last few years he basked in the belief that he had become a "curmudgeon."

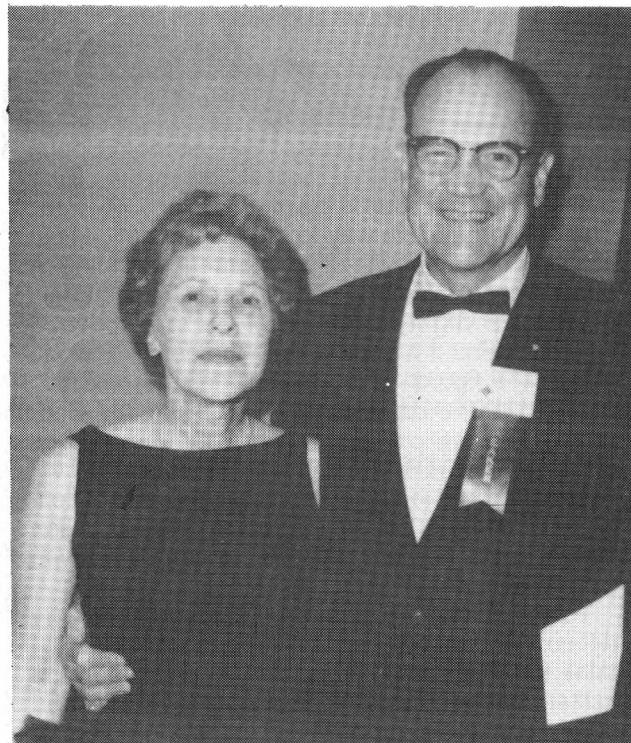
Bill was the first Editor of the MTT Transactions. He was also the first recipient of the Microwave Career Award in 1973, and in 1984 he was a recipient of the IEEE Centennial Medal.

In 1966, Bill received the Morris E. Leeds Award of the IEEE, and he chose to have it presented to him at the Microwave Symposium in Boston that year.

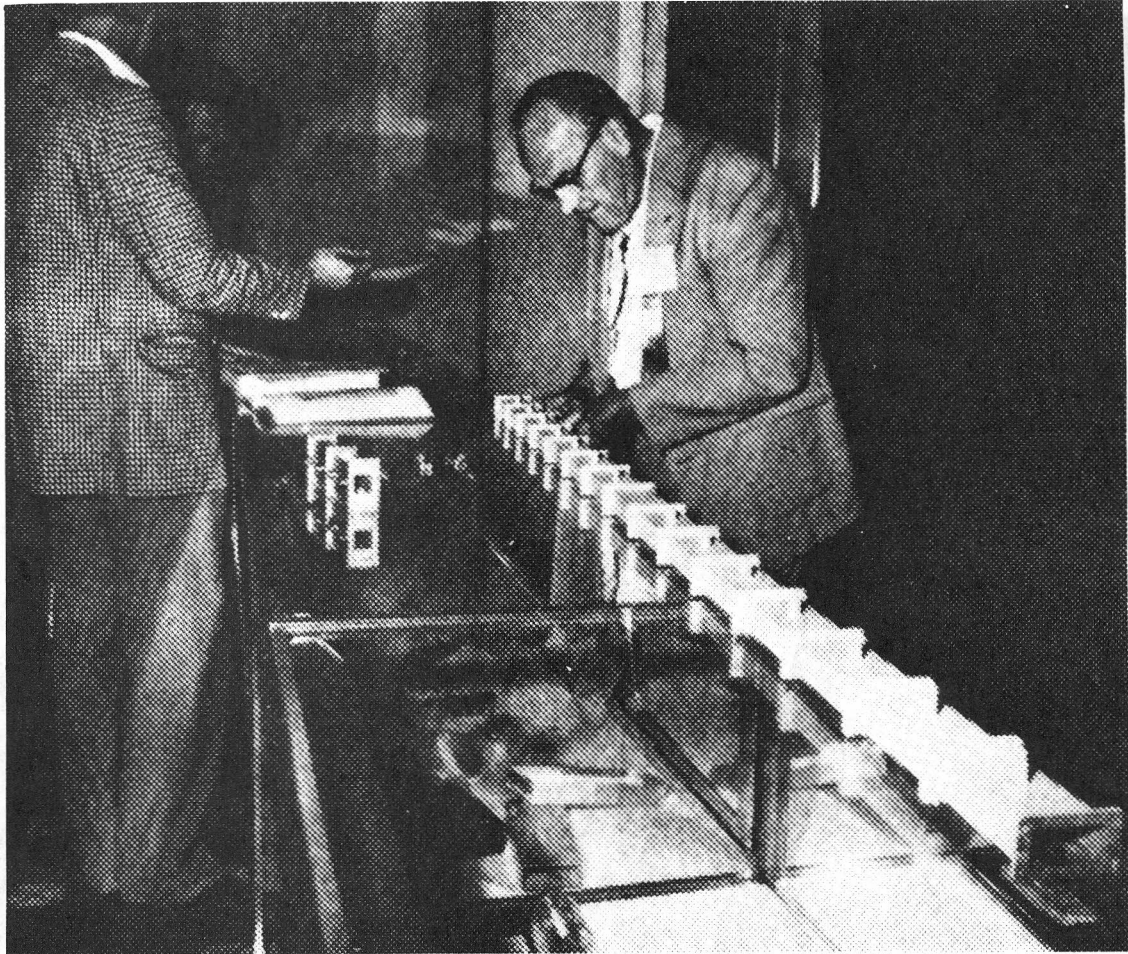
For many years Bill rarely missed a meeting of the MTT ADCOM. He attended all of the Symposia and was active in many of the committees that contributed to the preparation of the Symposia.

Bill was born in Vancouver, Washington, on June 17, 1905. He received the A.B. degree majoring in physics and mathematics from Willamette University, Salem, Oreg., in 1930.

In 1930 he joined the technical staff of Bell Laboratories with the Radio Research Department, Holmdel, N.J., where he worked on ultrahigh-frequency propagation and microwave components for radio relay systems and radars. In 1953 he transferred to the Military Development Department, Bell Laboratories, Whippany, N.J., where he was Supervisor of a group engaged in the study of microwave radar problems and the exploratory development and exploitation of the latest techniques for improving noise figures of receivers. He transferred to the Device Development Department, Murray Hill, N.J., in 1963. In 1964 he returned to Whippany to organize a group to do forward-looking radar development. He consulted on the subject of Radio Frequency Radiation Safety, not only for the Bell System, but also for the Office of Telecommunications



G-MTT National Symposium Long Island, 1964, Mr. and Mrs. Bill Mumford, (wife Betty).



Bill Mumford Assembling his Filter for the Historical Exhibit.

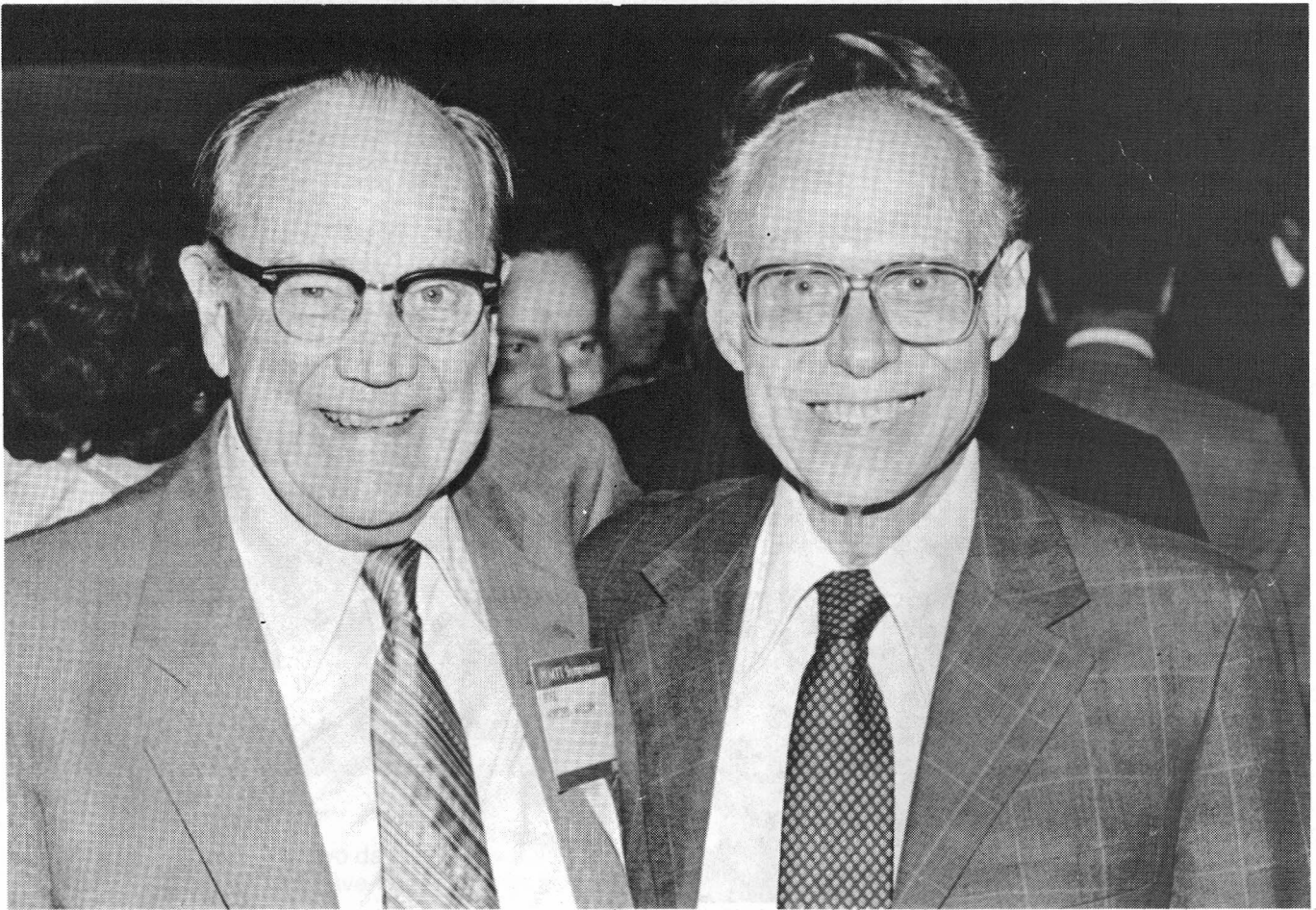


Boulder 1962—Tore Anderson and Bill Anderson.

Policy. He retired from Bell Laboratories in 1970, after 40 years of service there. His contributions in the microwave field included filters, directional couplers, wide-band coaxial-to-waveguide transducers, helix-to-waveguide transitions, and the gas-discharge noise generator. These are covered in 37 published papers and 19 patents. He was a co-author of *Radar Systems and Components* (Princeton, N.J.: Van Nostrand, 1949); a contributor to the *Reinhold Encyclopedia for Electronics*, 1962; and co-author of the book *Noise Performance Factors in Communication Systems* (Horizon House Microwave, Inc., 1968). In 1955 he served as Visiting Mackay Professor of Electrical Engineering at the University of California, and in 1962 he was Visiting Ford Professor of Electrical Engineering at the University of Wisconsin.

He was a member of the IEEE Groups on Circuit Theory, Electron Devices, and Antennas and Propagation. He served as the first Chairman of the Quantum Electronics Council. He became a Registered Professional Engineer in the State of New Jersey in 1950, and is listed in *Engineers of Distinction 1970*. He was a member of the URSI National Committee representing Commission I from 1966 to 1969, and was active on the

(Continued on Page 16)



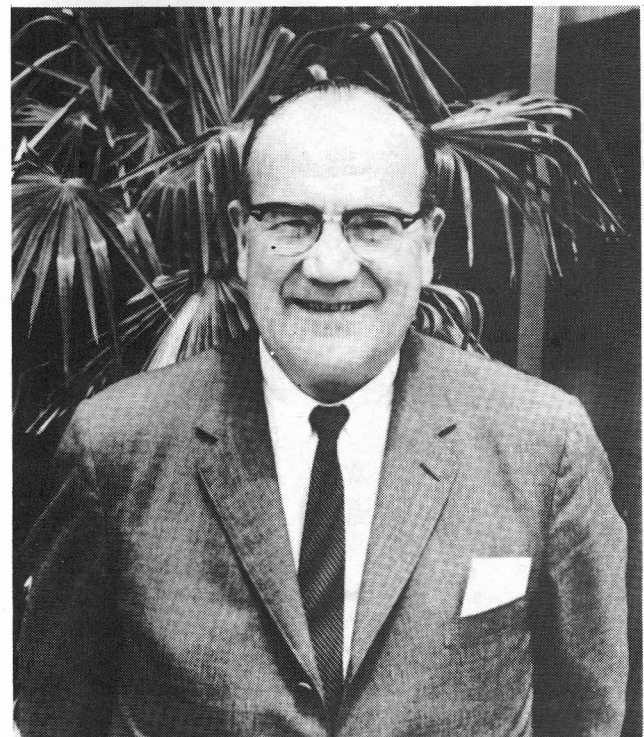
Reunion of Bill Mumford and John Pierce, 1984 International Microwave Symposium.

U.S. Standards Institute Committee C-95 having to do with radio frequency radiation hazards, being a co-author of Standard C-95.1. After retiring from the Bell Telephone Laboratories in 1970, he served a term on the Board of Directors of the Weinschel Engineering Company and did some consulting work with them. In 1971 he was appointed Adjunct Associate Professor of Environmental Medicine, part-time, at the New York University Medical Center, where his chief contributions were in the field of Microwave Biological Effects and Radio Frequency Radiation Hazards. Until recently he was active as an independent consultant and also was a member of the Electromagnetic Radiation Management Advisory Council of the Office of Telecommunications Policy in the Executive Office of the President of the U.S. He was listed in American Men of Science, Who's Who in Engineering, and Who's Who in America.

Bill was known to many of us as Mister Noise Figure, based on his invention of the noise tube. He was also a big contributor to the early work in waveguide filters. Last year he donated a souvenir noise tube and his first waveguide filter to the MTT Historical collection.

He was the only member of the MTT ADCOM who served continuously from its first year up until the present. Bill was a giant in our technology and our Society. We shall miss him.

—by Ted Saad



May 1969 Dallas Texas Symposium, William Mumford.

SPECIAL ARTICLES SOLICITED FOR THE MTT NEWSLETTER



by *J.B. Horton*

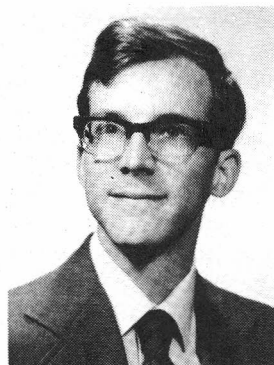
The MTT Newsletter staff is very interested in obtaining feature articles dealing with current topics in the technical and professional areas of interest to MTT Members. The idea is to provide the members with a general understanding of the topic and its significance in current and future activities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

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

The feature article for this issue deals with a relatively new type of mixer, the quasi-optical mixer. For sometime, the quasi-optical mixer has been a laboratory device waiting for an application. With the resurgence of millimeter wave applications, this mixer design is taking on a new significance. Although much work still needs to be done, recent designs reported at the annual MTT-S Symposium and other conferences show great promise. Our feature authors, Karl Stephan and Tatsuo Itoh, provide us with a historical background and an up-to-date review of the design techniques currently being used. The article also includes some very interesting potential applications of the quasi-optical mixer.



QUASI-OPTICAL MICROWAVE AND MILLIMETER-WAVE MIXERS



by *Karl D. Stephan and Tatsuo Itoh*

Introduction

As microwave systems progress to higher frequency and complexity, the engineer may be forced to simplify components and to combine functions whenever possible. A formerly simple task, such as conveying a received signal from antenna to mixer, becomes a major engineering challenge at millimeter-wavelength frequencies and shows the need for novel approaches to traditional functions. The designer needs to take advantage of strengths in short-wavelength design rather than accepting higher losses in scaling conventional microwave systems to shorter wavelengths.

Quasi-optical mixers represent just such an approach. A quasi-optical mixer combines the functions of a receiving antenna and a mixer into one compact unit which can be simple enough to be mass-produced by MIC techniques. Although development of the quasi-optical mixer is in the laboratory phase, a wide range of working designs have evolved in the last eight to ten years. Advances in the technology of monolithic microwave integrated circuits (MMIC's) have accelerated the development recently.

The recent resurgence of interest in millimeter-wave systems increases the already broad range of potential applications that quasi-optical mixers can fill. These applications include phased arrays, radar receiving systems, and multiple-beam microwave and millimeter-wave receivers for satellite communications and imaging systems. The purpose of this article is to summarize the principles of the quasi-optical mixer, review the basic design approaches that have appeared in the literature, and speculate on potential applications of this versatile component.

A General Quasi-Optical Mixer

The basic quasi-optical mixer is shown in Figure 1. One essential feature is that the signal to be received at a frequency f_{RF} is a free-space wave. This distinguishes

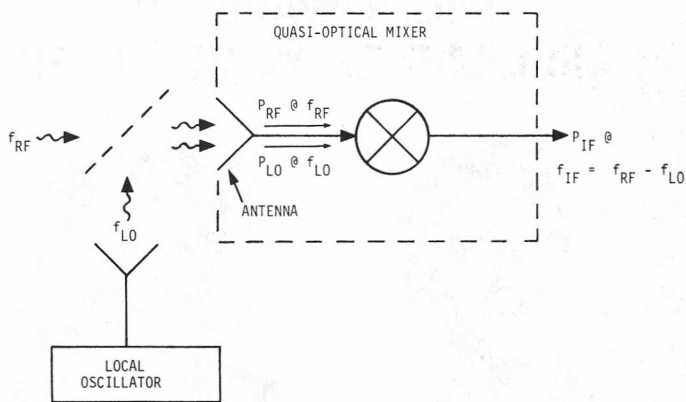


Fig. 1. Basic quasi-optical mixer.

the quasi-optical mixer from the conventional mixer which has a single input port at which an interface is well-defined. The receiving antenna is an intrinsic part of the quasi-optical mixer, since it is needed to receive and convert the incoming electromagnetic field into a current for nonlinear mixing. The antenna can take many forms, but it must have sufficient bandwidth to receive the local oscillator power as well as receive the incoming RF signal efficiently. (Other LO coupling techniques can be used, but these will not be discussed here). In Fig. 1 we show the RF and LO waves combined with a beamsplitter. Although high LO-to-RF isolation is not as easy to achieve in a quasi-optical mixer as in a conventional mixer, polarization duplexing and other techniques can be used to reach reasonable levels of isolation.

Once the signal has been received by the antenna, an available power P_{RF} can be defined, but not easily measured. Since the antenna forms an essential part of the mixer circuit, any attempt to separate the antenna and the mixer to measure P_{RF} usually leads to inconclusive results. The junction of the antenna and mixer is not necessarily a well-matched one, and the mixer's efficiency is a complicated function of the antenna impedance over a wide frequency range.

Conversion loss of the mixer is a critical design factor. For single-sideband operation, conversion loss is defined as the ratio of available power at the input frequency, P_{RF} , to available power at the intermediate frequency, P_{IF} :

$$L_c = \frac{P_{RF}}{P_{IF}} \quad (1)$$

The lack of a well-defined input port prevents the direct measurement of this ratio, since P_{RF} is inaccessible. One technique proposed by the authors⁽¹⁾ is the measurement of isotropic conversion loss L_{iso} . In this measurement, the RF wave's power density is measured and a hypothetical P_{RF} is calculated with the assumption that the mixer's antenna be isotropic with a gain of unity. Although this assumption is probably inaccurate,

it nevertheless leads to a workable quantity that expresses the IF power available from an RF wave. Absolute accuracy is not obtained, but relative measurements can be made. If the antenna gain G_t is known from measurements of scale models or by other means, the mixer conversion loss L_c can be found from the expression $L_c = G_t L_{iso}$.

Noise figure is a second vital parameter of interest to mixer designers. The theoretical calculation of the quasi-optical mixer noise figure is no different in principle from any other mixer noise calculation, and is a function of diode parameters, diode mounting parasitics, and interfaces. Let the mixer circuit noise figure be F_{mix} , and its conversion loss L_c . The overall noise figure of the system, F_{sys} , will be determined not only by F_{mix} but also by the noise figure F_{IF} of the IF system and losses in the antenna and RF path which we will call L_a . The system noise figure is then

$$F_{sys} = L_a F_{mix} + L_a L_c (F_{IF} - 1) \quad (2)$$

This expression shows that although a low-noise IF system can compensate for high mixer conversion loss, loss in the antenna or RF path contributes to the system noise figure directly as a multiplicative factor. This is why the quasi-optical mixer's elimination of waveguide or other lossy transmission media between the antenna and the mixer can lead to a system noise figure that is superior to a conventional mixer design.

It is customary to discuss noise parameters in decibels rather than the numeric ratios used in equations 1 and 2. Modern IF systems can achieve noise figures below 1 dB, which means that the IF noise contribution to system noise figure is relatively small, even for typical conversion losses of 5 to 8 dB. The single-sideband noise figure of a mixer is typically 1 to 2 dB higher than its conversion loss, so these two quantities are clearly the chief contributing factors to system noise figure.

Design Considerations

In most applications, the quasi-optical mixer design is shaped by the requirements of the system in which it is to be used. Most quasi-optical mixers have been solutions looking for problems, however, and a straightforward progression from system requirements to mixer design has been the exception rather than the rule. In addition to the usual considerations of noise figure, conversion loss, and frequency response, the quasi-optical mixer designer must decide upon a suitable antenna that not only couples to the free-space wave available at the mixer location, but also presents a suitable impedance to the mixer diodes. The impedance the diode sees is called the embedding impedance, and the importance of this impedance over a wide frequency range was pointed out by Held and Kerr⁽²⁾ in their classic paper on mixer conversion loss and noise. They found that the performance of a given diode in a given circuit depends on the embedding impedance at the operating frequencies, harmonics of the RF and LO frequencies, and combinations thereof.

For practical circuits at millimeter-wave frequencies, calculations of embedding impedance are difficult because of the effects of lowpass filters and supporting structures. Data from measurements of carefully scaled low-frequency models are often used. Some factors influencing quasi-optical mixer antenna design will now be discussed.

The type of antenna used depends on the nature of the incoming wave front. If the mixer is to be used without an external focusing structure such as a lens or parabolic dish, an antenna with fairly high gain in the direction of the RF source is desirable. Wire antennas that are several wavelengths long can be used, but the trend is toward planar antennas that can be mass-produced on a dielectric substrate. Elementary planar antennas such as slots or dipoles seldom have more than a few dB gain. An important exception is the tapered slot end-fire antenna proposed by Kollberg, et al. ⁽³⁾ This design is a prime candidate for operation with the quasi-optical mixer where high gain from a planar structure is required.

Usually, the quasi-optical mixer is placed at the focal plane of a focusing system which converts the incoming plane wave into a converging spherical wave. The mixer's antenna beamwidth should be matched to the solid angle of the converging cone of radiation. If the antenna beamwidth is too narrow, useful signal energy coming in from the edges of the cone will be rejected. If the beamwidth is too wide, thermal noise from warm surroundings can degrade the mixer's noise temperature, and diffracted rays from the edges of the focusing optics may introduce undesirable sidelobes in the overall receiving pattern.

Besides these specific requirements relating to the antenna's radiation pattern, the antenna's impedance over the frequency range is a vital concern. Viewed from the impedance standpoint, the antennas typically used fall into two broad categories: wideband and narrowband. Wideband antennas tend to have an impedance that is real and relatively constant with frequency. This simplifies the mixer design considerably, since the performance of the mixer with such a broadband termination is easy to calculate. ⁽⁴⁾ With the advantage of wide bandwidth, however, comes the penalty of poor spurious response rejection. Images and signals near harmonics of the local oscillator will produce interfering IF outputs.

Narrowband antennas (10%-20% usable bandwidth) are designed to resonate at a frequency that allows efficient coupling of the RF and LO signals. Mixer theory predicts that the primarily reactive impedance these antennas present to the mixer outside their resonant bandwidth can lead to lower conversion loss. Choosing mixer diodes for quasi-optical mixers is similar to choosing diodes for conventional mixers. Although diode packaging and antenna interfacing is an important factor, the single most important diode parameter is its cutoff frequency, $f_c = \frac{1}{2 R_s C_j}$, where

R_s is the diode's parasitic resistance and C_j is the zero-bias junction capacitance. Mixer efficiency starts to drop off at RF frequencies well below f_c , and a diode with an f_c several times the input frequency is needed for good mixer performance. Since the diodes must fit on the quasi-optical mixer structure, beam-lead diodes are common. As GaAs technology evolves diodes will be made an integral part of the MMIC GaAs substrate on which the rest of the mixer is built. Nightingale, et al., ⁽⁵⁾ have recently reported the design of a 35-GHz mixer using monolithically integrated diodes.

Removing the IF signal without disrupting the high-frequency fields requires a carefully designed lowpass filter. This is usually straightforward by means of fabrication on a printed structure, but care must be taken to isolate the IF port from the mixing signals. IF amplifiers can be integrated onto the same substrate as the mixer, although few investigators have carried integration of the quasi-optical mixer this far.

Historical Review

The earliest example of a component that can be viewed as a quasi-optical microwave mixer was developed by Kock and Harvey ⁽⁶⁾ in 1951. Their goal was to display microwave phase fronts emerging from a quasi-optical lens. Their setup shown in Fig. 2 can be explained in quasi-optical mixer terminology this way: A quasi-optical mixer, consisting of a dipole antenna connected to a crystal diode, was suspended at the end of a moving arm. Local oscillator power was delivered at a constant frequency through the reference feed horn. As the arm scanned through the phase fronts, the RF signal was Doppler-shifted by the motion of the arm relative to the lens. The IF (a low audio frequency in this case) was fed to a neon bulb which exposed a photographic plate as it moved through the field. Admittedly, calling this device a quasi-optical mixer stretches the definition a bit, but all the essential features are present: free-space RF and LO inputs, antenna coupled directly to the mixer element, and an IF output frequency.

More recent contributions to the field are summarized chronologically in Table I. This is a selected sampling of references chosen to portray the variety of design approaches that have been taken with this kind of mixer. Since many of the functions of a quasi-optical mixer can be performed by conventional mixers, it is understandable that the first applications of quasi-optical mixers were those in which conventional guided-wave mixers failed to work. In the submillimeter-wave frequency region metal waveguide is hopelessly lossy, leaving free space as one of the few viable transmission media available. Bearing this in mind, Clifton ⁽⁷⁾ devised the 600-GHz quasi-optical mixer illustrated in Fig. 3. The plastic lens focused both RF and local oscillator energy through free space inside the conical housing onto a mixer element which included a Schottky-barrier diode in a stripline filter structure. A waveguide short behind the diode was used for tuning. The element leads acted as an antenna. This idea was carried further in the corner-cube mixer described below.

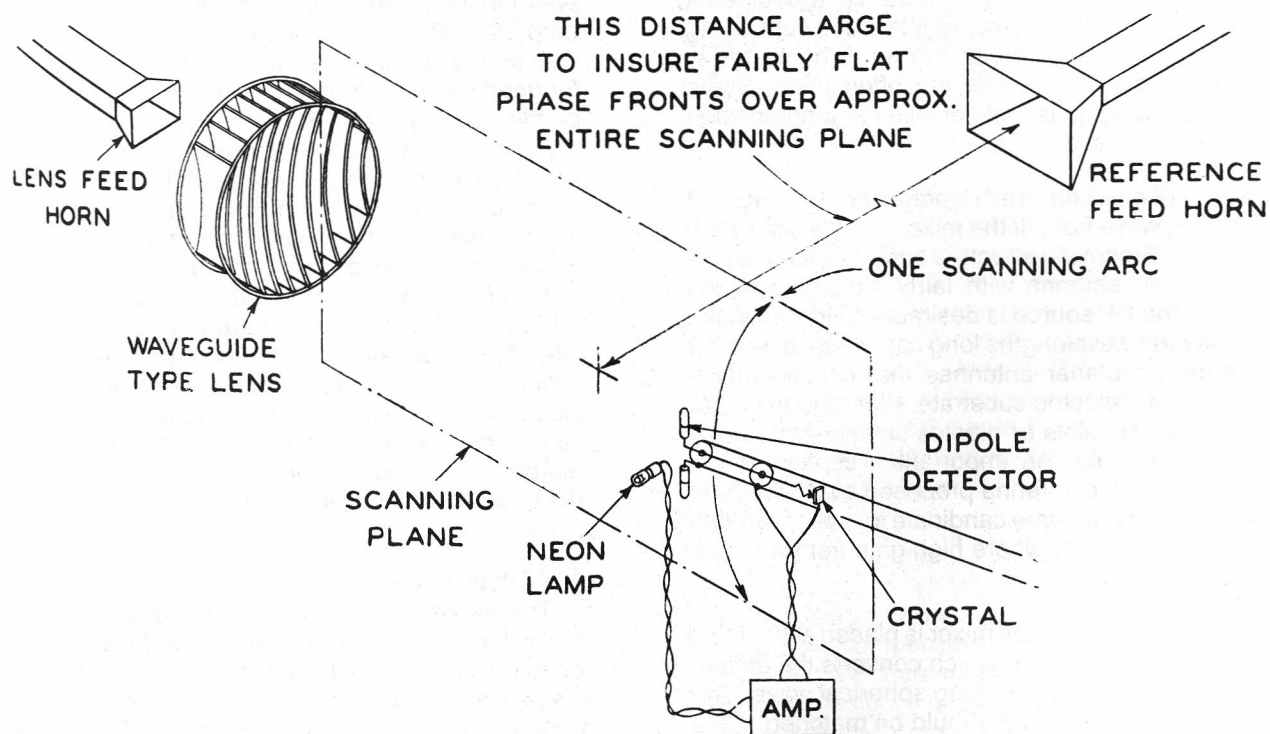


Fig. 2. Microwave phase-front imaging experiment using early form of quasi-optical mixer (from Kock and Harve [6], reprinted with permission from The Bell System Technical Journal. Copyright 1951 AT&T).

Table I Recent Contributions to Quasi-Optical Mixers

| Date | Reference | Frequency | Description |
|------|----------------------|-------------|---|
| 1977 | Clifton (7) | 600 GHz | Diode package mounted at focus of lens, waveguide backshort for tuning |
| 1977 | Kerr et al. (8) | 100 GHz | Two slot antennas feeding diode mounted on quartz substrate |
| 1978 | Fetterman et al. (9) | 316-761 GHz | Diode at end of long-wire antenna mounted in corner-cube reflector |
| 1981 | Clifton et al. (10) | 110 GHz | Monolithic mixer circuit with diode on GaAs substrate with slot antennas at end of horn |
| 1982 | Parrish et al. (12) | 140 GHz | Printed dipoles on grounded quartz substrate with beam-lead diodes |
| 1982 | Yuan et al. (11) | 125-136 GHz | Two slot antennas feeding balanced mixer with waveguide LO feed |
| 1983 | Stephan et al. (16) | 35 GHz | Slot ring antenna with one or two diodes; X-band version is balanced |
| 1984 | Stephan et al. (1) | 35 GHz | Bowtie antenna feeding subharmonic diode pair |
| 1985 | Rutledge et al. (15) | 94 GHz | Monolithic bowtie antennas feeding integrated diode in array |
| 1985 | Yngvesson (18) | 35 GHz | LTSA antenna feeding beam-lead diode |

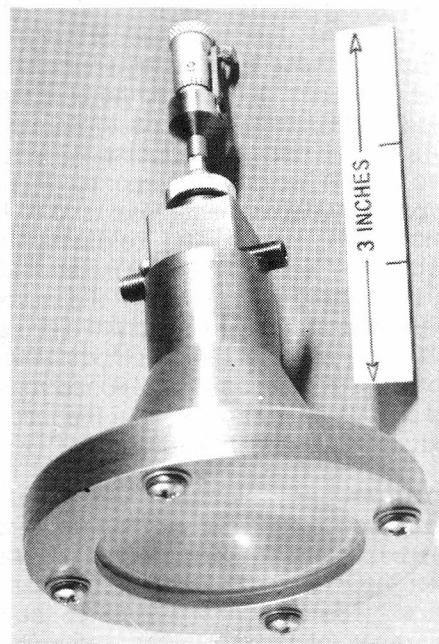


Fig. 3. 600 GHz lens-fed quasi-optical mixer (from Clifton [7]).

In the same year (1977), Kerr et al. ⁽⁸⁾ took a different approach. At their lower frequency of 100 GHz, the longer wavelength gave them room to construct two slot antennas on a 0.007-inch fused quartz substrate as shown in Fig. 4. These antennas were then coupled to a Schottky-barrier chip diode via quartz microstrip and a wire contact whisker that was mounted parallel to the substrate. The resonant slot antenna and whisker caused the design to have a fairly narrow bandwidth, but the higher coupling efficiency within the antenna's frequency range probably led to lower conversion loss.

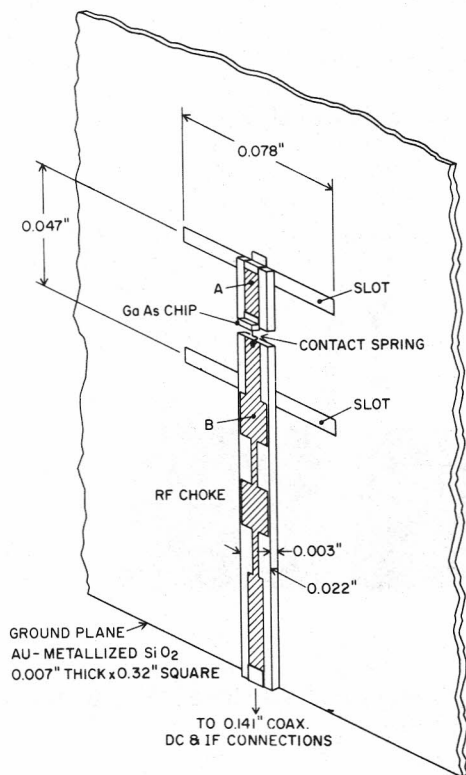


Fig. 4. 100-120 GHz slot-antenna quasi-optical mixer (from Kerr et al. {8}).

Meanwhile, Fetterman et al. ⁽⁹⁾ had found that by lengthening the diode contact whisker to several wavelengths and placing the diode and whisker in an open three-sided corner reflector (or "corner cube"), RF and local oscillator power could be coupled efficiently to the diode over a bandwidth exceeding one octave. Fig. 5 illustrates this mixer. The long whisker acted as a traveling-wave long-wire antenna, and the reflector concentrated the incoming energy to improve the coupling efficiency. This type of mixer has since become almost a standard technique in the submillimeter-wave field because of its simplicity and wide spectral response.

The first quasi-optical mixer to be made monolithically on GaAs was built by Clifton in 1982. ⁽¹⁰⁾ The circuit included a wide slot antenna with a coupling probe that connected to the Schottky-barrier diode fabricated with the antenna. This circuit was mounted at the narrow end of a horn as shown in Fig. 6. Fig. 7 shows the details of the diode circuit, including the RF bypass capacitor above the diode and the slot probe below it. This mixer was designed for 110 GHz and produced a double-sideband (DSB) noise figure of 3.4 dB.

Up until 1982, single-ended quasi-optical mixers were the most common design. A 125 GHz balanced design around two slot antennas was presented by L. Yuan et al. ⁽¹¹⁾ at the 1982 IEEE Microwave Theory and Techniques Symposium. Fig. 8 shows the probe-coupling technique used with a pair of slot antennas. The balanced pair of diodes reduced LO noise appearing at the IF output. The local oscillator power was fed through a waveguide in this case, rather than quasi-optically. Conversion loss of 7 dB was achieved with a 7 GHz bandwidth.

Applications

Most of the mixers discussed so far are proof-of-concept units not designed for a particular application. However, the quasi-optical mixer does have a unique and promising application in a millimeter-wave imaging array. An elementary diagram of such an array is illustrated in Fig. 9. The field of view is represented here by a grid of boxes, each containing one picture element (pixel). The scene may either be illuminated by a radar pulse or may merely emit thermal black-body radiation. The energy received from the scene is focused through a lens onto an array of receivers, each of which generates an output proportional to the energy emitted by its respective pixel. An appropriate display device can then synthesize a visual image of the microwave scene.

The reasons millimeter-wave imaging has not been done this way up to now are size and cost. A single-channel receiver with conventional mixer circuits is sufficiently bulky and complex so that a 25-channel imaging system built with conventional approaches would be excessively large and heavy. The concept of the quasi-optical mixer brings such an array much closer to reality. One quasi-optical mixer replaces the separate antenna and mixer required by the conventional approach. Since each conventional mixer requires local oscillator power delivered to its guided-wave input, a complex power-distribution network must be provided. On the other hand, quasi-optical mixers can receive local oscillator power from a central source radiating through free space, eliminating the distribution network. While quasi-optical mixers do not reduce the total antenna aperture size needed for a given resolution, they do permit simultaneous use of the same antenna by a number of receivers.

Motivated by these potential advantages, a number of groups began work on quasi-optical mixers for use in arrays. In 1982 Parrish et al. ⁽¹²⁾ described an array of

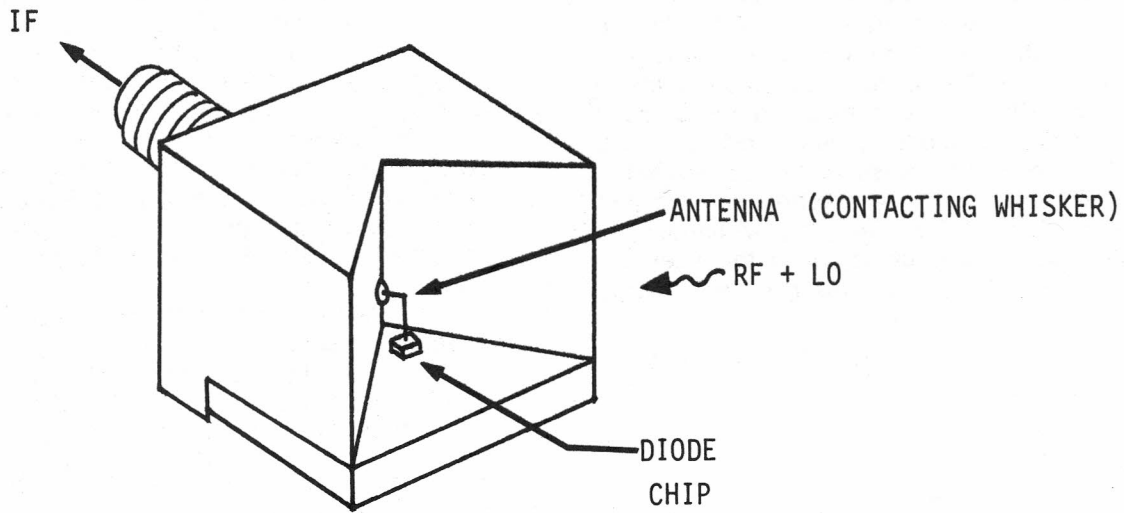


Fig. 5. Submillimeter-wave corner-cube mixer (from Fetterman et al. {9}).

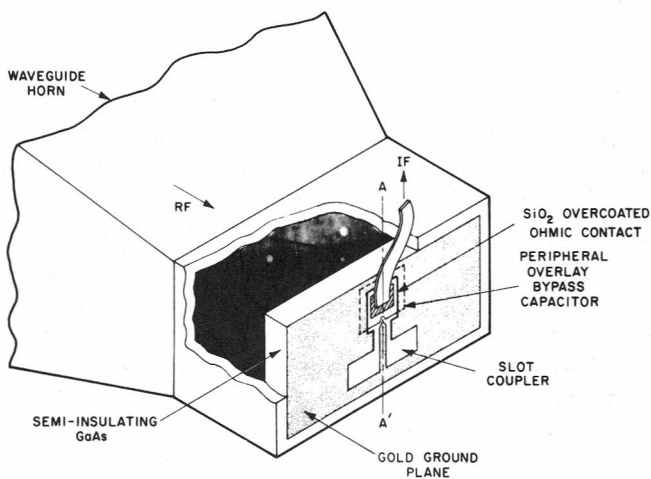


Fig. 6. 110 GHz monolithic quasi-optical mixer on GaAs substrate (from Clifton et al. {10}).

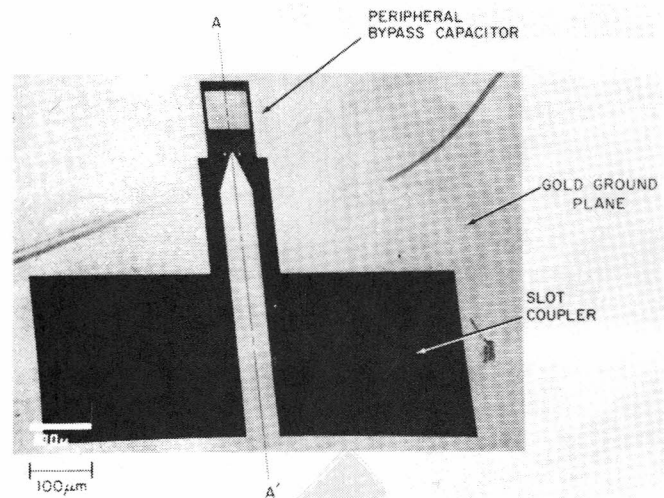


Fig. 7. Enlarged view of substrate in Fig. 6 (from Clifton et al. {10}).

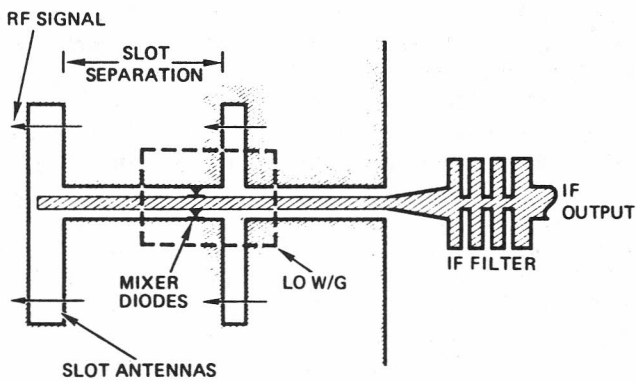


Fig. 8. 125 GHz balanced slot-antenna quasi-optical mixer (from Yuan et al. {14}).

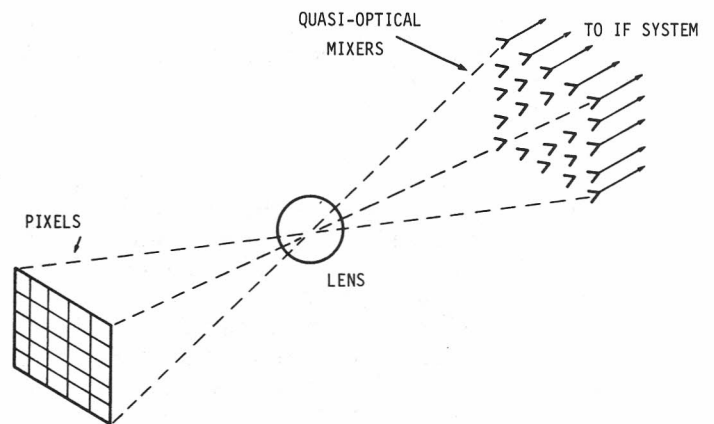


Fig. 9. Basic quasi-optical mixer imaging array.

140-GHz mixers using printed dipole antennas. Unlike slot antennas which require free space on either side of the supporting substrate, printed dipoles can work on a substrate backed by a continuous ground plane. Such an array is shown in Fig. 10. A recent version of this device, using a beam-lead diode, has achieved a single-sideband noise figure of 12.6 dB. ⁽¹³⁾

The specific requirement for this and other imaging work carried out above 100 GHz is the desire for enhanced plasma diagnostics in nuclear fusion research. High-temperature plasmas emit millimeter-wave radiation, and displays of the spatial distribution of this energy are used to study the mechanisms of plasma formation and decay. On the West Coast, workers at the California Institute of Technology and the University of California at Los Angeles have contributed significantly to the technology of millimeter-wave imaging systems and components for this application. Although most of their work concentrates on imaging detectors rather than mixers, ⁽¹⁴⁾ D. Rutledge and C.-E. Zah ⁽¹⁵⁾ have recently developed a monolithic mixer that uses a bow-tie antenna feeding a Schottky-barrier diode, both integrated on a GaAs substrate. Their mixer-detector (Fig. 11) is mounted on the flat side of a hemispherical dielectric lens (Fig. 12) and thus avoids

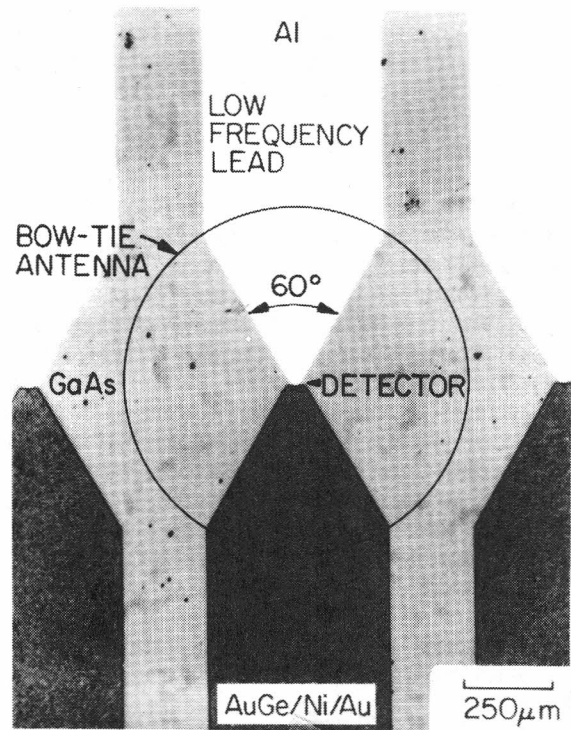


Fig. 11 Monolithic 94 GHz bowtie antenna feeding integrated mixer-detector diode (courtesy D. Rutledge and C.-E. Zah {15}).

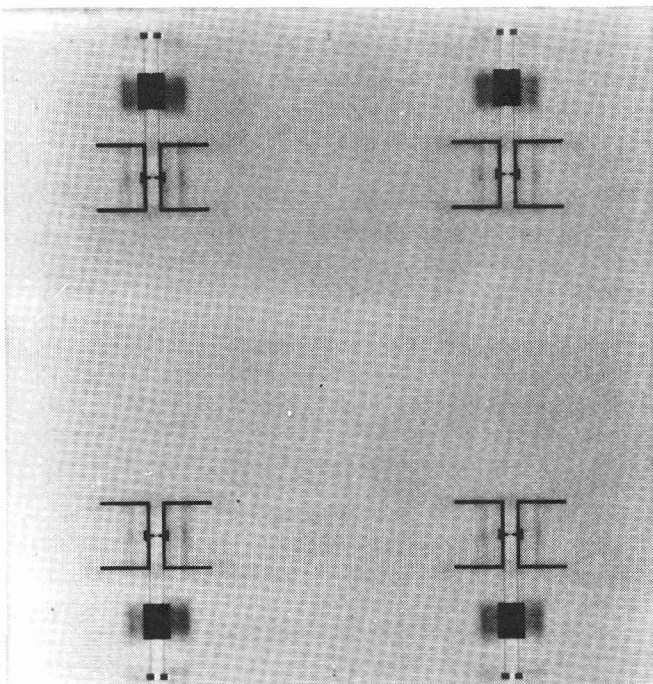


Fig. 10. Quasi-optical mixer array using printed dipoles (courtesy J. Taylor {13}).

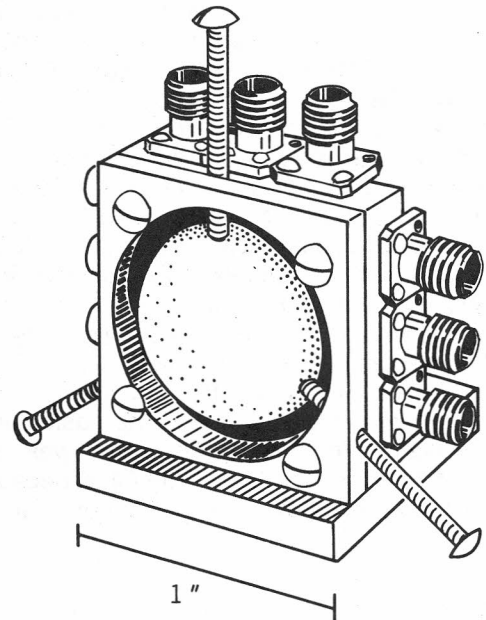


Fig. 12. Hemispherical lens feeding array of 94 GHz mixers of Fig. 11. Connectors are for IF outputs (courtesy D. Rutledge and C.-E. Zah {15}).

certain surface-wave problems that can arise unless very thin free-standing substrates are used. The single-sideband conversion loss of their mixer at 94 GHz is 13.5 dB, which includes about 6 dB of coupling loss to the mixer.

Besides the fairly narrow field of plasma diagnostics, there are other remote sensing applications that could benefit from a fast, sensitive, high-resolution microwave or millimeter-wave imaging system. As part of a program to explore millimeter-wave imaging, the authors of this article and N. Camilleri⁽¹⁶⁾ developed a new type of quasi-optical mixer in 1983. The basic structure uses a slot ring antenna instead of the slot dipoles common in other designs. A circular slot in the metal covering one side of a dielectric substrate forms a slot-ring antenna capable of receiving incoming radiation perpendicular to the substrate on either side (See Fig. 13). Two balanced mixer diodes at right angles to each other bridge the slot. In operation, vertically polarized local oscillator energy drives the diodes so that a horizontally-polarized incoming RF signal is downconverted at each diode. The resulting IF signals combine at the coplanar-waveguide lowpass filter that keeps the LO fields within the slot ring structure. Versions of this mixer have worked at frequencies as high as 35 GHz, and an X-band model showed conversion loss as low as 5.5 dB and a mixer noise figure of about 6.5 dB (SSB).

All the circuits described so far worked best as "straight-through" mixers; that is, the fundamental of the RF mixed with the fundamental of the LO to produce the IF. If insufficient LO power is available at the fundamental frequency, a lower-frequency oscillator can be used so that the proper LO harmonic is produced within the mixer. These subharmonic mixers generally show poorer conversion loss than their fundamental counterparts, but certain circuits can enhance their efficiency. Schneider, et al.⁽¹⁷⁾ found that a back-to-back pair of diodes can be made to conduct twice per local oscillator cycle, and thus can function nearly as well as a conventional mixer using twice the LO frequency. The authors used this technique to design a very wideband quasi-optical mixer⁽¹⁾ that produced a conversion loss as good as 8.6 dB. Fig. 14 illustrates the simple construction details of this mixer model, which was intended to test the basic concept prior to monolithic integration. This mixer was usable over a 2.5:1 frequency range (14-35 GHz) because of the inherently wide bandwidth of its bowtie antenna.

The Future

Twelve years ago, quasi-optical mixers were a laboratory curiosity known only to a few physicists. Today, at least one company (Millitech Inc.) offers them as a commercial product. With current growing interest in the millimeter-wave field where these devices are most practical, it is a fairly sure bet that the quasi-optical mixer will be in much greater demand in the future.

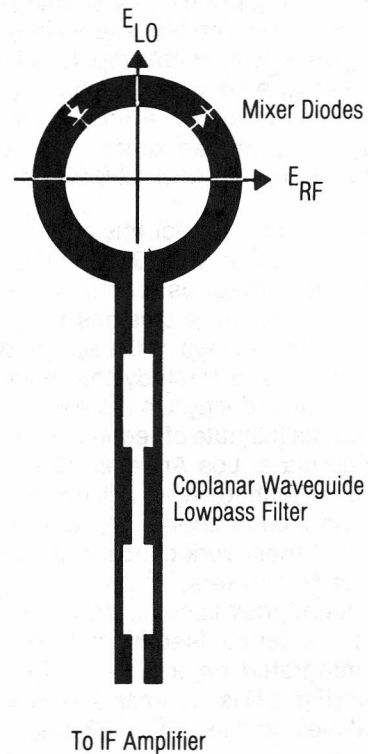


Fig. 13. Slot ring mixer showing LO and RF fields. Slot in one-sided metal cladding on dielectric is indicated with black.

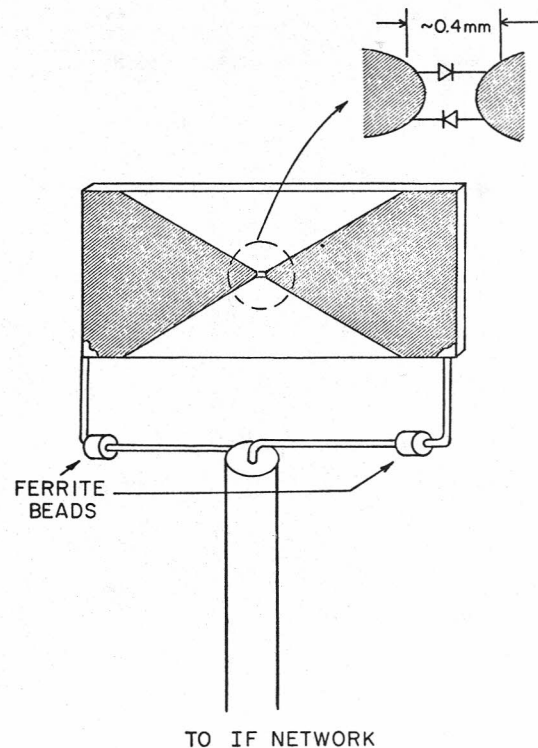


Fig. 14. Broadband subharmonically-pumped quasi-optical mixer using bowtie antenna (from Stephan et al. {1}).

This is not to imply that quasi-optical mixers have no applications below 30 GHz. The general trend toward integration at all microwave frequencies favors the use of quasi-optical mixers wherever many similar receivers must be clustered together in a small space. Satellite-mounted receivers, which cover different geographic areas with multiple beams could benefit from this technology, as techniques needed to implement such a receiver are developed. Also, quasi-optical mixers should be considered whenever there are many mixers all pumped by one local oscillator in a receiving system. Phased arrays have traditionally used an RF phasing and distribution network for both transmitting and receiving. This requires bidirectional phase shifters and often prevents amplifiers from being used at the antennas. Replacing a phased-array receiver with an array of quasi-optical mixers now allows the designer to do his phase shifting at the lower IF signal frequency, with much less concern about path length matching. As more millimeter-wave designs are considered, the idea of going to the IF directly at the antenna will gain in appeal.

Even though quasi-optical mixers may have many non-imaging applications such as these, it is likely that they will find applications sooner in the field of millimeter-wave imaging. The things one can view at millimeter wavelengths fall into three categories:

(a) **The ground:**

This includes earth remote sensing from airplanes or satellites for crop assessment, ocean current detection, etc. Conventional radiometers and radars using single antennas or arrays have proven highly successful in producing extraordinarily detailed maps with sophisticated image processing. The motion of the receiver with respect to the ground is usually used in a scanning operation, so quasi-optical mixers will find applications here in at most one-dimensional linear arrays, where they could replace a bank of individual receivers.

(b) **Things on the ground:**

This includes plasma diagnostics and remote sensing of objects under adverse atmospheric conditions. Early hopes that millimeter-wave "cameras" could penetrate heavy dust clouds have been frustrated by poor resolution with available instruments, and there is still considerable room for new work. It is possible that there are some very interesting things to look at that remain undiscovered because an easy-to-use portable camera is not available. A quasi-optical mixer array would be ideal for this.

(c) **Things above the ground:**

Radioastronomers, who have concentrated on wringing the last fraction of a decibel of noise out of their helium-cooled mixers, are the active group in this activity. Currently, imaging in radioastronomy is done after the fact with com-

puter image processing, because a single receiver is a complex and delicate piece of equipment. Putting two or more receivers together at the focal plane of a large dish to form even a rudimentary real-time image has been an impossible dream up to now. However, increasing numbers of millimeter-wave radioastronomers use quasi-optical techniques to couple RF and LO power to their mixers, even though the mixer diode itself is still mounted in waveguide. In time quasi-optical mixer arrays compatible with telescope optics will make real-time imaging possible, while greatly increasing the usage factor of a single telescope dish. Already several groups have started work on quasi-optical mixers which use superconductor-insulator-superconductor (SIS) junctions as an extremely low-noise receiving element.⁽¹⁸⁾ Although such mixers must be cooled to liquid helium temperatures, their noise performance can theoretically approach the quantum limit.⁽¹⁹⁾ As quasi-optical mixer performance approaches that of conventional mixers, the benefits of running four or eight receivers simultaneously will prove an irresistible temptation even if each mixer is slightly noisier than the original single unit.

Conclusions

This article has been a brief introduction to a subject that is neither fish nor fowl, since quasi-optical mixers do not fit into a neat category. They borrow from device technology, since operation at millimeter wavelengths is impossible without high-cutoff-frequency diodes. They depend on nonlinear circuits and theories such as the mixer analysis by Held and Kerr which holds out the promise of designing a mixer analytically. They borrow from antenna theory, since the mixer circuit also serves as the radiating element. Finally, their practicality depends on system design, which is significantly affected by the combination of traditional functions that these components perform. Greater awareness of the unique benefits that quasi-optical mixers offer to the microwave community should lead to many practical applications in the years to come.

Acknowledgments

The authors wish to thank the following individuals for their kind assistance in the preparation of this article: Dr. Brian Clifton, Dr. T. C. L. G. Sollner, and John Taylor of Lincoln Laboratories; Prof. Harold Fetterman of UCLA; Dr. Tony Kerr of the National Radio Astronomy Observatory; Prof. David Rutledge and Chung-En Zah of Caltech; and K. Sigfrid Yngvesson of the University of Massachusetts at Amherst.

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In 1977, he joined Motorola, Inc. in Fort Worth, TX. From 1979 to 1981, he was with Scientific-Atlanta, Atlanta, GA, where he engaged in research and development pertaining to cable television systems. After working at Hughes Aircraft in the summer of 1982 as a Student Engineer, he received the Ph.D. degree in electrical engineering from the University of Texas at Austin in 1983. In September 1983, he joined the faculty of the University of Massachusetts at Amherst, where he is presently Assistant Professor of Electrical Engineering.

His current research interests include the application of quasi-optical techniques to millimeter-wave circuits and subsystems.

Tatsuo Itoh received the Ph.D. Degree in Electrical Engineering from the University of Illinois, Urbana in 1969.

From September 1966 to April 1976 he was with the Electrical Engineering Department, University of Illinois. From April 1976 to August 1977 he was a Senior Research Engineer in the Radio Physics Laboratory,

SRI International, Menlo Park, CA. From August 1977 to June 1978 he was an Associate Professor at the University of Kentucky, Lexington. In July 1978 he joined the faculty at the University of Texas at Austin, where he is now a Professor of Electrical and Computer Engineering and Director of the Electrical Engineering Research Laboratory. During the summer 1979, he was a guest researcher at AEG-Telefunken, Ulm, West Germany. Since September 1983, he has held the Hayden Head Centennial Professorship of Engineering at the University of Texas. Since September 1984, he has served as Associate Chairman for Research and Planning of Electrical and Computer Engineering Department.

Dr. Itoh is a Fellow of the IEEE, a member of the Institute of Electronics and Communication Engineers of Japan, Sigma Xi, and Commission B of USNC/URSI. He serves on the Administrative Committee of IEEE Microwave Theory and Techniques Society and is the Editor of IEEE Transactions on Microwave Theory and Techniques. He is a Professional Engineer registered in the State of Texas.



ARFTG HIGHLIGHTS



by Mario A. Maury, Jr.

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

25th ARFTG CONFERENCE

The Spring ARFTG Conference was held as a workshop as part of the 1985 IEEE-MTT-S International Microwave Symposium in St. Louis, Missouri at the Cervantes Convention Center. The Conference started at noon on Thursday, June 6 and ended at 4:30 p.m. on June 7. The main Conference topic was "Automated Active Device Measurements" and was chaired by Bob Nelson of the National Bureau of Standards, Boulder, Colorado.

Lee Saulsbery of the National Bureau of Standards, Boulder, Colorado and President of ARFTG opened the meeting and introduced Mr. Harlan Howe, Jr., President of The Microwave Theory and Techniques Society (MTT-S). Mr. Howe welcomed the nearly 150 attendees to the conference.

The technical program chairman was Dr. Barry Perlman of RCA Laboratories, Princeton, New Jersey, who put together an excellent program consisting of 19 technical papers. The following is a partial summary of the papers presented:

- TIME DOMAIN MEASUREMENTS IN KA BAND (16.5 - 40.0 GHz) USING A WR28 5 PORT JUNCTION.
Gordon P. Riblet, Microwave Development Laboratories, Natick, MA
- IN SEARCH OF AN IMPEDANCE STANDARD FOR MICROWAVE FREQUENCIES Glenn F. Engen, National Bureau of Standards, Boulder, CO
- AN AUTOMATIC CALIBRATION SYSTEM FOR DIODE POWER DETECTORS
Dr. B.A. Herscher, Wavetek Pacific Measurement, Inc., Sunnyvale, CA
- REPORT ON COMMITTEE TO PROMOTE NATIONAL MICROWAVE STANDARDS
Mario A. Maury, Jr., Maury Microwave Corporation, Cucamonga, CA
- A SEMI AUTOMATED SCALAR-VECTOR SETUP FOR LOAD AND SOURCE PULL MEASUREMENT
Madhu Avasarala, Avantek, Inc., Milpitas, CA
- DE-EMBEDDED MEASUREMENTS USING THE HP8510A
Glenn Elmore, Hewlett Packard, Santa Rosa, CA
- A MICROSTRIP CHIP CARRIER INSERT FOR THE TRANSISTOR TEST FIXTURE
Gary Simpson, Maury Microwave Corporation, Cucamonga, CA and Richard O. Lane, California Eastern Laboratories, Santa Clara, CA
- COHERENT (I/Q) DETECTOR ERROR ANALYSIS SOFTWARE

K.R. Bradley, Texas Instruments, Dallas, TX

Formal Vendor Exhibits were held for the first time at an ARFTG Conference, there were 14 exhibitors participating as listed below:

| | |
|--------------------|--------------------------------|
| Cascade Microtech | Automatic Testing & Networking |
| Maury | Pacific Measurements |
| Hewlett Packard | Narda |
| Adams Russell | Polorad |
| Wiltron | Tektronix |
| EIP Microwave | Compact Software |
| Made-It-Associates | EESOF |

A continental breakfast and all the breaks were held in the exhibits area on both days of the Conference. This activity was extremely successful and it is now planned to have Vendor Exhibits as a regular part of future ARFTG conferences.

ARFTG Awards Banquet

The semi-annual ARFTG Awards Banquet was held the evening of June 6 and the following awards were presented by Lee Saulsbery, ARFTG President:

Best Paper Award, 24th Conference . . . Gary Simpson
Maury Microwave Corp.
Cucamonga, California

Automated Measurements
 Career Award Peter Lacy
 Wilton
 Mountain View, California

Automated Measurements
 Technology Award Barry Perlman
 RCA Laboratories
 Princeton, New Jersey

Service Award Robert Nelson
 NBS
 Boulder, Colorado

The Banquet Speaker was Professor Harold Shipton from Washington University, St. Louis, Missouri. His topic, "Radar and World War II: Some Personal Reflections," was very interesting and presented us with humorous look at one of the early applications of "microwaves." Entertainment for the evening was provided by Valerie Peters and her "Dancin' Plus" musical review.

EXECOM ELECTIONS

At the EXECOM meeting, the following members were elected or appointed to the following position:

Officers:

| | | |
|---------------------|---|---------------|
| President | — | Ray Tucker |
| Vice President | — | Robert Nelson |
| Secretary | — | Jim Taylor |
| Treasurer | — | Barry Perlman |
| Recording Secretary | — | Bob Landsman |

Committee Chairman and Co-Ordinators:

| | | |
|------------------|---|---------------|
| Standards | — | Lee Saulsbery |
| Awards | — | Frank Mendoza |
| Nominations | — | Peter Lacy |
| Publications | — | John Barr |
| Publicity | — | Rich Irwin |
| Library | — | George Oltman |
| MTT-S & Exhibits | — | Mario Maury |

ANNOUNCEMENT 26TH CONFERENCE

The Fall 1985 ARFTG Conference will be held December 5 and 6 at the Red Lion Inn in Ontario, California. The Conference Host will be Mario Maury of Maury Microwave Corporation, Cucamonga, California.

The theme of the Conference will be "Computer Aided Microwave Engineering." Papers are solicited on recent hardware and software developments on this topic, as well as other computer-aided RF design and testing topics. Manufacturers are also encouraged to discuss or demonstrate new products that have been developed for RF design and testing, a separate exhibits area will be available for demonstrations. Authors should submit a one page abstract and a 500 to 1,000 word summary providing sufficient technical content for proper evaluation. Two copies of the abstract and summary should be sent to the Technical Program Chairman before October 1, 1985. All accepted papers will be published in the Conference Digest. Please refer to the "ARFTG Instructions to Authors" for additional information.

Submit papers to the Technical Program Chairman (TPC):

Gary Simpson
 Maury Microwave Corporation
 8610 Helms Avenue
 Cucamonga, CA 91730
 (714) 987-5714

Manufacturers interested in exhibiting their products, contact the Assistant Exhibits Co-ordinator (EC):

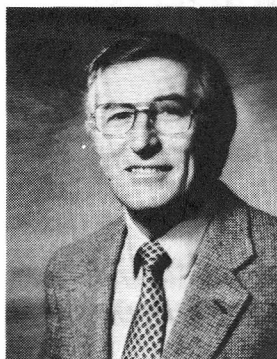
Ms. Darlene Payette
 Maury Microwave Corporation
 8610 Helms Avenue
 Cucamonga, CA 91730
 (714) 987-4715

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

George Oltman
 Hughes Aircraft Company
 Building 268/A55
 Canoga Park, CA 91304
 (818) 702-2293



DISTINGUISHED MICROWAVE LECTURER



by Kenneth L. Carr

As I'm sure you are aware, the title of this particular Lecture Series is "The Application of Microwave Technology to the Detection and Treatment of Cancer." The first of these lectures was presented to the Los Angeles Chapter on 18 June 1985, and was most graciously received.

As of this writing, we have firm commitments with the following Chapters:

| | |
|--------------|----------------------------------|
| September 17 | San Gabriel Valley |
| September 19 | San Fernando Valley |
| October 1 | Palm Beach Section |
| October 2 | Indian River Section (Melbourne) |
| October 3 | Orlando |
| October 4 | Charlotte, NC |
| October 17 | Minneapolis (Twin Cities) |
| October 31 | Salt Lake City |
| January 16 | Boston |
| March 27 | Seattle |

We have been contacted by approximately 45-50 additional Chapters, and are in the process of scheduling these into the remaining timeframe. Tentatively, the schedule reads as follows:

- September 12-16 Buenos Aires, Argentina
Sao Paulo, Brazil

- October 15 Tucson, Arizona
- October 16 Phoenix

- November 8-16 Beijing, China
Tokyo, Japan
Auckland, New Zealand
- November 18-21 Susquehanna, Pennsylvania
Southern New Jersey

- December 2-6 Newport News, Virginia
Norfolk
Salem, North Carolina

- January 28 Cedar Rapids, Iowa
- January 29 Chicago, Illinois
- January 30 South East Michigan District

- February 13 Baltimore

- March 4 Tulsa, Oklahoma
- March 10-17 West Germany
Middle & Southern Italy
Sweden

- March 19 Maine
- March 25 Santa Clara (Bay Area) CA

- April 1-4 San Francisco
Portland, Oregon
Spokane, Washington
Richland, Washington
- April 10 Long Island, New York
- April 14-18 Houston, Texas
Dallas
Austin

Due to the subject matter of this particular Lecture, we are suggesting that perhaps the meeting might include spouses of members, or other interested individuals.

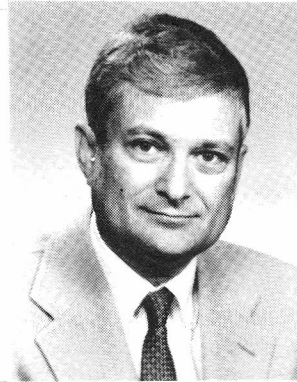
When moving, check on your carrier's insurance. By law, moving companies must reimburse claims—but at only \$1.25 a pound. Buy *extra* insurance for appliances, video equipment, computers or antiques.

The Interstate Commerce Commission.

Chocolate can help provide energy for long-distance running or cycling—but only *after* you've begun the exercise. *Reason*: If you eat sweets just *before* you begin training, it will stimulate the production of insulin, leading to a rapid drop in blood sugar. But once you begin to exercise, insulin production slows automatically.

Manfred Krager, professor of nutrition, Pennsylvania State University, cited in *Bicycling*.

DISTINGUISHED MICROWAVE LECTURER



by Sander Weinreb

It was a great pleasure to visit our Southern Hemisphere colleagues as one of the two 1984-85 Distinguished Microwave Lecturers. I presented "Radio Astronomy — A Challenge to the Microwave Engineer," to five groups in Australia and New Zealand. The locations, dates and approximate attendance were as follows:

| | | Attendance |
|---|--|------------|
| University of New South Wales, 7/24/85 | | 29 |
| Sydney | | |
| Commonwealth Scientific 7/25/85 | | 59 |
| Industrial Research Organization, Sydney | | |
| University of Western Australia, 7/26/85 | | 34 |
| Perth | | |
| University of Auckland, 7/31/85 | | 42 |
| Auckland, New Zealand | | |
| University of Canterbury, 8/2/85 | | 35 |
| Christchurch, New Zealand | | |

I received warm hospitality (even in mid-Winter!) from our Southern Hemisphere colleagues. I felt that the talk was well received with many excellent questions. I had the opportunity to visit several research facilities and was especially impressed by the superconducting oscillator work by Prof. David Blair's group in Perth, the Australia telescope array project at CSIRO; and image processing research by Prof. R. Bates and his students at the University of Canterbury.



Motivation versus manipulation. There are four rules that separate motivators from manipulators, according to Mortimer R. Feinberg, chairman of BFS Psychological Associates.* If you're a motivator, you (1) Rely on arguments and reasons you yourself believe. Thus you avoid rationalization or deception. (2) Give people options, not orders, while you still retain authority. (3) Respect confidences, keeping the flow of information open. (4) Think in terms of building permanent, mutual relationships that respect individual purposes and needs.

*666 Fifth Ave., New York 10103.

RAYLEIGH WAVE CENTENARY SYMPOSIUM



by *Reynold
S. Kagiwada*

On July 15th-17th 1985, the Rank Prize Fund sponsored a symposium to commemorate the hundredth year anniversary of the discovery of Rayleigh Waves. Although primarily associated with earthquakes, in the last 20 years Rayleigh Waves have been used by microwave engineers in the design and fabrication of several types of bandpass filters, oscillators, dispersive filters, delay lines, tapped delay lines, matched filters and synthesizers. These devices are commonly referred to as Surface Acoustic Wave (SAW) Devices.

The Rayleigh Wave Centenary Symposium was organized by Professor E.A. Ash of University College London and Professor E.G.S. Paige of Oxford University. About one hundred scientists and engineers from all over the world participated in the symposium. The program included:

| | |
|--|-----------------|
| Opening Remarks | F. E. Jones |
| Rayleigh Waves and Light Scattering | J. N. Howard |
| Rayleigh Wave Propagation | B. A. Auld |
| Related Propagating Acoustic Waves | M. F. Lewis |
| Quantum Aspects of Rayleigh Waves | K. F. Dransfeld |
| Rayleigh Wave Transducers | D. P. Morgan |
| Rayleigh Wave and Periodic Structures | E. G. S. Paige |
| Rayleigh Wave Linear Filters | R. S. Wagers |
| Rayleigh Wave Oscillators & Resonators | J. J. Gagnepain |
| Rayleigh Wave Non-Linear Components | C. Maerfeld |
| Acousto-Electronic Rayleigh Wave Devices | E. Stern |
| Systems Impact of Modern Rayleigh Wave Technology | C. S. Hartmann |
| The Fabrication Technology of Rayleigh Wave Devices | R. Veith |
| NDT with Rayleigh and Optical Waves | G. S. Kino |
| The Launching of Rayleigh Waves from Surface Point Devices | C. B. Scruby |
| Excitation, Detection and Reflection of Rayleigh and Surface Skimming Bulk Waves | M. Planat |
| Generation of Surface Waves by Thermo-elasticity | W. K. Arnold |

| | |
|--|-------------------|
| 1/f Noise in Rayleigh Wave Resonators and Delay Lines | T. E. Parker |
| Rayleigh Waves on Gallium Arsenide | P.H. Carr |
| Rayleigh Waves in Scanning Acoustic Microscopy | H. L. Bertoni |
| The Relationship Between Surface Wave Displacement and Anisotropy on Selected Crystal Structures | E. J. Dieulesaint |
| Optical Wave Guides | C. W. Pitt |
| Interaction of Rayleigh Waves with Optically Guided Waves | W. J. Stewart |

It was only fitting that the lectures were held at the Royal Institute since Lord Rayleigh did an extensive amount of his work while he was director of the Institute. The Royal Institute was truly an inspiring place. It was founded by Benjamin Thompson, Count Rumford in 1799 and has remained essentially the same over the 186 years. An astounding series of scientific discoveries has been made within its walls. Besides Lord Rayleigh's work, Rumford himself was an early and effective exponent of energy conservation. Thomas Young established the wave theory of light; Humphrey Davey isolated the first alkali and alkaline earth metals, and invented the miner's lamp; Tyndall explained the flow of glaciers and was the first to measure the absorption and radiation of heat by gases and vapors; Dewar liquified hydrogen and gave the world the vacuum flask; W.H. Bragg and his son discovered X-Ray crystallography and a generation later used it to unravel protein structures. Towering over the others is the work of Michael Faraday. Faraday's discovery of electromagnetic induction laid the foundation for today's electrical industries. It was an inspiration to view a unique collection of Faraday's Original apparatus at the Royal Institute.

The lecturers on Rayleigh Wave were invigorating and exciting. These lectures are the most comprehensive collection of papers in the state of the art of Rayleigh Wave. I look forward to receiving my copy of the digest.

I am especially grateful to Professor Ash and Professor Paige for my invitation. It was a great inspiration to attend lectures in the same rooms used by such greats as Lord Rayleigh, Faraday, Count Rumford, Young, Davey, Dewar, Bragg and many others. Special thanks to Rank Prize Fund's staff, especially Judith Barnes for helping to coordinate this memorable event.



HOW CAN WE FURTHER IMPROVE THE TECHNICAL PROGRAM OF THE MTT-S SYMPOSIUM?



by *Ferdo Ivanek*

The MTT-S Symposium is our central event of the year. Naturally, its technical program is a prime collective concern of our society. The planning and implementation are in the hands of the Technical Program Committee (TPC) whose make-up changes each year as the symposium moves to the next location. These groups of MTT-S volunteers draw on the experience of their predecessors and, in turn, pass on their own experience to the TPC group which follows them next year.

This approach has worked very well for our society. It drew into the organizational process a wide and diverse selection of interested volunteers who introduced new ideas and put them to work. This explains the steady, year-to-year improvements in our technical program. One may therefore be tempted to conclude that no major new changes are called for.

We all intuitively know that this cannot be true in our rapidly changing technological and business environment. We may not find enough time to think it through and draw conclusions, but all of us, symposium organizers, authors of papers and symposium attendees alike, make observations calling for improvements. Some of them get translated into actions, but other worthwhile improvements are neglected.

It is clear why this is so. We are usually too busy to take the next step. Let's be more specific and consider the matter from the viewpoint of the TPC which has two major concerns:

1. Organizational logistics
2. A technical program that optimally satisfies the MTT-S membership

Intentions may be different, but logistics inevitably preoccupy the TPC. There is a well established, extensive list of obligatory organizational tasks to be completed within a rather rigid schedule. Interested MTT-S members who are not familiar with this process may be surprised by the routine TPC report which includes numerous attachments (Call for Papers, communication to TPC members, paper authors, session chairmen, press releases, etc.).

Organizational logistics indeed constitute a time

consuming undertaking but they are manageable in a straightforward way. Individual responsibilities are easy to define, assign and follow up. Nevertheless, this usually takes up all the affordable volunteer time and makes more elusive the TPCs second major concern, namely, how to assure that the technical program optimally satisfies the MTT-S membership. Of course, no one questions the desirability of this objective, but it is difficult to define it well enough and in sufficiently specific terms to be able to produce a straightforward action plan. And without such a plan there is no promise of implementation.

Unfortunately, this problem becomes more and more difficult to deal with, due to the accelerating pace of technological progress and business diversification which cause the IEEE activities to expand and diversify, making the conference organizers' job all the more demanding. As a consequence, the TPCs usually spend comparatively little time discussing what could be done to offer the membership a substantially improved technical program and a higher quality of presentations. When held, such discussions tend to be sporadic, to diffuse into unfocused conversations and to end without commitment to specific action. Our own experience with the 1984 San Francisco Symposium suggests that the TPC becomes best equipped to deal with this matter after its mandate has expired!

Motivation and Initiative

After having written our TPC report in the conventional format, concentrating on organizational aspects, we discussed our experience among ourselves and concluded that we could have done better. Specifically, we agreed that the most desirable improvement would have been to better respond to the MTT-S membership needs and that this could have been accomplished by more actively shaping the technical program.

The real issue is, of course, in the definition of what exactly our symposium ought to offer to the MTT-S membership. To successfully resolve it, we need as broad a consensus as can possibly be reached with participation of all MTT-S members who take active interest in this issue. In order to stimulate constructive discussion, we prepared a specific proposal to the MTT-S ADCOM, which Harlan Howe and Dave McQuiddy put on the agenda of the June 2 meeting held in St. Louis. We were gratified by the favorable reactions of the meeting in general and of the 1986 TPC in particular.

It is important to point out that we proposed no specific ADCOM action, but only sought its guidance, because we believe that practical implementation depends ultimately on the TPCs. This means that we feel confident to rely on the proven mechanism of improving the symposium framework at the working level, through new TPC initiatives. We note with satisfaction that those past TPC innovations which were found to be successful are generally adopted by succeeding TPCs. Recent examples include the introduction of the open forum sessions, the reduction of session length to 90 minutes, and the introduction of the short paper category.

(Continued on Page 42)

1986 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM: MICROWAVES LINKING NATIONS



by E.C. Niehenke

Baltimore has been getting ready for the 1986 International Microwave Symposium ever since it was announced in 1981. Three brand new hotels have been built since that time and we now have booked 2500 rooms to accommodate the expected record attendance.

Why should we expect a record attendance? For many good reasons. The microwave industry is healthier than ever and we expect to receive lots of innovative quality papers. Authors should start writing their papers and plan to submit them to our conference. For the first time we will be making special awards for the best Open Forum Presentation as well as the best Symposium paper. The technical program committee under the guidance of Dr. Marvin Cohn has a fine program planned with innovative features including two focused areas: "Advances and Low Cost Component Manufacturing" and "Microwave Aspects and Application of GHz/Gbit Optical Transmission." These areas were deemed "Hot" and of special interest in 1986.

Another reason for an anticipated record attendance is the proximity of Baltimore to much of the microwave industry, being located on the high-tech Eastern Seaboard.

Still another reason for a high attendance is this year's Symposium location, the Baltimore Inner Harbor. No other location in the world offers such a convenient and modern facility. The spacious new Baltimore Convention Center will house the technical meetings and exhibits. Most of the hotels are within a few blocks of the Center and accessible by over-the-street walkways. The hotel complex and Convention Center are located in the Baltimore Inner Harbor, which provides direct access to planned sail and motor excursions of the Inner Harbor, Fort McHenry, and the Chesapeake Bay.

The Inner Harbor area contains the National Aquarium, the Maryland Science Center and Planetarium, the World Trade Center, the Historic U.S. Constellation, Six Flags Power Plant, and Harbor Place, Baltimore's

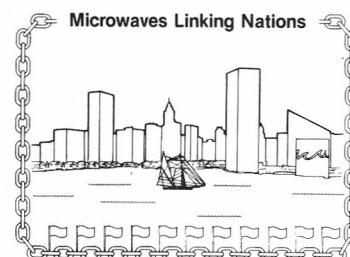
spectacular new dual pavilions that house a never-ending festival of food and fine shops. All these places are clustered around the Inner Harbor waterway, all within walking distance. For those who prefer water transportation, an Inner Harbor water taxi provides access to selected locations. Best of all is the almost tangible spirit of hospitality that pervades the atmosphere of the city.

The accompanying photographs depict some of the exciting Inner Harbor attractions surrounding the logo for the 1986 Symposium. The Baltimore Inner Harbor is pictured as sketched from the vantage point of Federal Hill. The chain and many national flags around the scene provide the border for the Symposium theme "Microwaves Linking Nations." This theme reflects the importance of microwaves in international communication and is appropriate for Baltimore, since this city is the center for people of all nations. Many exciting Symposium events are being finalized and will be presented in the next newsletter.

The guest program is planned and includes four tours. The first day, Monday, June 2, will include a historic tour of Baltimore as well as a tour of the Inner Harbor. A tour of historic Annapolis, including the Naval Academy is planned for Tuesday, June 3. On Wednesday, June 5, a tour of Washington, D.C., will include the Smithsonian Institute.

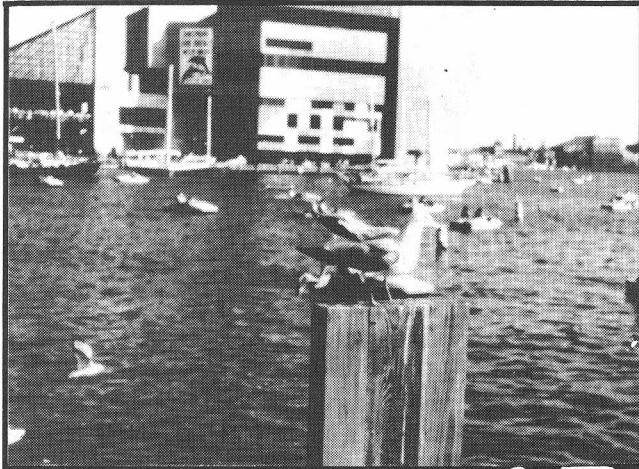
Our negotiating team has been hard at work getting you the lowest hotel rates. The combined average rate for the 10 hotels is a low \$69 single rate and \$79 double rate for any room in the hotel. Rates vary among the hotels, but there is only one rate at each hotel, one for single and one for double. On the lower range, one hotel offers rates of \$45 single, \$55 double. We also have 245 combined suites at 2 hotels which are complete with living rooms and kitchens, ideal for executives and families. These are priced at \$80 single, \$84 double. Almost all of the hotels are either new or recently renovated, so you can be assured of topnotch sleeping accommodations.

Baltimore is anxiously awaiting your visit, and you should mark your calendar now and plan to attend. The dates of the various events are listed below for your convenience. Sunday evening, June 1, is the Horizon House cocktail reception party. Monday, Tuesday, and Wednesday, June 2, 3, and 4, are the dates for the Microwave Symposium. Wednesday afternoon and all day Thursday, June 4 and 5, are the dates for the Monolithic Symposium. Thursday and Friday, June 5 and 6, will include workshops and the ARFTG conference. The 1986 International Microwave Symposium Committee cordially invites you and your families to join us in Baltimore.

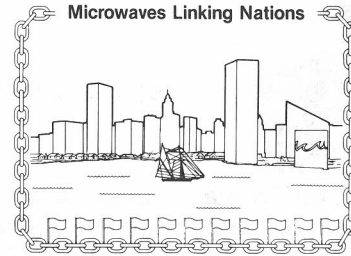


1986 INTERNATIONAL MICROWAVE SYMPOSIUM BALTIMORE, MARYLAND JUNE 2,3,4 1986

BALTIMORE INNER HARBOR



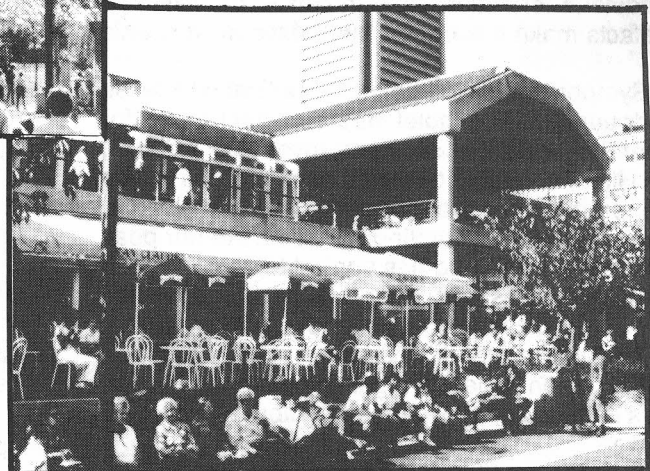
National Aquarium And Paddle Boats



Ride The Port Welcome To Fort McHenry

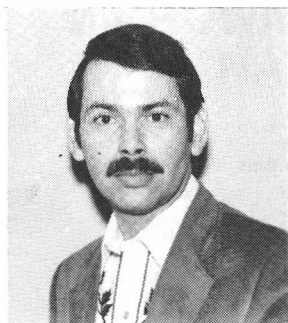


Maryland Science Center And Planetarium



Fine Dining And Shops At Harborplace

1987 INTERNATIONAL MICROWAVE SYMPOSIUM, LAS VEGAS, NEVADA



by Steven March

The 1987 IEEE MTT-S International Microwave Symposium will be held on June 9-11, 1987 at Las Vegas, Nevada. Since large numbers of MTT-S members do not reside at Las Vegas, the Symposium Steering Committee consists of several MTT-S ADCOM members and interested volunteers. The dates for the Symposium are Tuesday, 9 June 1987 through Thursday, 11 June 1987. Friday, 12 June, would be reserved for workshops. The IEEE Microwave and Millimeter-Wave Monolithic Circuits Symposium normally take one and half days; the half day usually being joint with the Microwave Symposium. Thus, Tuesday morning could be the joint half day and Monday, 8 June, the full day for the IEEE Microwave and Millimeter-Wave Monolithic Circuits Symposium. The AFRTG (Automatic RF Techniques Group) workshop, which normally lasts two days and includes its own banquet, would continue through Saturday, 13 June.

Las Vegas means the "the meadows" in Spanish. Immediately accessible from Las Vegas is one of America's richest recreational areas. One can visit a secluded national warm water oasis in the desert or the spectacular Hoover Dam. Lake Mead National Recreational Area is within an hour's drive for fishing or waterskiing. Even closer are the pine forests, meadows, and waterfalls of Mt. Charleston and Lee's Canyon. The Valley of Fire State Park's Mt. Charleston and Lee's Canyon. The Valley of Fire State Park's blazing red sandstone formations and Indian Rock paintings and artifacts make this one of the West's most scenic areas.

The Symposium has selected MGM Grand Hotel as its headquarters. The hotel has sufficient room for three parallel technical sessions, over 300 exhibits, and the Historical Exhibit. All of these activities will be held in contiguous locations on the same floor, removed from other distracting activities. For our peak evening, the MGM Grand has agreed to "block" 2500 of its 2700 bedrooms for our conference attendees and exhibits. Thus, all Symposium attendees, if they desire, should be able to stay in the same hotel. Additional rooms are currently being negotiated with the Dunes, Caesar's Palace, and the Flamingo Hilton, all within a 3 minute walk.

The Symposium Steering Committee looks forward to seeing you in Las Vegas.

1989 INTERNATIONAL MICROWAVE SYMPOSIUM LONG BEACH, CALIFORNIA



by Chuck Swift

The 1989 MTT-S International Microwave Symposium, June 14-16, is a full blown effort. The first call for papers was issued in my last article in the Spring Newsletter. The symposium site is the Long Beach Convention Center and the Hyatt Regency, Long Beach. The Convention Center is the only facility on the West Coast next to the Pacific. It has approximately 90,000 square feet of exhibit space. The complex has a Terrace Theater, tri-level, with 3,100 seats and a center theater with 862 seats. Long Beach offers excellent attractions, such as the Queen Mary, Spruce Goose, Harbor Cruises, Catalina Cruises, Queen's Wharf, Seaport Village and Shoreline Village. Just a short ride away is Marineland, Hollywood, Magic Mountain, Disneyland, Knott's Berry Farm, Museum of World Wars Wax Museum, Los Angeles County Museum of Art, Griffith Observatory, Huntington Library, J. Paul Getty Museum, Norton Simon Museum of Art, Los Angeles Zoo, and the Lion Country Safari. The great variety of attractions in the area can fill everyone's needs.

After a worldwide search of the literature, I would now like to share with you perhaps the first really practical microwave article. It wasn't published in an engineering journal or a trade magazine but in the Los Angeles Business Journal on June 24, 1985. It was entitled "Stretching Float Time: Unusual Gambit Creates Food for Thought" by David Rees. It was reported that E.F. Hutton & Co. brokers were cooking their personal checks in a microwave oven. It was presumed that this would erase the magnetic encoding so the cooked checks would be kicked out by the banking industry's high speed processing equipment. Thus, this would delay the check's from clearing and increasing float time.

This is Yankee ingenuity in applying microwave. Truly "when E.F. Hutton speaks, everyone listens."

When asked about this technique, local bankers say they hadn't heard of the practice.

"It's new and absolutely fascinating to me," says John Popovich, Vice-President and Manager of Consumer Affairs at First Interstate Bank of California.

An officer of the Bank of America, the nation's biggest bank is quoted as saying "I hadn't heard of it but guess it probably would work as well as a number of techniques."

"There are lots of ways to treat a check's magnetic encoding so it can't be (machine) read," says H. Peter Franzel, senior Vice President of district operation at the Federal Reserve Bank of San Francisco.

I'd be interested in learning more about the "other techniques." Perhaps we should have a session on it at the 1989 MTT-S International Microwave Symposium. Maybe a poster session, with different manufacturers demonstrating the superiority of L band over S band, and how 550 W is optimum power to keep the check from appearing scorched. I would appreciate your thoughts and comments in writing, preferably written on thousand dollar U.S. bills. I'll still let you ponder over: "What do you call a boomerang that doesn't come back?"



EEPA — INDUSTRY GROUP EMPHASIZES PUBLIC EDUCATION

by *Richard H. Ekfelt*

The Electromagnetic Energy Policy Alliance (EEPA) is a Washington, DC-based association which brings together manufacturers and users of electrical/electronic systems who are dedicated to formulate responsible policy toward the presence of electromagnetic fields in today's society. One of its primary functions is to respond to issues arising from the concern and misunderstanding surrounding nonionizing radiation. Because most of the world's scientific community believes that the low-level electromagnetic exposures associated with modern technology create no unreasonable risk to human health or the environment, and cognizant of the myriad benefits to be derived from the application of electromagnetic energy, EEPA is resolved to oppose unreasonable and unwarranted restriction on its use.

EEPA has set forth five specific policy goals on which to focus its efforts:

- To promote the establishment of reasonable uniform national standards related to the use of nonionizing electromagnetic energy;
- To conduct and/or sponsor research to develop a more thorough understanding of the effects of nonionizing electromagnetic energy on humans and other living organisms;
- To develop educational programs designed to promote an informed public understanding of the benefits and risks associated with the use of nonionizing electromagnetic energy; and
- To act in an advisory capacity to government and the public on the technical, scientific and other relevant aspects of the production, use and effects of nonionizing electromagnetic energy.

EEPA was organized in 1984 through the inspiration and efforts of its eight founding members: MCI, Motorola, AT&T Bell Laboratories, RCA, Rockwell International, the National Association of Broadcasters, Raytheon, and GTE Corporation. The membership has grown steadily throughout its first year and one-half to include such corporate members as ITT, M/A COM, Hewlett-Packard, Pacific Bell, NBC, IBM, the Association of Home Appliance Manufacturers (AHAM), the Association of Maximum Service Telecasters (AMST), Cox Communications, and Westinghouse Broadcasting and Cable, as well as a number of individual members who represent private laboratories, private consultants, broadcasting, microwave appliances, heat-sealing operations, and computer technology firms.

The Alliance has been very active in its first year which culminated May 14-16 in the 1985 EEPA Annual Meeting at the Hotel Inter-Continental in San Diego. The meeting program featured panel discussions by industry experts from academia, government and industry, followed by questions from the audience.

In the first Session, entitled "Medical-Legal Aspects in Liability and Siting Cases," the nearly one hundred attendees heard Drs. Budd Appleton and Herbert Pollack refute many of the specific health-effects allegations commonly raised in liability cases. Attorneys Michael Bonesteel and Robert Harvey then discussed methods for preparing and litigating such cases.

In Session II, "Current Research on Bioeffects of Electromagnetic Energy," Dr. Ross Adey (Pettis Memorial VA Medical Center—Loma Linda, California) discussed the mechanisms of athermal interaction between EM fields and living tissue; Dr. Kristian Storm (UCLA) reviewed a recent 5-year study involving successful treatment of solid cancer with magnetic induction hyperthermia; Professor Om Gandhi reviewed current research at the University of Utah with the SAR of the low and high ends of the radio frequency spectrum; and, Professor Sol Michaelson (University of Rochester Medical Center) illustrated the principles of rational exposure standard-setting.

Session III—"Update on Standards and Regulations"—included Dr. Robert Cleveland (FCC Office of Science and Technology) who reviewed the recent FCC interim adoption of the ANSI RF/MW exposure standard, and then Jane Clemmensen (SRI International) gave estimates of the cost that will be incurred by broadcasters in complying with the ANSI Standard. Larry Epstein, Esq. discussed development and adoption of the local exposure standard in Portland, Oregon, and then Capt. Robert Downs (USAF) compared RF safety regulations from 23 countries.

The fourth and final Session was called "Public Affairs and Education." Om Gandhi (University of Utah) warned that because industry is conducting too little research regarding RF/MW energy, few quality graduate students are attracted to university research programs in this field. Thomas Kern (NCR Corporation) demonstrated recently developed educational pro-

grams regarding the use of VDTs in the workplace. Douglas Kindrick (AT&T Corporation) stressed the importance of assisting elected officials to learn about technology. Robert Locke, Science Editor of *The Tribune* (San Diego) spoke about the journalist's perception of EM issues. Finally, Jay Franklin (MAPP) described his audience-participation demonstrations of the principles of electromagnetic energy, and stressed the importance of "hands on" demonstrations in helping to allay peoples' concerns about EM energy.

In addition to sponsoring seminars on industry issues (EEPA also sponsored a one-day seminar last November in Chicago), EEPA has been involved in advocating FCC adoption of the ANSI C95.1-1982 exposure standard for RF/MW radiation, supporting the FCC in its proposed categorical exclusion of certain communications services from coverage of its interim standard, and supporting industry petitions to grant to the FCC limited preemption over state and local authorities whose decisions thwart FCC policies to encourage competition and to develop new technologies and public services. EEPA's two active standing committees on Public Affairs and Science & Technology, have also submitted comments on the National Safety Council Data Sheet on Microwave Equipment Hazards, the recent national Institute for Occupational Safety and Health (NIOSH) criteria document for a recommended occupational exposure standard for radiofrequency and microwaves between 300 KHz and 300 GHz, and a recent RF/MW exposure standard proposed by the State of Massachusetts.

In the coming year, EEPA will continue its active participation in regulatory affairs and standard-setting efforts. Moreover, the group has plans to publish literature on a number of industry issues, to commission a biostatistical study of current scientific literature in the field, and to create a legal resource file on recent liability litigation and siting cases.

EEPA's current Officers and Directors are: President — Barry D. Umansky, Esq. (National Association of Broadcasters); Vice President Science & Technology — George M. Wilkening (AT&T Bell Laboratories); Vice President Public Affairs — Morton L. Topfer (Motorola); Secretary — Harold Sobol (Rockwell International!); Treasurer — Howard Rosenthal (RCA); Director — Daniel Walters (MCI); Director — John M. Osepchuk (Raytheon); and Director — Daniel L. Bart, Esq. (GTE). EEPA is headquartered at 1800 M Street, N.W., Washington, DC 20036; 202/452-1070. For further information contact Richard H. Ekfelt, Executive Director.



Senior managers believe that someone promoted into their own position would need 18 months, on the average, to learn the job. Their immediate subordinates, however, feel that they could learn the senior positions in about five or six months.

Competence and Power in Managerial Decision Making by F. Heller and B. Wilpert, John Wiley & Sons, 605 Third Ave., New York 10158, \$39.95.

CALL FOR PAPERS SPECIAL TRANSACTIONS ISSUE ON NEW AND FUTURE APPLICATIONS OF MICROWAVE SYSTEMS

With the evolution of new technologies in the microwave and related fields, microwave systems applications have increased rapidly over the last decade. Frequency crowding in the traditional microwave band, S-, C-, X- and Ku-bands, has resulted in extension of applications into the high millimeter wave region. New devices and subsystem fabrication techniques have added to the attractiveness of these new frequency regions. Recent applications of these new technologies have gone beyond the traditional military applications to the civil sector, including private communications, medical electronics and energy transfer. These applications plus the many new and future applications in the traditional fields such as radar, communications and microwave relays, form the basis for a special issue on microwave systems.

The IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES, in conjunction with the MTT-16 technical committee on Microwave Systems, is planning to publish a special issue on New and Future Applications of Microwave Systems in October, 1986. Papers are solicited to describe new and original applications of microwave systems. Special emphasis will be on application of unique new and future technologies which apply to microwave, millimeter wave and submillimeter wave systems. This will include related fields such as digital technology and unique applications of processing using microwave techniques. Topics of interest include but are not limited to the following areas:

- Communications
- Radar
- Energy systems
- Medical applications
- High density line-of-sight systems
- Microwave radios
- Monolithic subsystems with high level of integration
- Power combining for high power
- Wideband (GHz and above) synthesizers
- Unique applications

Authors are requested to submit four (4) copies of their manuscript by March 1, 1986, to the guest editor:
J.B. Horton
Chairman, MTT-16
TRW, 92/3166
One Space Park
Redondo Beach, CA 90278
(213) 535-8491

PACE REPORT



by Robert A. Moore

What are the important professional issues for microwave engineers? If the attendance at the Panel Session on DoD funding of R & D at the International Microwave Symposium is any indication, certainly the topic of the Panel Session is an important issue. Not only did almost 250 people attend, but there was lively discussion. One issue raised was the effect of the increased difficulty of funding sole source and its effect on academic research efforts. It was pointed out by panelist Dr. Leo Young that this is having a major effect and that efforts must be expended to overcome the negative impact.

Does the success of this seminar indicate a strong interest in this subject or in professional/career oriented subjects in general? Or was the attendance high because it was an easy way to both get a low cost meal and to get back to the technical sessions by 1:30. Clearly the convenience had something to do with the attendance. However, I cannot believe that the number of people would sit in on an uninteresting session just for a low cost lunch. Further the fact that over half the attendance remained for half an hour for discussion after the technical sessions indicated to me significant interest. To me the success of the session suggests the format of the luncheon panel session is attractive for professional topics. If the subject and panel members are properly selected, the writer would be most grateful for suggested topics for future sessions.

"Is the IEEE United States Activities Board (USAB) properly structured and focused to best represent the professional/career interests of the electrical/electronic engineering community in particular?" Granted the USAB must serve all electrical/electronic engineering interests. However, I feel that microwave engineering interests are similar to most electrical/electronic engineering interests. If this is true, our evaluating USAB performance can rightfully be in terms of how well it serves our community. Later we will worry about broader responsibilities.

An example of the type of help the USAB can provide is illustrated by a request of the MTTTS (through appropriate channels) to increase NBS efforts to develop and maintain microwave standards. For functions which require maintenance of standards, there has been a recognized deterioration in the ability of NBS to properly service the microwave industry. At the same time, industrial usage has been expanding rapidly. As a result, the Promote National Microwave Standards

(PNMS) Committee, collaborating with the MTTTS, has studied and proposed a course of action. We feel that the likelihood of favorable results will be enhanced if the USAB endorses the PNMS/MTTS position as its own.

Another issue is the federal procurement regulations and procedures to the small business and entrepreneur trying to get started. At the present time a small group within the microwave community is working on recommended changes in the DoD small business in entrepreneur interface environment. They expect to propose an appropriate USAB position. Heading this effort is Dr. Stephen Honickman, STG Electrosystems, 720 Manchester Road, Ballwin, MO 63011, (314) 391-7090.

Even with the difficult environment which must be faced by the IEEE USAB in achieving results, microwave engineers constantly must be asking questions concerning its effectiveness and of any substantive changes needed in its structure, focus, or approaches. Does the USAB primarily represent management of large companies as some insist? For example, there are IEEE efforts to foster greater interest in engineering as a profession for young people. Certainly, management's responsibility is to assure an adequate work force of engineers. This effort to increase participation in engineering education could be looked upon by working engineers as threatening their security.

Let us look at the principal functions of the USAB. Besides certain logistical functions, the USAB largely functions to provide an effective interface between the electrical/electronic community and key career activities such as government at various levels and in some cases, major employers. It provides the interface through information flow, publicity, conferences on issues, testifying and lobbying. Spokespersons for the IEEE regularly testify before congressional committees on key issues. A Congressional Newsletter is published and mailed to IEEE leaders and members who request it. These activities are carried out through groups or councils which study issues and maintain relevant government and other institutional interfaces. These councils, respectively cover Member, Government, Career and Technology interests. If you have an interest in one or more of these councils, I would be happy to assist you in making the appropriate contacts.

Occasionally I read articles and letters to the editor from engineers who indicate the need for more representation directly related to employment security and compensation needs. Specifically, their concerns are for representation in the legislative agenda and in employer interface, which differs from the current direction of the IEEE USAB. Such a representation might be interested in policing hiring, layoff and pension policies and procedures of major companies. Does this view represent a major portion of the microwave engineering community? Others feel that though the USAB could be more effective, the preference is for a body much as it is that represents the electrical/electronic engineering community in terms of legislative and professional issues which have major impact on the economic, professional, technical and retire-

ment status of engineers. Do you feel this way? How do most of us feel? Please let me hear from you. My address is Westinghouse DEC, PO Box 746, MS 335, Baltimore, Md. 21203. You can call me at (301) 765-4027.



**TO ALL MICROWAVE SOCIETY MEMBERS
MICROWAVE SOCIETY
SCHOLARSHIP PROGRAM -
for Children of Microwave Society Members**

We are pleased to announce that each year beginning in 1986 Microwave Society of the IEEE will sponsor two (2) college scholarships for children of Microwave Society members through the annual nationwide scholarship competition conducted by National Merit Scholarship Corporation (NMSC), which is an independent, nonprofit organization devoted exclusively to scholarship activities.

Two Microwave Society Scholarships will be awarded in the spring of 1986 to students who will complete high school requirements in 1986 and who will enter a regionally accredited U.S. college in 1986 to pursue a course of study leading to one of the traditional baccalaureate degrees.

Microwave Society Scholarship winners will be chosen through the facilities of NMSC from among the children of Microwave Society members who meet the competition requirements established by NMSC. The winners will be chosen on the basis of test scores, academic record, leadership and significant extra-curricular accomplishments.

Each Microwave Society Scholarship will be a renewable award, covering up to four years of full-time study or until baccalaureate degree requirements are completed, whichever occurs first. The amount of the stipend accompanying the scholarship will be related to the individual winner's financial situation and the costs of attending the college of the winner's choice. The maximum amount that may be awarded to a winner is \$2,500 per year; the minimum will be \$1,000 per year.

Further information and entry forms can be obtained by contacting the Chairman, MTT-S Education Scholarship Program.

Dr. Krishna K. Agarwal
Rockwell International Corporation
Mail Stop 402-140
P.O. Box 10462
Dallas, Texas 75207
(214) 996-5751

This completed application must be postmarked no later than November 1, 1985.

NOTE: Students who will be completing high school and entering college in 1987 must take the October, 1985 PSAT/NMSQT in order to become eligible for NMSC-administered scholarships to be awarded in 1987.

CHAPTER CHAIRMEN'S DINNER AND MEETING REPORT



by Ted Nelson

For the second consecutive year I had the pleasure of attending the Chapter Chairmen's Dinner and Meeting held annually in conjunction with the MTT-S International Symposium. This year the dinner took place in the Pierre Laclede Room of the St. Louis Sheraton on Tuesday evening June 4, 1985. The meeting followed in the Robert E. Lee room of the Sheraton. A total of thirty five attended and included eight ADCOM members, three committee members, the 1985/86 Distinguished Lecturer and representatives from twenty three Chapters.

The introduction was given by MTT-S President Harlan Howe, who then turned the meeting over to Ed Niehenke, Chairman of the Membership Services Committee. Ed introduced Reynold Kagiwada, Pat Green and I who spoke on the Newsletter, Chapter Membership and Chapter Records respectively. Pat presented an award to the Chairman of the Chapter that had the largest percent increase in membership, Alexander Krauska of the Milwaukee Chapter. Alex told us how he achieved the increase, by tailoring meetings, lectures and advertising to his particular audience in Milwaukee.

The 1985/86 MTT-S Distinguished Lecturer, Kenneth Carr, talked about his topic: "The Application of Microwave Technology to the Detection and Treatment of Cancer." Roger Kaul spoke on how to arrange a coordinated lecture series for a local chapter. Dick Sparks, International Liaison for ADCOM, talked about the 10 MTT-S International Regions, their makeup and membership. Barry Spielman spoke on Technical Programs and Committees as a next step of involvement for Chapter Chairmen.

The meeting concluded with the representatives of each Chapter giving their thoughts and ideas as to what helped their Chapter during the past year. Some of these were: use trade shows to attract a large audience; have a MTT-S Symposium speakers' night with the local people who spoke at the Symposium (you can find out who they are in the Symposium Digest); Symposium Short Courses bring in a large number of people; general subjects are better attended than specific ones; social events bring a large audience and there-

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MTT-S Chapter Chairmen and MTT-S ADCOM meet and enjoy dinner at the 1985 MTT-S Chapter Chairmen's Dinner.



23 MTT-S Chapter Chairmen or representatives, as can be seen from this photo, are all smiles, and rightfully so, due to the excellent leadership and success of their MTT-S Chapters.

(Chpt.-Chairman—Continued from Page 38)

fore attention to a local Chapter; so do company tours; have competitive organizations give presentations on the same topic; make sure all Chapter members know about meetings through advertising and mailings.

Our gratitude goes to those Chapters represented at the dinner and meeting. They were: Baltimore, Central New England/Boston, Chicago, Dallas, Florida West Coast, India, Los Angeles, Middle and South Italy, Milwaukee, New Jersey Coast, New York/Long Island, North Jersey, Orlando, Philadelphia, Princeton, St. Louis, Santa Clara Valley/San Francisco, Southeastern Michigan, Switzerland, Twin Cities, Tokyo, Washington/Northern Virginia and West Germany.

Also special thanks to all 1984/85 Officers who worked hard to put together rewarding programs for their local Chapters. I have listed in this Newsletter all 1984/85 Chapter meetings reported to me thus far. Chapter Officers may consider using this list for choosing speakers for next year. Many of these speakers, if contacted, may be willing and happy to come and talk before a local Chapter.

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PROGRAM AND GENERAL DESCRIPTION OF THE FIRST INTERNATIONAL MICROWAVE SYMPOSIUM IN BRAZIL

The 1985 International Symposium on Microwave Technology in Industrial Development, Brazil was held at the Research and Development Center (CPqD) of TELEBRÁS, located at km 118.5 of Campinas/Mogi-Mirim Road, in Campinas, State of São Paulo, Brazil, during the days 22-25 July. The program of the symposium is concluded and in phase of distribution, while the proceedings are in the press.

The ambitious initiative for the organization of a first international microwave symposium in Brazil resulted from the fast growth of the development of microwave theory and techniques, antennas, propagation and optics and of the fast increase of the interaction of members of the Brazilian Microwave Community with others from the rest of the world mainly due to the active participation of these members in the disclosure of scientific knowledge in periodicals and international symposia. This initiative was possible particularly due to the creation of the Brazilian Microwave Society (SBMO) that decided to assume the responsibility of organizing this symposium after realizing that the time has arrived for the realization of events of this importance in Brazil.

Of particular importance was the confirmation of collaboration of other societies, such as the Institute of Electrical and Electronics Engineers (IEEE) from the USA, the Institution of Electrical Engineers (IEE) from England and the Brazilian Telecommunications Society (SBT). Equally important was the impressive support given by TELEBRÁS, UNICAMP, CPFL, VARIG and other organizations that demonstrate a firm interest in the realization and in the plain success of this event.

This symposium that brought together professionals from everywhere in the world represents a singular opportunity for the presentation and discussion of scientific and technological work accomplished in Brazil and abroad within the various fields of interest in microwaves, antennas, propagation and optics. The quantity and quality of the papers programmed is a clear indication of the interest demonstrated by the participants in having their work presented in this important forum of discussions.

Eighty two (82) papers were selected, including the seventeen (17) invited papers. These invited papers were specifically chosen with Invited Speakers, most of them attending the symposium with travel support obtained through their own initiative, a fact that enriches and valorizes the realization of the event. As a result, the important objective of focusing relevant subjects to the international scientific community will be attained.

The first invited paper was on the Brazilian telecommunications system and was presented by an authorized specialist from CPqD of TELEBRÁS. A panoramic view of the innumerable peculiarities of this system, that contains a high degree of Brazilian technology, was presented.

Three invited papers on remote sensing and radars stimulated important interactions in this area.

— "Advances in Active and Passive Array Radar Modules," by Richard A. Sparks, Raytheon Co., USA.

— "Trends in Remote Sensing," by Domenico Solimini, University of Rome, Italy.

— "How to Use Coherent Remote Sensing Data: An Inverse Scattering Viewpoint," by W. Ross Stone, IRT Corporation, USA.

Four invited papers on antennas, two of them on large size antennas and two on printed antennas provided the basis for the increased approximation of specialists in the area. These papers are as follows.

— "Performance Monitor For A Large Array Antenna," by R.I. Wolfson, G.G. Charlton and E.N. Patino, ITT Gilfillan, USA.

— "Reflector Antenna Analysis," by Giorgio Franceschetti, IRECE, Italy.

— "Computer-Aided Design of Microstrip Circuits and Antennas," by K.C. Gupta, University of Colorado, USA.

— "A Formulation of the Integral Green's Function for a Rigorous Analysis of Microstrip Antennas," by Juan R. Mosig and Fred E. Gardiol, École Polytechnique Federal de Lausanne, Switzerland.

Valuable discussions in microwave integrated circuit structures was exchanged with the inclusion of the following two invited papers.

— "New Waveguide Structures for Microwave and Millimeter Wave Circuits," by Tatsuo Itoh, The University of Texas, USA.

— "A Transmission Line Model for the Lossless Ferrite-loaded Non-reciprocal Waveguide," by Charles R. Boyd, Jr., Microwave Applications Group, USA.

Invited papers in microwave circuits and systems stimulated the interest and allowed an exchange of experience in these areas. These papers are listed below.

— "Recent Advances on Microwave Communication Filters," by A.E. Williams and R.R. Bonetti, Communication Satellite Corporation, USA.

— "General Approach to Noise Reduction of Oscillators," by Alain Bert, Thomson — CSF, France.

— "Artwork Generation and Mask Production for Microwave Circuits," by Steven L. March, Compact Software, Inc., USA.

— "Ga As Monolithic Linear Integrated Circuits," by I.J. Bahl, ITT - Gallium Arsenide Technology Center, USA.

— "Computer Modeling Techniques for Large Systems EMC Analysis," by Prakash Bhartia, Defense Research Establishment Ottawa, Canada.

Biological effects and microwave industrial applications will have their important discussions initiated with the following invited papers.

— "Industrial Applications of Radio, Micro and Millimeter Wave Technology," by S.S. Stuchly, University of Ottawa, Canada.

— "Biological Effects and Medical Applications of Radio and Microwaves," by Maria A Stuchly, Environmental Health Centre, Canada.

Following this judicious choice of Invited Speakers and subjects the regular papers were carefully selected and grouped in sections programmed in one of the four days of the Symposium. These sections and the corresponding number of papers are given below.

— **Remote Sensing:** one paper from the USA and two from Brazil.

— **Antennas:** one paper from the USA, one from Spain and three from Brazil.

— **Antennas and E.M. Theory:** two papers from the USA, one from Canada and three from Brazil.

— **Receivers:** two papers from Hungary and four from Brazil.

— **Guided Waves:** one paper from Canada, one from Italy, one from India and four from Brazil.

— **Optical Devices:** one paper from Italy, one from USA and five from Brazil.

— **Microwave Sources:** two papers from France, one from England, one from Poland, one from Hungary and one from Brazil.

— **Circuits and Systems:** one paper from Switzerland, one from Italy, one from Poland, one from Canada, one from India and two from Brazil.

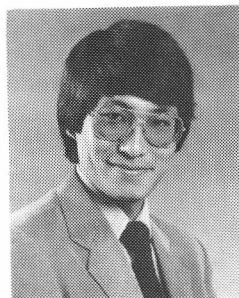
— **Microwaves, Antennas and Optics:** two papers from the USA, one from Canada, one from England and one from Brazil.

— **Microwave Devices:** one paper from France, two from the USA and three from Brazil.

— **Industrial and Biological Applications:** one paper from Spain, one from Canada, two from the USA and three from Brazil.



SHORT COURSES



by Kurtis L. Kurisu

A number of organizations are offering short courses this Fall, which will be of interest to some members of the Microwave Theory and Techniques Society. The following selected short courses will be offered by UCLA Extension during September, October, and November.

Modern Radar Technology and Applications, September 16-20, course number 867.40, \$975 per pupil, Instructors to include S.A. Hovanessian, J.E. Hobson, H.R. Erhardt, and F.C. Williams.

Synthetic Array and Imaging Radars, October 28 - November 1, course number 867.46, \$975 per pupil, Instructors to include S.A. Hovanessian, J.C. Kirk, J.J. Kovaly, D.L. Mensa, F.V. Stukur, and F.C. Williams.

Adaptive Antenna Signal Processing for Interference Rejection, November 11-15, course number 867.46, \$975 per pupil, Instructors to include E. Mendelovicz, and T.W. Miller.

The Continuing Education Office of George Washington University is offering the following courses. These courses are to be held in Washington.

Solving Engineering Design and Analysis Problems Using Probabilistic Methods, October 14-18, course number 1218DC, \$920 per attendee, Instructor R.H. Pettit.

Digital Telephony, October 21-25, course number 597DC, \$920 per attendee, Instructors B.E. Keiser and R.E. O'Neil.

Introduction to Modulators and Transmitters, November 4-5, course number 1230DC, \$650 per attendee, Instructors F. Amoroso and R.C. Dixon.

Modern Data Communications, November 4-7, course number 241DC, \$835 per attendee, Instructor P.D. Bergstrom.

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(Improve—Continued From Page 31)

Harlan Howe, Reinhard Knerr, Dave McQuiddy, Ed Niehenke and Marv Cohn encouraged us, after the June 2, 1985 ADCOM meeting, to publish our proposal in the Newsletter with the intent of engaging all interested MTT-S members in further discussions. My special reviewer, Joe White, made an observation which raises expectations for the MTT-S membership's interest in such a discussion. He pointed out that the symposium attendee's major concerns, like those of the TPC, can similarly be categorized into logistics and technical program content. I couldn't possibly do better than to quote Joe:

"The attendee's organizational logistics include adjusting his schedule to set aside the time to attend the symposium, submitting a paper (in some cases), travel and lodging arrangements, travel around the conference city and finding the conference rooms and exhibits, selecting those papers, panels and workshops of interest, and coping with time conflicts encountered therein, making time to enjoy the brief but often extended impromptu meetings with his colleagues, many of whom he sees only at the annual MTT-S symposium, and so forth.

Needless to say, the attendee faces no less organizational preoccupation than does the TPC. For most attendees the first moment that the question of how well the symposium addressed his needs arises as he is departing the symposium. Usually, even at this late hour, the issue is prompted by the inevitable question asked by a colleague: 'How was the conference?'"

What Needs to be Taken into Consideration?

In the pursuit of optimally matching the MTT-S technical program to the membership's needs, there are three basic considerations, namely:

- technological developments
- IEEE activities
- our vision of the MTT-S future.

We shall combine them for brevity and draw conclusions from the current MTT-S position within the IEEE, which is quite different from that of the Professional Group on Microwave Theory and Techniques when it was formed. At that time, nearly three and a half decades ago, conventional microwave technology was based on the use of distributed circuit elements and transit-time effects, which clearly distinguished the MTT from the rest of the IEEE.

In the meantime, lumped elements extensively replaced distributed elements and transit-time effects were made negligible in microwave transistors, thus paving the way for MMIC's, both analog and digital. On the other hand, distributed circuits and transit-time effects were put to new use in SAW and related devices, and glass fibers emerged as the optical equivalent of metallic waveguides.

To illustrate the consequences of these and other microwave theory and techniques developments and applications on the current MTT-S position within the IEEE, we compiled the accompanying table which attempts to identify the primary overlaps that devel-

oped between the MTT-S Technical Committees and the most closely related IEEE Societies.

| MTT-S TECHNICAL COMMITTEES | IEEE SOCIETIES | AEROSPACE AND ELECTRONIC SYSTEMS | ANTENNAS AND PROPAGATION | CIRCUITS AND SYSTEMS | COMMUNICATIONS | COMPONENTS, HYBRIDS & MFG. TECHNOLOGY | ENGINEERING IN MEDICINE/BIOLOGY | ELECTRON DEVICES | INSTRUMENTATION & MEASUREMENTS | LASERS AND ELECTRO-OPTICS | MAGNETICS | SONICS AND ULTRASONICS |
|---|----------------|----------------------------------|--------------------------|----------------------|----------------|---------------------------------------|---------------------------------|------------------|--------------------------------|---------------------------|-----------|------------------------|
| COMPUTER-AIDED DESIGN | | | | X | | | | | | | | |
| MICROWAVE ACOUSTICS | | | | | | | | | | | | X |
| FIBER AND INTEGRATED OPTICS | | | | | | | | | | X | | |
| SUBMILLIMETER-WAVE TECHNIQUES | | | | | | | | | | | | |
| MICROWAVE HIGH-POWER TECHNIQUES | | X | | | | | | | | | | |
| MICR. & MM-WAVE INTEGRATED CIRCUITS | | | | | | | | | | | | |
| MICR. & MM-WAVE SOLID-STATE DEVICES | | | | | | | | X | | | | |
| MICROWAVE NETWORK THEORY | | | | | X | | | | | | | |
| DIGITAL MICROWAVE SYSTEMS | | | | | X | | | | | | | |
| BIOLOGICAL EFFECTS & MEDICAL APPLICATIONS | | | | | | X | | | | | | |
| MICROWAVE MEASUREMENTS | | | | | | | | | X | | | |
| AUTOMATIC RF TECHNIQUES | | | | | | | | | X | | | |
| MICROWAVE FERRITES | | | | | | | | | | | | X |
| MICROWAVE LOW-NOISE TECHNIQUES | | X | | | | | | | | | | |
| MICROWAVE FIELD THEORY | | | X | | | | | | | | | |
| MICROWAVE SYSTEMS | | | | | X | | | | | | | |
| MANUFACTURING TECHNOLOGY | | | | | | X | | | | | | |

Opinions on the extent of overlap may differ in detail but we are sure that in essence there is general agreement that the MTT-S developed into a truly multidisciplinary IEEE entity. This obviously made the TPC job progressively more demanding. And we submit that, irrespective of the differences in the individual visions of the MTT-S future, it will become increasingly demanding to assure that the technical program optimally satisfies our membership.

In a comparison within the IEEE we presently find ourselves among those societies which depend for their technical program almost entirely on the response to a general Call for Papers that does not place sufficient emphasis on the area(s) of most important new development. We are also among those IEEE societies which do not regularly practice paper solicitation and only rarely include in their programs invited papers. However, we make good use of workshops and panel sessions that considerably contribute to the success of our symposia. Nevertheless, there clearly is room for improvement in the technical program and it actually does not take much to implement it.

Proposed Action Plan

Since the MTT-S TPC procedures and practices that evolved over the years work very well and provide plenty of room for initiative and innovation, further significant improvements can be introduced through the

existing system in a straightforward way. We therefore proposed to complement these well advanced TPC practices in the following ways:

1. Define in the Call for Papers for each symposium one or two focal themes that best reflect the prevailing current efforts or most significant trends in the microwave industry, and preassign corresponding groups of sessions.

2. Selectively solicit and invite papers to assure due coverage of the focal themes and of the recurring topics.

3. Systematically promote cooperation and coordination with the related IEEE societies to reduce undesirable overlap between the respective symposium/conference programs, to reroute contributed papers to the most suitable event and to mutually complement programs with invited review papers.

Focal themes serve to preferentially structure the symposium program in order to emphasize the areas of most significant current technological development. We are already practicing it with the joint MTT-MMIC sessions, and we may simply extend this practice to other areas, shifting the emphasis from year to year, as warranted.

We are proposing four focal themes for consideration at this time:

- Low-Cost Microwave Hardware Manufacturing
- CAD/CAM in Microwave Applications
- Microwave Theory and Techniques in Lightwave Transmission
- Microwave Engineering Education.

It is important to clearly define the selected focal theme(s) in the Call for Papers in order to stimulate contributions from and provide guidance to workers in the particular area(s) and to others serving such applications with their specific products. This requires formulating the Call for Papers in such a way that it clearly distinguishes between the interest areas of the standing MTT-S Technical Committees and the broader focal theme(s).

The number of sessions covering a chosen focal theme should preferably be kept flexible to best accommodate each particular need. For example, three sessions appear to be the indispensable minimum for "Low-Cost Microwave Hardware Manufacturing," one each devoted to passive components, active components, and systems applications, respectively. However, one can envisage more sessions and/or a different subdivision if this better accommodates the submitted contributions. "Microwave Engineering Education," on the other hand, could be adequately covered even with a single session.

Solicited papers can be of great help in assuring that significant new developments, particularly those in the focal theme areas, will indeed be timely reported at the symposium. While the MTT-S has not used this approach in the past, at least not in an organized manner, some IEEE conferences contain a high percentage

of papers solicited by preassigned session organizers. We do not propose to go this far with our symposium, but we do recommend adopting this approach for the focal theme sessions.

To avoid possible misunderstandings, it may be useful to stress that solicitation, as proposed here, simply means to selectively inquire with potential authors from areas of most interesting current development as to whether they plan to submit a contribution in response to the Call for Papers, and, if warranted, to encourage them to do so. In this way we should be able to assure some high-quality contributions that otherwise would not be ready by the announced deadline for submission, but may possibly be published elsewhere before the next symposium.

Solicitation thus aims to attract the most significant first microwave publications to the MTT-S symposium. Of course, solicited papers are subject to the regular TPC review and selection process, but this is not known to discourage authors who observe the standard MTT-S symposium criteria.

Invited papers are most suitable for reviewing progress in areas of key interest to the MTT-S membership as a whole or to a segment thereof. We believe that areas of common interest with other IEEE societies can be particularly well served in this way. A preferred type of candidate for invited speaker would appear to be either someone whose primary IEEE activity is in the MTT-S but whose applications are better covered by another society, or, vice versa, someone whose IEEE activity is predominantly or entirely outside the MTT-S, although his work is based on microwave theory and techniques.

Improving the cooperation with other IEEE societies and their TPCs would also help to identify papers submitted elsewhere that would be better placed in our symposium, and vice versa. The MTT-S TPC is occasionally practicing it unilaterally, but multilateral and more extensive practice would be desirable, because all parties are better served if a paper is properly placed where it attracts more attention and gets higher recognition.

Initial Implementation in the 1986 MTT-S Symposium

The main stimulus for submitting this set of proposals for publication at this time came from Marvin Cohn, TPC Chairman, and Ed Niehenke, Steering Committee Chairman of the 1986 MTT-S Symposium to be held in Baltimore. They showed great interest when we first discussed the matter and promptly initiated discussions in their committees, which soon resulted in specific action plans and paper solicitation.

Marv informed me in the course of this writing that the focal theme "Low-Cost Microwave Hardware Manufacturing" (tentative title) has been adopted and an organizer assigned for the corresponding group of sessions. A second focal theme is under consideration and will also be included in the Final Call For Papers if it shows sufficient promise.

We believe that a single focal theme would be sufficient, especially for the beginning, and the one they chose for 1986 appears to be quite timely in view of the recent progress in low-cost microwave hardware manufacturing for TVRO applications. These truly remarkable accomplishments attracted attention by other segments of the microwave industry which are naturally interested in substantially lowering their manufacturing costs.

Microwave engineers can be pleased to note that the home satellite receiver was introduced before the home computer. The growth of TVRO installations surpassed most expectations and stimulated significant advances in microwave technology that deserve to be in the focus of attention of our next symposium.

Special Thanks

In addition to the individuals named above, most supportive in writing this article were Jim Crescenzi and Joe Barrera, my closest collaborators on the 1984 MTT-S TPC. I would have preferred to write jointly with them, as a follow-up of our joint TPC work and the subsequent entirely unanimous discussions on the subject of this article. Nevertheless, this would have been too time consuming to permit submission by the editorial deadline. (I actually missed it and express my thanks to Reynold Kagiwada for his indulgence.) Last, but not least, Joe White, whom I admire for his efforts toward better technical presentations, was kind enough to reserve time during his vacation to help me improve the clarity of this article and to translate portions thereof into better English. Many thanks to all of them.



“EMC 1985”: 6TH ZURICH SYMPOSIUM AND TECHNICAL EXHIBITION ON ELECTROMAGNETIC COMPATIBILITY, MARCH 5-7, 1985

850 participants from 26 countries, 43 exhibitors and a growth rate of 35% with respect to the “EMC 1983”: These figures of the “EMC 1985” confirm the growing importance of electromagnetic compatibility and the high standing of the series of Zurich-organized biennial EMC symposia, which this year celebrated ten years of their existence (previous symposia: 1975 and 77 in Montreux, 1979 in Rotterdam, 1981 and 83 in Zurich).

As in 1983, the symposium was held under the auspices of Mr. R. Trachsel, Director-General of the Swiss PTT and was sponsored by the Swiss Electrotechnical Association (SEV/ASE). A number of international and national professional organizations cooperated. Organization of the conference was with the Institute for

Communication Technology of the Swiss Federal Institute of Technology (Zurich) (ETHZ). President of the Symposium was Prof. Dr. P. Leuthold (Zurich), organizing chairman Dr. T. Dvorák (Zurich) and technical program chairman Prof. Dr. R.M. Showers (USA).

The technical program featured 116 papers in 19 sessions, 5 workshops, 2 discussion panels, an exhibition and 2 technical excursions. A welcome cocktail party, dinner, authors lunch and a ladies program contributed to the general success of the meeting.

The sessions were entitled: “Automated EMC measurements,” “ESD techniques,” “Triggered lightning EMP,” “EMC measurements,” “Printed circuit board EMC,” “Lightning EMP,” “EM interaction with bio-systems,” “Statistical aspects of noise and limits,” “EM phenomena in power transmission,” “EMC computer programs,” “EMI in microelectronics,” “Nuclear EMP impact,” “Power and data line transients,” “Spread spectrum and mobile communications,” “Shielding and cable coupling,” “Statistical theory of EMC,” “Power electronics,” “Key problems of spectrum use,” “Systems EMC & protection.”

The workshops, organized by H.K. Mertel, and discussion panels were devoted to following topics: computer-aided design for EMC; measurements related to biological effects; filters and surge arrestors for EMP; communications and EMC; open test site calibration; EMP instrumentation; transient phenomena; URSI factual statement on NEMP and associated effects.

With 34 papers, the USA still remains the leading contributor to the technical program which featured 116 papers, originating from 18 countries and 4 continents. Compared to 1983, however, there was a net increase in contributions from Europe and other parts of the world.

The following outstanding papers received certificates of honour and monetary awards totalling 5000. — Swiss Francs: A.D. Spaulding: “Locally optimum and sub-optimum detector performance in non-Gaussian broadband and narrowband interference environments;” J. Sack, H. Schmeer: “Computer-aided analysis of the RFI voltage generation by small commutator motors;” S. Yamazaki, H. Kuřonuma, Y. Noguchi: “Relation between APD/CRD of automobile ignition noise and resultant TV picture degradation;” F.C. Zach: “A new pulse width modulation control for line commutated converters minimizing the mains harmonics content;” C.E. Baum: “Black box bounds;” B.L. Michielsen: “A new approach to electromagnetic shielding.” A citation was presented to Dr. T. Dvorák, who founded and organized the conference during the last decade.

Further information and the 680-pages conference proceedings “electromagnetic compatibility 1985,” (price: Swiss Francs 100. —, incl. mailing) is available from:

Dr. T. Dvorák, ETH Zentrum-IKT, 8092 Zurich, Switzerland, phone: (+ 411) 256-2790.

The 7th Zurich EMC Symposium and Technical Exhibition is planned for March 1987. The call for papers will be mailed in December 1985.

MTT-S SPECIAL MEETINGS, COURSES, SYMPOSIUMS, WORKSHOPS, CLINICS & SOCIAL EVENTS (1984-1985)

| Date | Attendance | Type of Meeting | Subject |
|---------------------------------------|------------|--|---|
| BALTIMORE MTT/AP | | | |
| 2-25-84 | 29 | Short Course Speakers: C.R. Boyd Microwave Applications Group Douglas Adam Westinghouse R&D Center Russel G. West Trans Tech, Inc. | "Introduction to Microwave Ferrites" |
| 6-17-84 | 46 | Social | 1984 Membership Drive Picnic |
| 1-19-85 | 88 | Short Course Speakers: W. Zettler Alpha Industries M. McCann MaCom R. Garver Harry Diamond Labs. | Pin Diodes and Microwave Control Devices |
| 3-9-85 | 59 | Short Course Speakers: Helmut Shrank Westinghouse Electric Corp. Jim Armitage Westinghouse Electric Corp. Joe Frank Technology Service Corp. Dr. Geoffrey Hyde Comsat | "Trends in Modern Antenna Design" |
| CENTRAL NEW ENGLAND/BOSTON MTT | | | |
| 10-18-84 | 125 | Tour Speakers: Robert Walline M/A-COM John Vaughn M/A-COM Leonard Rosenheck M/A-COM | "Tour of M/A-COM Advanced Semiconductor Operations" |
| CHICAGO MTT/AP | | | |
| 5-14-84 | 128 | Exposition and Symposium organized by: Clarence Arnow Micro-Now Instrument Co. | Mini-Microwave Expo 1984 |
| 3-5-85 | 150 | Tour | Tour of Northrup Anechoic Chamber |
| DALLAS MTT | | | |
| 5-24-84 | N/A | Workshop Speakers: Dr. R. Levy Microwave Development Labs Dr. L. Rucker University of Texas at Arlington | 1984 Technology Update "Broadband Matching —CAD Techniques" "FM and AM Characteristics of Field Effect and Bipolar Transistors" |

| | | | |
|----------|-----|--|--|
| | | Dr. C. Hartmann RF Monolithics J. Fiedziuszko Ford Aerospace & Communications Corporation Dr. F. Lee Gigabit Logic | “SAW and BAW Resonators and Filters” “Dielectric Resonator Technology” “GaAs Digital IC Technology from 1952 and Applications” |
| 9-27-84 | 235 | “Exposition & Industry Night” Speaker: Dr. Hal Sobol Rockwell Int., Dallas | “State of Microwave Communication Technology” |
| 11-16-84 | 34 | Special one-day Conference, Dr. Kris Agarwal, Rockwell Speakers: Dr. Hal Sobol Rockwell Dr. Tatsuo Itoh University of Texas at Austin Dr. D. Norton, Texas Eng. Experiment Station Mr. Glenn Bandy, Texas Instruments Dr. M. Christiansen, Texas Tech University Dr. R. D. Nevels, Texas A&M Dr. Joe Halpain, SEI COM Dr. Jim Thompson, University of Texas at Arlington Dr. J. M. Lewallen, SWRI Instruments Dr. S. A. Long, University of Houston Mr. Paul Hartman Rockwell International | “University-Industry Cooperation” Conference “Changing Times Opportunities & Avenues” “Technology Infrastructure for Texas” “University Industry Interaction” |
| 3-23-85 | 105 | Technical Conference Speakers: Dr. K. Agarwal/A. Estes Dr. J. Butler Southern Methodist University Mr. Eric Strid Tektronics/Cascade Microwave Dr. Bill Childs EESOF Dr. Chalmers Butler University of Houston and Dr. Tatsuo Itoh, University of Texas at Austin | “Update on Microwave Techniques, Methods & Applications” “Lightwave Devices & Systems” “Digital GaAs IC’s – Packaging, Testing & Reliability” “Integrated Workstation – A Turnkey Engineer” “Practical Numerical Methods with Application to Microwave Structures” |

ISRAEL MTT/AP

9-11-84 100 +

One Day Symposium

Six invited papers on topics such as:
 Phased Array Antennas,
 Printed Millimeter-Wave Antennas, Triplexer Design, Frequency Synthesizer, FET Mixers, Etc.

LOS ANGELES MTT

6-19-84 N/A

Social

An Evening with C.W. Swift

NEW JERSEY COAST MTT/ED/QEA

11-16-84 350

Mini Show

Exhibits by Local Electronics Representatives *

* Joint Meeting of New Jersey Tri-Section (North Jersey, New Jersey Coast and Princeton Chapters).

NEW YORK/LONG ISLAND MTT

5-2-84 N/A

Symposium

"Wide-Band and Precision Microwave Sources"

NORTH JERSEY MTT/AP

11-16-84 350

Mini Show

Exhibits by Local Electronics Representatives *

* Joint Meeting of New Jersey Tri-Section (North Jersey, New Jersey Coast and Princeton Chapters).

PHOENIX MTT/AP/ED

2-8-84 205

Workshop

1984 Phoenix, Workshop VLSI Technology
 Superstition Mountain Hike
 Autumn Picnic
 "GaAs Technology"

3-24-84 50

Social

10-27-84 50

Social

2-19-85 131

Workshop

PRINCETON MTT/ED

11-16-84 350

Mini Show

Exhibits by Local Electronics Representatives *

12-13-84 21

Tour

"Tour of RCA Astro-Electronics, Hightstown, NJ"

3-22-85 157

Annual Sarnoff Symposium

"Microwave and Millimeter Wave Solid State Devices and Circuits"

* Joint Meeting of New Jersey Tri-Section (North Jersey, New Jersey Coast and Princeton Chapters).

SANTA CLARA VALLEY/SAN FRANCISCO MTT

3-23-85 275

One Day Short Course
 7 Speakers

"Advances in Hybrid MIC Design & Fabrication"

SWEDEN MTT/AP

3-15-85 30

Symposium
 Lecturer Affiliation:
 RMCS, England
 Univ. Mass. USA
 Ericson, Sweden

N/A

SWITZERLAND MTT/AP

5-15-84 46

Workshop

"Measurement Techniques in Microwaves and Electromagnetism"
 "Reflections"

Speakers:
 Prof. G. Epprecht
 Microwave Lab., ETH Zurich
 Dr. J. Forrer
 Lab. Physical Chemistry,
 ETH Zurich

"An Electron Spin Echo X-Band Spectrometer with Loop Gap and Bimodal Microwave Resonators" —

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| | | <p>J. F. Zurcher LEMA, EPF Lausanne Ch. Rieder CRPP, EPF Lausanne Dr. T. Sphicopoulos LEMA, EPF Lausanne</p> | <p>"A Compact Portable Six-Port Reflectometer" "Measurement Problems at 120 GHz" "Automatic Determination of Frequency Response Parameters, Field Distribution and Distortion in Microwave Cavities" "Beam Pipe Coupling Impedance Measurements" "An Efficient Technique for the Measurement of the Phase Noise of Microwave Amplifiers" "Estimation of Errors in Attenuation Measurements"</p> |
| | | <p>F. Casper CERN, Geneva L. G. Bernier LEMA, EPF Lausanne</p> | |
| | | <p>J. Heierli Huber and Suhner, Herisau</p> | |
| 10-8-84 | 38 | <p>Fall Meeting with Distinguished Lecturers Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA Peter Schmid Inst. Applied Physics ETH Zurich</p> <p>Hans Kaufmann AFIF, Zurich</p> <p>Dr. Y. Rahmat-Samii Jet Propulsion Laboratory</p> | <p>"High Speed Digital IC Performance Outlook"</p> <p>"Tapered Coplanar Waveguides for Picosecond Optoelectronic Sampling Devices" "Optical Monomode Waveguide Modulators in GaAs with High Speed Driving Capability" "Antenna Far-Fields from Near-Field Measurements – A Novel Plane Polar Technique"</p> |
| 5-22-85 | 40 | <p>Workshop Speakers: S. Sarkar Swiss PTT P. Niklaus Brown Boveri Company E. Zimmerman HB9-MIN Lee Johnson Oscilloquartz</p> <p>A. Zimmerman Autophon</p> <p>Jean-Francois Zurcher EPF Lausanne</p> <p>W. Vollenweider Autophon</p> | <p>"Optical Versus Radio Communications" "The Development of Microstrip Planar Array Antennas" "Achievements as a Microwave Radio-Amateur" "Question: How to Determine Very Accurately Dimensions of a Complex Waveguide Assembly Prior to Brazing" "The Requirements to be met When Several Emitters Operate at the Same Frequency" "What Happens When a Researcher from an Institute of Technology Tries to Sell the Product He Developed" "The Design of an Integrated Subharmonic Mixer"</p> |
| TOKYO MTT 5-24-84 | 11 | <p>English Speech Clinic K. Dobbyn (Technical Writing/ Presentation Specialist)</p> | <p>Rehearsal for speakers at 1984 IEEE MTT-S International Microwave Symposium</p> |

MTT-S CHAPTER MEETINGS (1984-1985)

| Date | Attendance | Speaker | Title Of Presentation |
|-------------------------|------------|---|---|
| ALBUQUERQUE | | | |
| MTT/AP/EMC | | | |
| 4-10-84 | N/A | Lennart Marin | "Broad-Band Analysis of VLF/LF Aircraft Wire Antennas" |
| 6-6-84 | N/A | Dikewood Corportion Dr. Conrad Longmire Mission Research Corp. | "Electrical Properties of Soil" |
| ATLANTA MTT/AP | | | |
| 1-17-84 | 20 | Maurice Raffensperger VOA, US Information Agency | "Voice of America Broadcasting" |
| 2-21-84 | 55 | Dr. Thomas Barnes Univ. of Texas at El Paso | "Origin and Destiny of the Earth's Magnetic Field" |
| 3-6-84 | 23 | Dr. Barry Turner National Radio Astronomy Laboratory | "A Large Deployable Reflector Antenna" |
| 5-1-84 | 53 | Dr. Stephen F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements" |
| 5-15-84 | 20 | V.K. Tripp Engineering Experiment Station, Georgia Tech. | "Random Antenna Damage" |
| 9-25-84 | 23 | Dr. Paul G. Steffes Georgia Institute of Technology | "Microwave Sensing of the Venus Atmosphere" |
| 10-23-84 | 31 | Dr. Ed Reedy Georgia Institute of Technology | "Radar Research at Georgia Tech" |
| 11-13-84 | 30 | David Frank | "Improved Millimeter Wave Signal Analysis" |
| 1-15-85 | 26 | James Cook Scientific-Atlanta | "30 GHz Satellite Communications Antennas" |
| 2-19-85 | 38 | Dr. Sander Weinreb MTT-S Distinguished Lecturer National Radio Astronomy Observatory | "Radio Astronomy - A Challenge to the Microwave Engineer" |
| 3-11-85 | 44 | Dr. Y. Rahmat-Samii AP-S Distinguished Lecturer Jet Propulsion Laboratory | "Large Space Deployable Antennas" |
| 4-8-85 | 20 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook" |
| 5-21-85 | 14 | Dr. Don Bodnar GTRI, Atlanta, GA | "Hankel Transforms in Phased Array Design" |
| BALTIMORE MTT/AP | | | |
| 3-15-84 | 36 | Dr. Stephen F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements" |
| 4-11-84 | 29 | Prof. Benedikt A. Munk AP-S Distinguished Lecturer Ohio State University | "Scan Independent Phased Arrays" |
| 5-14-84 | 162 | Edward C. Niehenke Westinghouse Electric Corp. | "China: The People and the Technology" |

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| 2-12-85 | 35 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook" |
| 3-20-85 | 15 | Dr. Salcman University of Maryland | "Microwave Hyperthermia" |
| 4-24-85 | 15 | Dr. Sander Weinreb MTT-S Distinguished Lecturer National Radio Astronomy Observatory | "Radio Astronomy - A Challenge to the Microwave Engineer" |

BENELUX MTT/AP

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|----------|----|--|--|
| 10-10-84 | 20 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook" |
| 10-10-84 | 20 | Dr. Y. Rahmat-Samii Jet Propulsion Laboratory | "Advances in Diffraction Analysis of Satellite Communication Reflector Antennas" |

CANAVERAL MTT/AP

| | | | |
|---------|----|--|--|
| 1-18-84 | 23 | Joseph A. Pape Scientific Atlanta | "A Modular Automatic Antenna Analyzer" |
| 2-29-84 | 23 | Dr. Stephen F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements" |
| 4-17-84 | 36 | Prof. Benedikt A. Munk AP-S Distinguished Lecturer Ohio State University | "Scan Independent Phased Arrays" |
| 5-14-84 | 23 | Walter D. Burnside Ohio State University | "Modern Electromagnetic Measurement System" |

CENTRAL NEW ENGLAND/BOSTON MTT

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|----------|-----|--|--|
| 1-26-84 | 42 | Ted Sadd Sage Laboratories | "Microwave Theory and Techniques in China" |
| 2-16-84 | 120 | R.A. Phaneuf, C. Gupta, & I. Crossley, Alpha Industries | "Three Millimeter Wave Technology Presentations and A Tour of Alpha Ind." |
| 3-22-84 | 28 | Harold E. Stinehelfer Made-It-Associates | "Microwave Analysis Using Reflection and Transmission Time-Domain Techniques" |
| 4-12-84 | 35 | Edward C. Niehenke Westinghouse Electric Corp. | "Advanced Systems Need Super Components" |
| 4-19-84 | 33 | Alex Chu MIT Lincoln Laboratories | "Millimeter-Wave Components for Transmitter and Receiver Applications" |
| 5-3-84 | 43 | Dr. Stephen F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements" |
| 9-20-84 | 24 | Cal T. Swift University of MA, Amherst | "Passive Microwave Remote Sensing from Aircraft and Space Craft" |
| 11-15-84 | 22 | Dean F. Peterson Steinbrecker Corp. | "Millimeter-Wave Power Generation for Communications Application" |
| 12-13-84 | 24 | Zvi Galani Raytheon Co. | "A Novel Low-Noise Dielectric Resonator GaAs FET Oscillator" |
| 1-9-85 | N/A | A.J. Fenn MIT Lincoln Labs | "Monopole Phased Array for Space Based Radar Applications" |
| 2-5-85 | 95 | D. Loughton Raytheon Co. D. McQuiddy Texas Instruments | "Hybrid & MMIC T/R Modules" |

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| 4-18-85 | 35 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital GaAs IC Performance Outlook" |
| 5-16-85 | 63 | Ted Saad Sage Laboratories | "The Story of the MIT Radiation Laboratory" |
| CHICAGO MTT/AP | | | |
| 2-20-84 | 24 | R. Dennis Fraser Alcoa-NEC Communications | "Direct Broadcasting Systems" |
| 3-19-84 | 38 | Dr. Stephen F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements" |
| 4-16-84 | 12 | Dr. Y. Rahmat-Samii AP-S Distinguished Lecturer Jet Propulsion Laboratory | "Large Antenna Systems for Space Applications" |
| 6-11-84 | 24 | Helmut Shrank Westinghouse Electric Corporation | "Low Sidelobe Phased Array Antennas" |
| 9-18-84 | 30 | Kenneth L. Carr M/A-Com, Inc. | "The Use of Microwave Technology in the Detection and Treatment of Cancer" |
| 10-15-84 | 31 | Dr. Sander Weinreb MTT-S Distinguished Lecturer National Radio Astronomy Observatory | "Radio Astronomy - A Challenge to the Microwave Engineer" |
| 11-19-84 | 75 | Dr. Barry Spielman Naval Research Laboratory | "Millimeter-Wave Monolithic Technology" |
| 2-4-85 | 10 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook" |
| 6-10-85 | 28 | Dr. Bruce E. Briley AT&T Bell Laboratory | "The Fiber Optics Field: Present and Future" |
| COLUMBUS MTT/AP | | | |
| 1-12-84 | 41 | George T. Ruck Battelle Columbus Labs | "Electromagnetic Scattering from the Sea" |
| 2-16-84 | 48 | Dr. Edward F. Miller NASA/Lewis Research Center | "NASA's Role in Satellite Communication" |
| 3-27-84 | 45 | Dr. Y. Rahmat-Samii AP-S Distinguished Lecturer Jet Propulsion Laboratory | "Large Antenna Systems for Space Applications" |
| 4-4-84 | 29 | Dr. Stephen F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements" |
| 5-8-84 | 55 | Prof. John D. Kraus Ohio State University | "Antennas since Hertz and Marconi" |
| 5-22-84 | 27 | Ivan F. LaHaie Environmental Research Institute of Michigan | "The Inverse Source Problem for Three-Dimensional Partially Coherent Sources and Fields" |
| 7-2-84 | 24 | Roberto Tiberio University of Florence Italy | "A Uniform GTO Formulation for the Diffraction by a Wedge with Impedance Faces" |
| 9-7-84 | 27 | Dr. Herbert Uberall Catholic University, Washington, DC | "Complex Electromagnetic Resonance Frequencies of Prolate Spheroids and Finite Cylinders and Their Physical Interpretation" |
| 9-28-84 | 175 | Dr. John D. Kraus Ohio State University | "Radio Astronomy and Searching for the Real E.T." |

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| 10-22-84 | 20 | Walter Wayne Hofer Lawrence Livermore National Laboratory University of California | "High Power Microwave Research" |
| 11-20-84 | 20 | Alan J. Fenn MIT Lincoln Laboratory | "Planar Near Field Antenna Theory and Measurements" |
| 1-14-85 | 23 | Dr. Wilson Pearson McDonnell Douglas Astronautics Company | "High Frequency Diffraction at Metallic Edges Near Media Interfaces" |
| 3-18-85 | 31 | David M. Pozar University of Massachusetts | "Some Recent Developments in Printed Antenna Studies" |
| 3-21-85 | 39 | Professor Y.T.Lo University of Illinois | "What a 'Random' Array Can and Cannot Do — An Understanding and a Misunderstanding" |
| 5-1-85 | 51 | L.C. Hoots Brunswick Corporation | "Introduction to Radomes" |
| 5-20-85 | 35 | Dr. Donald R. Wilton University of Houston | "Numerical Solution Techniques in Electromagnetics" |
| 6-7-85 | N/A | David A. Hill National Bureau of Standards | "Near-Field Arrays for Plane Wave Synthesis" |

DALLAS MTT

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|----------|----|--|---|
| 1-26-84 | 39 | Richard True Litton Industries | "Modern Electron Tubes" |
| 2-23-84 | 43 | Dr. Franco N. Sechi RCA Laboratories | "FET Power Amplifier Design Using Load-Pull Techniques" |
| 3-22-84 | 53 | Dr. Sang Sheem Rockwell International | "Optical Fiber Communications" Technology" |
| 5-24-84 | 35 | Dr. Fred Doerbeck Texas Instruments, Inc. | "GaAs Materials Technology from 1952 to 1984" |
| 10-24-84 | 40 | Harold Stinehelfer, Sr. Made-It Associates, MA. | "Microwave Analysis Using Reflection & Transmission Time Domain Techniques" |
| 12-13-84 | 28 | Dr. Andrew Blanchard University of Texas at Arlington, TX | "Point and Distributed Targets & Their Influence on the Radar System" |
| 1-24-85 | 58 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook" |
| 2-21-85 | 58 | Dr. Sander Weinreb MTT-S Distinguished Lecturer National Radio Astronomy Observatory | "Radio Astronomy - A Challenge to the Microwave Engineer" |
| 4-25-85 | 32 | Mr. William Conner Rockwell International | "Microwave Single Sideband Systems" |
| 5-30-85 | | '85 MTT Symposium Speaker's Night | "Summary of Presentation of Papers" |

FLORIDA WEST COAST MTT/AP

| | | | |
|----------|----|--|------------------------------------|
| 1-25-84 | 70 | Dr. Carl Sutton Medical School University of South Florida | "Biological Effects of Microwaves" |
| 2-28-84 | 32 | Dr. Stephen F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements" |
| 5-2-84 | 21 | Larry Alter ECI Division of E-Systems | "Adaptive Phased Arrays" |
| 9-20-84 | 19 | Ray French Sperry, Clearwater, FL | "Electromagnetic Interference" |
| 10-17-84 | 8 | Prof. Benedikt A. Munk AP-S Distinguished Lecturer Ohio State University | "Scan Independent Phased Arrays" |

HOUSTON MTT/AP/ED/MAG

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|---------|----|--|--|
| 1-25-84 | 36 | Jean Van Bladel Univ. of Ghent, Belgium | "Electrodynamics of Moving Media" |
| 3-8-84 | 46 | Roger F. Harrington Syracuse University | "The Method of Moments In Electromagnetics" |
| 4-30-84 | 41 | Edward D. Wolfe Cornell University | "Miniaturization-A Multidisciplinary Engineering Adventure" |

INDIA MTT/ED

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|---------|-----|------------------------------------|--|
| 2-6-84 | 10 | Prof. James B. Beyer | "Monolithic Microwave Integrated Circuit Distributed Amplifier" |
| 2-27-84 | 10 | Prof. F.E. Gardiol | "Microstrip Antennas-Analysis Using Integral Formulation" |
| 4-16-84 | 10 | Prof. I.M. Stephenson | "Computer Aided Design of Microwave Integral Circuits, Part I" |
| 4-16-84 | 10 | Brian Easter | "Computer Aided Design of Microwave Integrated Circuits, Part II" |
| 1-7-85 | N/A | N/A | "Annual General Body Meeting" |
| 2-11-85 | N/A | N/A | "Chapter Meeting" |
| 2-25-85 | 15 | Mr. Jon Collins Comsat, UK Ltd. | "Compact Software and its Applications" |
| 3-25-85 | N/A | N/A | "Chapter Meeting" |
| 5-10-85 | N/A | N/A | "Chapter Meeting" |

LOS ANGELES MTT

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|---------|----|--|---|
| 1-17-84 | 61 | Fred Labaar TRW | "Phase Noise Fundamentals and Measurements" |
| 2-21-84 | 64 | George L. Matthaei University of California at Santa Barbara | "Some New Dielectric Waveguide Filter Techniques" |
| 3-20-84 | 75 | James Schellenberg Hughes Aircraft Co. | "FET Technology" |
| 4-24-84 | 65 | Ted Saad Sage Laboratories | "Thirty Years of Microwaves" |
| 5-22-84 | 60 | Dr. Steven F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements" |
| 5-21-85 | 55 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook" |
| 6-18-85 | 30 | Kenneth L. Carr MTT-S Distinguished Lecturer M/A-COM, Inc. | "The Application of Microwave Technology to the Detection and Treatment of Cancer" |

MIDDLE AND SOUTH ITALY MTT/AP

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|---------|----|---|---|
| 1-31-84 | 50 | Giorgio Franceschetti University of Naples | "Sampling Techniques in the Analysis and Synthesis of Antennas" |
| 3-14-84 | 25 | T. Itoh University of Texas at Austin | "Open Guided Wave Structures" "Transmission Lines on Semiconductor Substrate" |
| 3-16-84 | 25 | T. Itoh University of Texas at Austin | "Quasi-Optical Plane Mixer" "E-Plane and Fin-Line Techniques" |
| 9-7-84 | 35 | Tsukasa Yoneyama University of Ryukyus, Okiwawa, Japan | "Nonradiative Dielectric Waveguide" |
| 9-10-84 | 40 | George Deschamps University of Illinois, Urbana, Illinois | "Electromagnetics and Differential Forms" |

MTT-CHAPTER MEETINGS (1984-1985)

| Date | Attendance | Speaker | Title of Presentation |
|--|------------|--|--|
| NEW JERSEY COAST MTT/ED/QEA | | | |
| 2-22-84 | 347 | Dr. Stephen F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements"* |
| 11-16-84 | 116 | Dr. Sander Weinreb MTT-S Distinguished Lecturer National Radio Astronomy Observatory | "Radio Astronomy - A Challenge to the Microwave Engineer"* |
| 11-16-84 | 93 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook"* |
| NORTH JERSEY MTT/AP | | | |
| 2-22-84 | 347 | Dr. Stephen F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements"* |
| 9-18-84 | 19 | Dr. Tatsuo Itoh University of Texas at Austin | "Transmission Lines for Microwave & Millimeter-Wave Circuits" |
| 11-16-84 | 116 | Dr. Sander Weinreb MTT-S Distinguished Lecturer National Radio Astronomy Observatory | "Radio Astronomy - A Challenge to the Microwave Engineer"* |
| 11-16-84 | 93 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook"* |
| 3-11-85 | N/A | Dr. Fred J. Rosenbaum Central Microwave Co. | "Millimeter Wave Solid Sources" |
| 4-24-85 | 22 | Dr. Glenn R. Thorn Raytheon Company | "Advanced Milimeter-Wave Technology, Solid State Systems of the Future" |
| ORLANDO MTT/AP | | | |
| 3-1-84 | 11 | Dr. Stephen F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements" |
| 9-20-84 | 13 | Phil Bartley Hewlett Packard Co. Atlanta, Georgia | "Network Analysis in the Time Domain" |
| 10-18-84 | 13 | Prof. Benedikt A. Munk AP-S Distinguished Lecturer Ohio State University | "Scan Independent Phased Arrays" |
| 11-15-85 | 19 | Dr. Oren B. Kesler Texas Instruments, Inc. | "Radar Signature Technology" |
| 4-20-85 | 33 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook" |
| * Joint Meeting of New Jersey Tri-Section (North Jersey, New Jersey Coast and Princeton Chapters). | | | |
| OTTAWA MTT/AP/EMC | | | |
| 3-14-84 | 71 | S. Stapleton & Dr. B. Ashton Canadian Astronautics | "The Microwave Landing System (MLS) Antenna" |

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| 4-5-84 | 42 | Dr. Stephen F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements" |
| 11-7-84 | 88 | Peter Townsend | "The David Florida Laboratory and Satellite Testing in Canada" |
| 1-9-85 | 49 | Keith Hooley | "Electromagnetic Environment Simulation for Test and Evaluation of Military Surveillance Systems" |
| 2-27-85 | 33 | D. Allcock and M. Klemas | "Beyond Phased Arrays Toward Adaptive Antennas" |
| 4-17-85 | 57 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook" |

PHILADELPHIA MTT/AP

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|---------|----|---|--|
| 1-26-84 | 22 | Alan J. Simmons Lincoln Labs Massachusetts Institute of Technology | "Recent EHF Satellite Communications Antenna Developments at MIT Lincoln Labs" |
| 2-23-84 | 12 | Dr. Stephen F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements" |

PHOENIX MTT/AP/ED

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| 4-13-84 | 35 | Dr. Peter Williams Arizona State University | "Secondary Ion Mass Spectroscopy (SIMS)" |
| 9-18-84 | 26 | Prof. Benedikt A. Munk AP-S Distinguished Lecturer Ohio State University | "Frequency Selective Surfaces" |
| 9-18-84 | 23 | Dr. Robert Dulton Stanford University, Palo Alto, CA | "Simulation Techniques for Silicon Processing" |
| 11-20-84 | 31 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook" |
| 1-22-85 | N/A | Dr. Sander Weinreb MTT-S Distinguished Lecturer National Radio Astronomy Observatory | "Radio Astronomy - A Challenge to the Microwave Engineer" |
| 3-19-85 | 31 | R.E. Munson | "Microstrip Antenna Technology" |
| 4-24-85 | 35 | Jim Plumber | "Silicon VLSI Technology and its Impact on Device Physics" |

PORTLAND MTT/CAS/IM/ED/SU/CHMT/CS/COM

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|---------|----|--|---|
| 4-24-84 | 80 | Melvin D. Wright Tektronix, Bvrtn, OR | "Microlithography" |
| 4-24-84 | 80 | Bill Siu Intel Corp., Aloha, OR | "CMOS Technology Advances in the 80's" |
| 5-22-84 | 45 | Chris King Planar Systems, Bvrtn, OR | "Flat Panel Display Technology" |
| 5-22-84 | 45 | Eric Strid Tektronix, Bvrtn, OR | "On Gallium Arsenide and Blob Charts" |
| 9-25-84 | 15 | Jon Orloff Oregon Graduate Center | "Development of High Brightness Sources for IC Research" |
| 11-6-84 | 42 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook" |

PRINCETON MTT/ED

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| 2-22-84 | 347 | Dr. Stephen F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements"* |
| 11-16-84 | 116 | Dr. Sander Weinreb MTT-S Distinguished Lecturer National Radio Astronomy Observatory | "Radio Astronomy - A Challenge to the Microwave Engineer"* |
| 11-16-84 | 93 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook"* |
| 2-21-85 | 11 | John M. Osepchuk Raytheon Co. | "The Controversy About Hazards of Electrical Radiation and the Role of the IEEE" |
| 5-8-85 | 45 | William C. Brown Raytheon Co. | "Microwave Power Transmission Applications: Microwave Power Aircraft and Solar Satellites" |

* Joint Meeting of New Jersey Tri-Section (North Jersey, New Jersey Coast and Princeton Chapters).

ST. LOUIS MTT/AP/ED

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|---------|-----|---|---|
| 2-21-84 | N/A | James M. Roe Peterson-Roe Corporation | "The 1983 Microwaves Study Group to the Peoples Republic of China" |
| 4-4-84 | N/A | Walter M. Scott McDonnell Douglas Microelectronics Center | "Modern Infrared Detector Technology" |
| 4-17-84 | N/A | Dr. Y. Rahmat-Samii AP-S Distinguished Lecturer Jet Propulsion Laboratory | "Large Antenna Systems for Space Applications" |

SAN DIEGO MTT/AP

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| 1-11-84 | 47 | Dr. Stephen F. Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements" |
| 3-16-84 | 27 | Dr. Cheng Donn Randtron Systems | "Some Practical Design Aspects of Corrugated Horns" |
| 4-19-84 | 35 | Dr. John J. Fratimico, Jr. Global Analytics | "Application of Periodic Structures to Reflector Antenna Systems" |
| 5-4-84 | 24 | John Boyles Hewlett-Packard Co. | "Applications of the HP8510 Network Analyzer" |
| 9-21-84 | 22 | Scott Roleson H.P., San Diego Div. | "Using Very Small Loops as EM Compatibility Tools" |
| 11-21-84 | 20 | Dr. Thomas Kornbau General Dynamics Electronics | "Periodic Arrays of Rotated Dipoles" |

SAN FERNANDO VALLEY MTT

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| 1-12-84 | N/A | Richard Q. Lane California Eastern Labs | "De-Embedding Techniques for the Measurement of Device Scattering Parameters" |
| 3-1-84 | N/A | Charles L. Grasse Teledyne MEC | "Acousto-Optic Bragg Cells: Tomorrow's Receiver Technology?" |
| 6-14-84 | N/A | Stanley Mason Avantek, Inc. | "Design and Use of Internally Matched GaAs FETs in C-Band Power Amplifiers" |
| 1-22-85 | 43 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook" |
| 3-21-85 | 35 | Dr. Kinishiro Ogawa | "Fiber Optics and Microwave" |
| 5-23-85 | 75 | Dr. George Kaelin | "GaAs Monolithic Microwave Integrated Circuit (MMIC) Technology" |

SANTA CLARA VALLEY/SAN FRANCISCO MTT

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| 9-13-84 | 73 | S.J. Fiedziuszk | "Dielectric Resonators & Applications" |
| 10-11-84 | 26 | 6 Speakers | "Education & the Microwave Industry" |
| 11-8-84 | 90 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook" |
| 1-10-85 | 157 | K. Feher | "Digital Modulation Techniques for Satellites" |
| 2-14-85 | 73 | W. Keenan | "Distributed Amplifiers" |
| 4-11-85 | 38 | Dr. Sander Weinreb MTT-S Distinguished Lecturer National Radio Astronomy Observatory | "Radio Astronomy - A Challenge to the Microwave Engineer" |
| 5-9-85 | 40 | D. Raicu | "Low Frequency YIG Preselectors" |
| 6-13-85 | 37 | D. Kajfez | "Modes in Dielectric Resonators" |

SOUTHEASTERN MICHIGAN MTT/AP/ED

| | | | |
|----------------|----|--|--|
| 1-31-85 | 98 | Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook" |
| and 2-1-85* | | | |

* Split Meeting - East Lansing and Ann Arbor

SWEDEN MTT/AP

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|---------|-----|--|---|
| 3-27-84 | 27 | Lecturer Affiliation: Ericsson Co., Sweden | N/A |
| 4-11-84 | 20 | Lecturer Affiliation: Chalmers, Sweden | N/A |
| 9-7-84 | 36 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories and UCLA | "High Speed Digital IC Performance Outlook" |
| 10-1-84 | 22 | Dr. Y. Rahmat-Samii AP-S Distinguished Lecturer Jet Propulsion Laboratory | "Large Antenna Systems for Space Applications" |
| 10-2-84 | 17 | Dr. Y. Rahmat-Samii AP-S Distinguished Lecturer Jet Propulsion Laboratory | "Large Antenna Systems for Space Applications" |
| 4-23-85 | 27 | Lecturer Affiliation: Philips, England | N/A |
| 5-28-85 | N/A | Lecturer Affiliation: RCA, USA | N/A |

SWITZERLAND MTT/AP

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| 10-4-84 | 38 | Dr. Y. Rahmat-Samii Jet Propulsion Laboratory | "Antenna Far-Fields From Near Field Measurements - A Novel Plane Polar Technique" |
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TOKYO MTT

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| 4-5-84 | 15 | Prof. Ernst Bonek Technical University Vienna | "PLL (Phase Locked Loop) Infrared Receivers" |
| 4-5-84 | 15 | Dr. Nim Cheung Bell Communications Research | "Introduction to Bell Communications Research" |

| | | | |
|----------|----|---|--|
| 9-20-84 | 48 | E. Yamashita University of Electro-communications S. Mizushina Shizuoka University T. Nishikawa Murata Manufacturing Y. Kobayashi Saitama University H. Ogawa ECL, NTT N. Kusama NEC | "Reports from 1984 MTT-S International Microwave Symposium" |
| 10-26-84 | 20 | Prof. Herbert French Admiralty Res. Establishment | "New Signal Processing Techniques for Electro-Optic Remote Sensing-Parts I & II" |
| 10-29-84 | 84 | Prof. Tatsuo Itoh University of Texas at Austin | "Research on Microwave and Millimeter-Wave Integrated Circuit Components" |

TWIN CITIES MTT

| | | | |
|----------|----|--|---|
| 4-3-84 | 24 | Paul Heinerscheid United States Satellite Broadcasting, Co. | "Direct Broadcast Satellite Systems and Applications" |
| 5-4-84 | 40 | Dr. Stephen Adam MTT-S Distinguished Lecturer Hewlett-Packard Co. | "Modern Microwave Measurements" |
| 9-27-84 | 27 | Ed Niehenke Westinghouse Defense and Electronics Ctr. | "Advances in Low Noise GaAs FET Technology" |
| 10-25-84 | 21 | Dr. George O'Clock Mankato State University | "Spread-Spectrum Systems and Technologies" |
| 11-15-84 | 41 | Dr. Paul T. Greiling MTT-S Distinguished Lecturer Hughes Research Laboratories" and UCLA | "High Speed Digital IC Performance Outlook"* |
| 2-14-85 | 24 | Dr. Vlad Sokolov Honeywell Physical Sciences Center | "GaAs Monolithic Microwave/Millimeter Wave Integrated Circuits" |
| 3-14-85 | 27 | Dr. Richard Snyder RS Microwave Company | "Microwave Filters: State-of-the-Art Review" |
| 4-11-85 | 26 | Dr. Berin Fank Varian Millimeter Wave Products | "High Efficiency InP Millimeter Wave Oscillators and Amplifier" |
| 5-16-85 | 29 | Robert Ying Hughes Millimeter/Microwave Circuits Department | "Millimeter Wave Solid State Transmitter Sources" |

UTAH/SALT LAKE CITY MTT/AP/ED

| | | | |
|---------|-----|--|---|
| 2-6-84 | 43 | Prof. Donald R. Wilton AP-S Distinguished Lecturer University of Houston | "Numerical Solution Techniques in Electromagnetics" |
| 2-27-84 | N/A | Richard K. Chang Yale University | "Laser Scattering from Passive and Active Microparticles" |



(Short Courses—Continued from Page 41)

Modulation, Modulators and Transmitter Design, November 6-8, course number 1231DC, \$730 per attendee. Instructors F. Amoroso and R.C. Dixon.

Integrated Services Digital Networks, November 13-15, course number 1227DC, \$730 per attendee, Instructor H.J. Helgert.

Introduction to Receivers, November 18-19, course number 1225DC, \$650 per attendee, Instructor R.C. Dixon.

Modern Receiver Design, November 20-22, course number 1079DC, \$730 per attendee, Instructor R.C. Dixon.

Frequency Synthesis, December 9-11, course number 1080DC, \$730 per attendee, Instructor R.C. Dixon.

Wideband Communications Systems, December 9-13, course number 537DC, \$920 per attendee, Instructor B.E. Keiser.

For the above George Washington University short courses; further information can be obtained from Shirley Forlenzo at (202) 676-8530 or toll free (800) 424-9773.

Principle of Telecommunications Switching Systems, October 16-18, course number 1204DC, \$730 per attendee, Instructor R.D. Rosner.

Packet Switching Networks for Data Communication, October 7-10 (Orlando, course number 12010F), November 4-7 (Ottawa, course number 12010C), December 10-13 (Washington, course number 1201DC), \$835 per attendee, Instructor W.E. Nipper.

HF Spectrum: New Concepts and Technologies, November 18-22, course number 893DC, \$920 per attendee, Instructors J.M. Goodman and D.R. Uffelman.

For the above George Washington University short courses, further information can be obtained from Ron Donais at (202) 676-8523 or toll free (800) 424-9773 (U.S.) and (800) 535-4567 (Canada).

Future Trends in Satellite Communications, System Planning, Design, and Operation at K_u and K_a Bands, September 30-October 4, course number 1221DC, \$920 per attendee, Instructor E. Simo.

Communications Satellite Systems—The Earth Station: A Practical Approach to Implementation, October 7-9, course number 823DC, \$730 per attendee, Instructors M.J. Downey and R. Sims.

Telecommunications Management Planning: Future ISON Networks, Products and Services, Mobile Cellular Telecommunication Systems, December 4-6 course number 1086DC, \$730 per attendee, Instructor W.C.Y. Lee.

Communications Satellite Engineering, November 18-22, course number 259DC, \$920 per attendee, Instructors E. Cacclamanix, W. DeHart, W.B. Garney, J.R. Owens, and R. Sims.

Telecommunications Policy: Current Developments and Future Directions, December 16-18, course number 1076DC, \$730 per attendee, Instructor A.H. Ende.

Satellite Communications Networks: Planning/Spacecraft Operations/Earth Station Operation, December 16-20, course number 1144DC, Instructors E.J. Collins and M.J. Downey.

For the above George Washington University short courses, further information can be obtained from Darold Aldridge at (202) 676-8718 or toll free (800) 424-9773 (U.S.) and (800) 535-4567 (Canada).

Microwave Systems Planning, October 21-25, course number 832DC, \$920 per attendee, Instructor A. Schneider.

Antennas and Arrays: Analysis, Synthesis, and Applications, October 28-November 1, course number 824DC, \$920 per attendee, Instructor V.R. Arens, J.K. Rainas, and J.P. Shelton.

For the above George Washington University short course, further information can be obtained from Dick White at (202) 676-6106 or toll free (800) 424-9773 (U.S.) and (800) 535-4567 (Canada).

The address for Continuing Engineering Education, George Washington University, Washington D.C. 20052.

The Continuing Education Institute is offering the following courses that may be of interest.

Secure Communication Systems, September 30-October — (Washington D.C.), and October 7-9 (Los Angeles, CA), course number 225.05, \$850 per participant, Instructor D.J. Torrieri.

Filter Optics: Technology and Applications, October 28-30, course number 207.06, \$795 per participant, Instructor S.D. Personick.

Microwave Circuit Design: Linear, October 7-11 (Cambridge, Mass.) and November 4-8 (Palo Alto, CA), course number 117.18, \$995 per participant, Instructors L. Besser, S.L. Marcl and R. Wenzel.

Microwave Circuit Design: Non-Linear, December 2-6, (Palo Alto, CA), course number 119.07, \$995 per participant, Instructors K.C. Gupta, E.C. Niehencke, R.A. Pace, and F.N. Sechi.

VLSI Materials and Process Technology, November 4-7 (Monterey, CA), course number 146.06, \$895 per participant, Instructors G.E. McGuire, K.E. Bean, S. Brogodo, B.E. Deal, R.B. Fair, P.S. Ho, W.C. O'Mara, and F. Pease.

For registration form or other information call (213) 824-9545 (Los Angeles), (301) 596-0111 (Washington D.C.), and 46-(0122) 17570 (Finsgary, Sweden), or write to Continuing Education Institute, 10889 Wilshire Blvd., Los Angeles, CA 90024.

UCLA Extension and The University of Maryland University College is offering, **Modern Microwave**

Measurements and Applications, November 19-22 (Los Angeles, CA) course number 881.73, \$875 per student, Instructor S.F. Adam.

For reservations and/or registration information, contact the Short Course Program Office, UCLA Extensions, P.O. Box 24901, Los Angeles, CA 90024, (213) 825-1295 or 825-344-.

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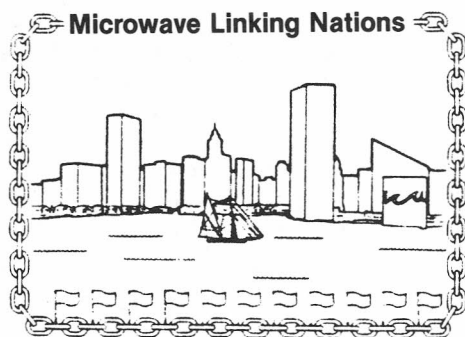
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Tyby Klein
(301) 655-2211

Blondie Rubin
(301) 766-5900



Baltimore, Maryland
June 2, 3, and 4, 1986

1986 IEEE/MTT-S International Microwave Symposium



Final Call for Papers

Papers are solicited describing original work in the microwave field. A list of suggested topics is given below, but papers concerned with other aspects of microwave theory and technology will be considered. Suggested topics are:

- Biological Effects and Medical Electronics
- Computer-Aided Design
- Solid-State Devices and Circuits
- High-Power Devices and Systems
- Integrated Optics, Fiber Optics, and Optical Techniques
- Microwave and Millimeter-Wave Integrated Circuits
- Phased and Active Array Techniques
- Submillimeter Wave Techniques and Devices
- Measurement Theory and Techniques
- Microwave Systems
- GaAs Monolithic Circuits
- Ferrite Devices
- Communications Systems
- Low-Noise Techniques
- Field and Network Theory
- Microwave Acoustics
- Passive Components

The planned technical program includes focused sessions on selected areas of current interest to the microwave community. The focused topics for this Symposium will be **Advances in Low-Cost Component Manufacturing** and **Microwave Aspects and Applications of GHz/Gbit Optical Transmission**. Papers describing original work in these two areas are being solicited. Papers that are candidates for these sessions will be subjected to the same review process that all other papers will undergo. Submissions in these areas should be marked clearly as such to facilitate classification and review.

A prospective author is required to submit 10 copies each of:

1. A 500-1000 word summary, with supporting illustrations, clearly explaining the author's contribution, the paper's originality, and its relative importance
2. A 30-50 word abstract
3. A separate sheet with the complete mailing address of the author and a statement categorizing the submitted paper as full length, short, or open forum

Mail submissions to: **Marvin Cohn**
c/o LRW Associates
1218 Balfour Drive
Arnold, Maryland 21012

To be considered, submissions should be received by **December 9, 1985**. Late submissions will be returned unreviewed.

To allow the presentation of papers in the format best suited to each, the program will consist of three categories of papers: full length, short, and open forum. The third category gives authors the opportunity to present theoretical and experimental material in poster form, to display hardware, and to answer questions in a more relaxed atmosphere. The Technical Program Committee will try to abide by the preferences of an author regarding category of paper but reserves the right to place the paper in the category it considers most appropriate. Awards will be made for both the best symposium paper and the best presentation in the open forum.

Authors will be notified of the status of their submissions by February 10, 1986. Authors of accepted papers will receive copyright release forms and instructions for publication and presentation.

The 1986 IEEE Microwave and Millimeter Wave Monolithic Circuits Symposium will be held in Baltimore on June 4-5, 1986, in conjunction with the 1986 IEEE MTT-S International Microwave Symposium. Do not submit the same material to both symposia.

The Automatic RF Techniques Group (ARFTG) will also hold its 26th conference on June 5-6, 1986, in conjunction with the Microwave Symposium.

Note: *Authors are cautioned to obtain all required company and government clearances prior to submittal. A statement signed by the authors stating that such clearances have been obtained must accompany the final manuscripts of accepted papers that will be published in the Symposium Digest. The deadline for receipt of these final manuscripts is **March 14, 1986.***



**IEEE INTERNATIONAL CONFERENCE ON
INFRARED AND MILLIMETER WAVES
December 9-13, 1985
Americana Dutch Resort Hotel
Lake Buena Vista (Orlando)
Florida 32830**

| | MILLIMETER WAVES | GYROTRONS/FEL | SUB-MILLIMETER WAVES | PLASMA DIAGNOSTICS |
|------------------|-------------------------|----------------------|---|---------------------------|
| Mon. AM | MM Sources | | Atmos. & Astron. | Plasma I |
| Mon. PM | MM Receivers | | Dielectric Mat'ls. | Plasma II |
| Tues. AM | Sources & Systems | MM Materials | Detectors | Plasma III |
| Tues. PM | Detectors & Mixers | Gyrotron I | Semiconductors | |
| Wed. AM | Guided Propagation | Gyrotron II | SMMW Devices | |
| Wed. PM | MMW Systems | Gyrotron III | Lasers I | |
| Thurs. AM | Gd. Prop. & Int. C. | Gyrotron IV | Lasers II | |
| Thurs. PM | Atmos. Physics | Gyrotron/FEL | Spectroscopy | |
| Fri. AM | MMW Devices | Free El. Laser | Pulsed Sources & IR Nonlinear Optics | |

Hotel reservations (\$55/day) must be made one month in advance by the delegate (305) 828-4444, Telex 56-7 460. Higher rates will apply at nearby hotels in Walt Disney Village after that.

Advance registration by mail (\$105 for IEEE members) may be sent to Kenneth J. Button, M.I.T., Box 72, M.I.T. Branch, Cambridge, MA 02139-0901. Abstracts (35-40 words) may be sent to James C. Wiltse, Ga. Tech. Res. Inst. Atlanta, GA 30332 or to K.J.B. Late abstracts from MTT members are acceptable.

Discount airfares are available on Eastern Airlines by calling (800) 327-1295 referring to access number EZ12P5.

1986 IEEE MICROWAVE AND MILLIMETER-WAVE MONOLITHIC CIRCUITS SYMPOSIUM



Baltimore, MD – June 4-5, 1986



FIRST CALL FOR PAPERS

The 1986 IEEE Microwave and Millimeter-Wave Monolithic Circuits Symposium will be held in Baltimore, Maryland on June 4 and June 5, 1986. This symposium is held annually in conjunction with the IEEE MTT-S International Microwave Symposium.

Papers are solicited describing original work in the field of analog and related digital monolithic integrated circuits with applicability to the 1-300 GHz frequency range. The following subject areas concerned with design, fabrication and testing of microwave and millimeter-wave monolithic integrated circuits are particularly appropriate but other aspects of this technology will also be considered for this conference:

- Analog and Related Digital Integrated Circuits
- Solid-State Devices and Circuits
- Fabrication Technology and Yield
- Radiation Effects and Reliability
- Packaging and Testing
- Systems, Subsystems and Components
- Signal Control and Modulation
- Computer Aided Design Techniques
- Integrated Optoelectronic Circuits

Authors are required to submit 5 copies of a 500-1000 word summary, with supporting illustrations, that clearly explains their contribution. In addition, 5 copies of an abstract of 30 to 50 words must be submitted with the complete mailing address of the author(s). Please do not submit the same material to both MTT-S and this symposium. The paper summary and abstract must be received on or before 9 December 1985 by:

Yalcin Ayasli
Hittite Microwave Corporation
5 Ingleside Road
Lexington, Massachusetts 02173
Telephone: (617) 863-5366

Authors are responsible for obtaining all required company and government clearances prior to submission of papers. Notice of acceptance or rejection will be mailed to authors by 10 February 1986. Authors of accepted papers will receive material and instructions for preparing photoready copies of papers to be printed in the Symposium Digest, copyright release forms, and presentation guidelines.

The authors are also encouraged to prepare expanded versions of papers presented at the Symposium to be considered for publication in a special section of the MTT-S and/or ED-S Transactions.

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THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.

Announces the 14th Annual Competition for

1986-1987

Congressional Fellowships

A CONGRESSIONAL INTERNSHIP FOR MEMBERS OF IEEE

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 shall be 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 plans to award two Congressional Fellowships for the 1986-1987 term. Additional funding sources may permit expansion of awards.

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

**Secretary, Congressional Fellows Program
The Institute of Electrical and Electronics Engineers, Inc.
1111 Nineteenth St., N.W.
Suite 608
Washington, D.C. 20036**

Applications must be postmarked no later than March 31, 1986 to be eligible for consideration.

MEETINGS OF INTEREST

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

1985

- **1985 International Symposium on Gallium Arsenide and Related Compounds** — Sept. 23-26. Karuizawa Prince Hotel, Karuizawa, Japan. Contact: Dr. Yoshio Miyagi, IEEE Tokyo Section Office, c/o Engineering Coordination Division, NEC Corporation 33-1, Shiba Cocho, Minato-ku, Tokyo, Japan 108, Tel: 011-81 03-454-1111, Telex: NECTOK J22686.
- **1985 Electrical Electronics Insulation Conference** — Sept. 30-Oct. 3. Boston Sheraton Hotel, Boston, MA. Contact: Dr. Harry R. Sheppard, Materials & Mfg. Technology, Manager, Westinghouse Electric Company, 469 Sharpsville Avenue, Sharo, PA 16146. (412) 983-4335.
- **1985 IEEE SOS/SOI Technology Workshop** — Oct. 1-3. Prospectors Square Ski & Conference Center, Park City, UT. Contact: Mr. James A. Ford, Control Data Corporation, 2300 East 88th Street, Bloomington, MN 55240. (612) 853-3572.
- **Workshop on Reliability Assurance of Computer Controlled Communication Systems** — Oct. 1-3. Hotel La Sapiniere, Val David, Canada. Contact: Ms. J.A. Brown, AT&T Bell Laboratories, Room 1H4F-301, Naperville-Wheaton Road, Naperville, IL 60566. (312) 979-3115. TELEX: (312) 979-5605.
- **5th International Conference on Integrated Optics and Optical Fibre Communication** — October 1-4. Fondazione Cini, Venice, Italy. Contact: IOOC-ECOC'85, Istituto Internazionale delle Comunicazioni, Via Pertinace, Villa Piaggio, 16125 Genova, Italy.
- **Electrical and Electronics Conference & Exposition** — Oct. 7-9. Metro Toronto Convention Centre, Toronto, Ontario, Canada. Contact: IEEE Canadian Region Office, 7061 Yonge Street, Thornhill, Ontario L3T 2A6. Canada (416) 881-1930.
- **Integrated Services Digital Networks — ISDN '85** — Oct. 6-10. Sandestin Beach Hilton, Destin, FL. Contact: Mr. Russell G. DeWitt, Contel Service Corporation, Network Design, 245 Perimeter Center Parkway, Atlanta, GA 30346. (404) 391-1895.
- **International Geoscience and Remote Sensing Symposium — IGARSS '85 and USNC/URSI Commission F Meeting** — Oct. 7-9. University of Massachusetts, Amherst, MA. Contact: Professor Robert McIntosh, Electrical and Computer Engrg., Room 16, Engrg. Bldg. East, University of Massachusetts, Amherst, MA. 01003. (413) 545-0709.
- **Electronicom '85 International Electrical and Electronics Conference & Exhibition (IEEC & E)** — Oct. 7-9. Metro Toronto Convention Centre, Toronto, Ontario, Canada. Contact: IEEE Canadian Region Office, 7061 Yonge Street, Thornhill, Ontario, Canada L3T 2A6. (415) 881-1930.
- **IEEE International Conference on Computer Design: VLSI in Computers (ICCD '85)** — Oct. 7-10. Rye Town Hilton, Port Chester, NY. Contact: ICCD'85, P.O. Box 639, Silver Spring, MD 20901. (301) 589-8142. TWX: 7108250437 IEEECOMPSON.
- **INTELEC '85 — Seventh International Telecommunications Energy Conference** — Oct. 14-17. Hotel Hilton International, Munich. FRG. Contact: H.-A. Kiehne, VARTA Batterie AG, P.O. Box 21 05 40, D-3000 Hanover 21, Federal Republic of Germany. Tel: +511 790 37 28.
- **1985 Ultrasonics Symposium** — Oct. 16-18, Cathedral Hill Hotel, San Francisco, CA. Contact: W.R. Shreve, Hewlett-Packard Company, 1651 Page Mill Road, Palo Alto, CA 94304. (415) 857-2664.
- **IEEE Military Communications Conference — MILCOM '85** — Oct. 21-23. Stouffer's Bedford Glen, Bedford, MA. Contact: Mr. Frank Gicca, GTE Products Corporation, 77 A St., Needham Heights, MA 02194. (617) 466-5290.
- **AUTOTESTCON '85** — Oct. 21-24. Nassau Veteran Memorial Coliseum, Long Island Marriott Hotel, Uniondale, Long Island, NY. Contact: Louis A. Luceri, 660 Grand Avenue, Lindenhurst, N.Y. 11757. (516) 391-5592.
- **IEEE EASCON '85 — 18th Annual Electronics and Aerospace Systems Conference** — Oct. 28-30. Capital Hilton Hotel, Washington, DC. Contact: Dr. Mary Lynn Richford, IBM Federal Systems Division, 1701 North Fort Myer Drive, Arlington, VA 22209. (703) 841-7433.
- **18th Asilomar Conference on Circuits, Systems, and Computers**. Nov. 6-8. Asilomar Conference Grounds, Pacific Grove, CA. Contact: Dr. Gene H. Hostetter, Department of Electrical Engineering, University of California-Irvine, Irvine, CA 92717.
- **1985 IEEE Gallium Arsenide (GaAs) Integrated Circuit Symposium** — Nov. 12-14. Monterey Conference Center, Monterey, CA. Contact: Dr. Ronald E. Lundren, Symposium Chairman, Hughes Research Laboratories, 301 Malibu Canyon Road, Malibu, CA 90265. (213) 317-5335.

- **International Conference on Computer Aided Design (ICCAD '85)** — Nov. 18-21. Contact: Dr. Paul B. Weil, Hughes Aircraft Company, MS 270/055, 8433 Fallbrook Avenue, Canoga Park, CA 91034. (818) 702-1791.
- **Western Electronic Show & Convention (WES-CON)** — Nov. 19-21. Moscone Convention Center, San Francisco, CA. Contact: Mr. Dale Litherland, Electronic Conventions, Inc. 8110 Airport Boulevard, Los Angeles, CA. 90045. (213) 722-2965.
- **2nd International Technical Symposium on Optical and Electro-Optical Applied Science and Engineering** — Nov. 25-Dec. 6. Palais des Festivals et des Congres, Cannes, France. Contact: SPIE, P.O. Box 10, Bellingham, WA 98227. (206) 676-3290. Telex: 46-7053.
- **International Electron Devices Meeting — IEDM '85** — Dec. 1-4. Washington Hilton, Washington, D.C. Contact: Ms. Melissa Widerkehr, Courtesy Associates, Inc. 655 15th Street, NW, Suite 300, Washington, DC 20005. (202) 347-5900. Telex: 440487 COURTESY.
- **Global Telecommunications Conference (GLOBECOM '85)** — Dec. 2-5. Hyatt Regency, New Orleans, LA. Contact: G.A. Ledbetter, South Central Bell, 365 Canal Street, New Orleans, LA 70140 (504) 528-7350.
- **IEEE Semiconductor Interface Specialists' Conference** — Dec. 4-7. Bonaventure Hotel & Spa, Fort Lauderdale, FL. Contact: Dr. Peter S. Winokur, Sandia National Laboratories, Division 2144. Albuquerque, NM. 87185. (505) 846-2998.
- **1985 Power Semiconductor Devices Workshop** — Dec. 5. National Bureau of Standards, Gaithersburg, MD. Contact: David L. Blackburn, National Bureau of Standards, Building 225, Room B310, Gaithersburg, MD 20899. (301) 921-3541.
- **10th International Conference on Infrared and Millimeter Waves** — Dec. 9-13. American Dutch Resort Hotel, Lake Buena Vista (Orlando) Florida. Contact: Kenneth J. Button, MIT, Box 72, MIT Branch, Cambridge, MA. 02139-091 (617) 253-5561.
- **IEEE 1986 Aerospace Applications Conference** — Feb. 8-15. Steamboat, CO. Contact: Dr. Russell A. Gaspari, 6656 West 87th Place, Los Angeles, CA 90045. (213) 648-1325.
- **Int'l. Solid-State Circuits Conference (ISSCC)** — Feb. 12-14. San Francisco Hilton, San Francisco, CA. Contact: Lewis Winner, 301 Almeria Avenue, Coral Gables, FL. 33134. (305) 446-8193.
- **Conference on Optical Fiber Communication-OFC '86** — Feb. 24-26. Atlanta Marriott Marquis Hotel, Atlanta, GA. Contact: OSA Meetings Department, 1816 Jefferson Place, N.W., Washington, D.C. 20036. (202) 223-8130.
- **Int'l. Zurich Seminar on Digital Communications: "New Directions in Telecommunications Switching and Networks"** — March 11-13. Swiss Federal Institute of Technology (ETHZ) Zurich, Switzerland. Contact: Secretariat '86 IZS, Dr. R. Hartmann, Zellweger Uster AG, CH-8634 Hombrechtikon, Schweiz/Suisse/Switzerland. Tel: +055/416111. Telex: 875558.
- **SOUTHCON '86** — March 11-13. Orange County Convention Center, Orlando, FL. Contact: Dale Litherland, Electronic Conventions, Inc. 8110 Airport Boulevard, Los Angeles, CA 90045 (213) 772-2965.
- **IEEE 1986 National Radar Conference (RADAR-86)** — March 12-13. Los Angeles, CA. Contact: Milton E. Radant, Hughes Aircraft Company, P.O. Box 92426, Bldg. R1, MS/D-428, Los Angeles, CA 90009. (213) 647-0134.
- **Conference and Sensors Technology and Applications** — March 17-19. Bad Nauheim, Federal Republic of Germany. Contact: German Section of IEEE, The Secretary, Dr. Ing. F. Coers, Stresemannallee 15, VDE-Hau, D-6000 Frankfurt 70, Federal Republic of Germany. Tel: +(069) 6308-221.
- **SOUTHEASTCON '86** — March 24-27. Holiday Inn - Downtown, Richmond, VA. Contact: V. Bodin, 7305 Longview Drive, Richmond, VA. 23225. (804) 272-4735.

1986

- **1986 Annual Reliability and Maintainability Symposium** — Jan. 21-23. Riviera Hotel, Las Vegas, NV. Contact: Mr. Norman Kutner, Westinghouse Electric Corporation, 401 East Hendy Avenue, P.O. Box 499 (MS 21-9), Sunnyvale, CA 94088. (408) 735-2261.
- **Test Structure Workshop** — Feb. 10-11. Newporter Inn, Newport Beach, CA. Contact: Dr. Martin G. Buehler, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91109. (818) 354-4368.
- **IMTC/86 — IEEE Instrumentation and Measurement Technology Conference** — March 26-27. University of Colorado Events Center, Hilton Harvest House, Boulder, CO. Contact: Robert Myers, Conference Coordinator, 1700 Westwood Boulevard, Suite 101, Los Angeles, CA 90024. (213) 475-4571.
- **5th Annual Phoenix Conference on Computers and Communication** — March 26-28. Sunburst Hotel, Scottsdale, AZ. Contact: Steve Paquette, Phoenix Metro Group, 34 West Monroe, Phoenix, AZ. 85003. Ph: (602) 254-5521.

- **1986 Reliability Physics Symposium** — April 1-3. Anaheim, CA. Contact: H.C. Jones, Westinghouse Corporation. P.O. Box 1521 MS 3664, Baltimore, MD 21203. (301) 765-7387.
- **IEEE Workshop on Metropolitan Area Networks** — April 3-5. Bon Cesar Beach Resort, St. Petersburg, FL. Contact: Dr. Victor B. Lawrence AT & T Information Systems, Room 3M109, Route 66, Neptune, NJ 07753. (201) 922-7033.
- **IEEE INFOCOM '86** — April 7-10. Sheraton Bal Harbour, Miami, FL. Contact: IEEE INFOCOM '86. P.O. Box 639, Silver Spring, MD 20910. (301) 589-8142. TWX: 7108250437 IEEECOMPSO.
- **1986 International Conference on Robotics and Automation** — April 7-11. San Francisco, CA. Contact: Robotics & Automation, c/o Harry Hayman, 738 Whitaker Terrace, Silver Spring, MD 20901. (301) 434-1990.
- **INTERMAG '86** — April 14-18. Hyatt Regency, Phoenix, AZ. Contact: R.J. Fairholme, Motorola, Magnetic Bubbles, 7402 South Price Road, Tempe, AZ 85283. (602) 897-3005.
- **EUROCON '86 — 7th European Conference on Electrotechnics: Advanced Technologies and Processes in Communication and Power Systems** — April 21-23. Paris, France. Contact: Dr. L.J. Libois, IEEE French Section, c/o S.E.E. 49 rue de la procession, 75724 Paris, Cedex 15, France. Tel: 567.07.70.
- **36th Electronic Components Conference (ECC)** — May 5-7. Westin Hotel, Seattle, WA. Contact: Mr. Leo G. Feinstein, Sprague Electric Company, 115 Northeast Cutoff, Worcester, MA 01606 (617) 853-5000.
- **Electro '86** — May 13-15. Bayside Exposition Center, Boston, MA. Contact: Dale Litherland, Electronic Conventions, Inc. 8110 Airport Boulevard, Los Angeles, CA 90045. (213) 772-2965.
- **National Aerospace & Electronics Conference (NAECON '86)** — May 18-20. Dayton Convention Center, Dayton, OH. Contact: NAECON, 140 Monument Avenue, Dayton, OH. 45402. (513) 223-6266.
- **Int'l. Microwave Symposium and Workshops** — June 2-6. Baltimore, MD. Contact: Edward C. Niehenke, Westinghouse Electric Corporation. P.O. Box 746, M.S. 339, Baltimore, MD. 21203. (301) 765-4573.
- **Microwave and Millimeter Wave Monolithic Circuits** — June 4-5. Baltimore, MD. Contact: Roger W. Sudbury, L-324, MIT Lincoln Laboratory, P.O. Box 73, Lexington, MA. 02173. (617) 863-5500.
- **AFRTG** — June 5-6. Baltimore, MD. Contact: Mario A. Maury Jr., Maury Microwave Corporation, 8610 Helms Avenue, Cucamonga, CA. 91730. (714) 987-4715. ext. 21.
- **1986 IEEE International Symposium on Applications on Ferroelectrics** — June 8-11. Lehigh University, Bethlehem, PA. Contact: Dr. Wallace Arden Smith, Philips Laboratories, 345 Scarborough Road, Briarcliff Manor, NY 10510. (914) 945-6032.
- **1986 IEEE International Symposium on Electrical Insulation** — June 8-11. Key Bridge Marriott, Washington, D.C. Contact: Mr. David E. Cooper, Southern California Edison Co., Research and Development Lab., Room 497C, P.O. Box 800, Rosemead, CA 91770. (818) 302-6836.
- **1986 International IEEE/AP-S Symposium and USNC/URSI Meeting** — June 8-13. Wyndham Franklin Plaza Hotel, Philadelphia, PA. Contact: Mr. Charles C. Allen, General Electric Space Division, Valley Forge Space Center, Room U4018, P.O. Box 8555, Philadelphia, PA 19104. (215) 354-4595.
- **Int'l. Quantum Electronics Conference (IQEC '86)** — June 9-13. Phoenix, AZ. Contact: Meetings Manager, Joan Carlisle, Optical Society of America, 1816 Jefferson Place, NW, Washington, D.C. 20036. (202) 223-0920.
- **Conference on Lasers and Electro-Optics (CLEO '86)** — June 10-13. San Francisco, CA. Contact: Ms. Joan Carlisle, Meetings Manager, Optical Society of America, 1816 Jefferson Place, NW, Washington, DC 20036. (202) 223-0920.
- **Int'l Conference on Communications — ICC '86** — June 22-25. Sheraton Hotel, Toronto, Ontario, Canada. Contact: Hugh J. Swain, Andrew Antenna, Limited, 606 Beech Street, Whitby, Ontario, Canada LIN 5S2. (416) 668-3348.
- **2nd International Conference on Conduction & Breakdown in Solid Dielectrics** — July 7-10. Kongresszentrum, Erlangen, Germany. Contact: Dr. P. Fischer, Siemens AG, Abt. ZFE CWV 2, P.O. Box 3240, 8520 Erlangen/Germany. Tel: 09131-75690.
- **1986 International Conference on Solid State Devices and Materials** — Aug. 20-22. Tokyo Prince Hotel, Tokyo, Japan. Contact: Professor Takuo Sugano, Department of Electrical Engineering, University of Tokyo, Hongo, Bunkyo-ku, Tokyo, 113 Japan. Tel: (03) 812-2111 ext. 6675.
- **Intersociety Energy Conversion Engineering Conference (IECEC)** — Aug. 24-29. Town and Country Hotel, San Diego, CA. Contact: Barbara Hudson, Shirley Blackwell, American Chemical Society, 1155 16th Street, NW, Washington, D.C. 20036 (202) 874-4401.
- **4th International Conference on Molecular Beam Epitaxy** — Sept. 7-10. University of York, York, England. Contact: B.A. Joyce, Philips Research Laboratories, Redhill, Surrey, England. Tel: (0293) 785544 - Horley.

- **AUTOTESTCON '86** — Sept. 8-11. San Antonio, TX. Contact: Jame Noel, SA-ALC/MMI, Kelly AFB, TX 78241 (512) 925-8904.
- **1986 IEEE Int'l. Symposium on Electromagnetic Compatibility** — Sept. 16-18. Town and Country Conference Center, San Diego, CA. Contact: Herbert K. Mertel, EMACO, Inc. 7562 Trade St. San Diego, CA 92121. (619) 578-1480.
- **Electronics and Aerospace Systems Conference — EASCON '86** — Sept. 22-24. Shoreham Hotel, Washington, D.C. Contact: Dr. Arvid G. Larson, Vice President, Analytic Disciplines Inc. Suite 400, 2070 Chain Bridge Road, Vienna, VA 22180. (703) 893-6140.
- **X11th International Symposium on Discharges and Electrical Insulation in Vacuum** — Sept. 22-25. Hotel Shores, Shores, Israel. Contact: Professor S. Goldsmith, Faculty of Exact Sciences, Tel-Aviv University, Tel-Aviv, Israel. Tel: 03-420303.
- **1986 Applied Superconductivity Conference** — Sept. 28-Oct. 3. Hyatt Regency - On the Harbor, Baltimore, MD. Contact - Ms. Lahni N. Blohm, Executive Administrator, ASC86, Code 6630C, Naval Research Laboratory, Washington, D.C. 20375. (202) 767-3246.
- **Western Electronic Show & Convention (WESCON)** — Sept. 30-Oct. 3. Los Angeles, CA. Contact: Dale Litherland, Electronics Conventions, Inc. 8110 Airport Blvd., Los Angeles, CA 90045. (213) 772-2965.
- **IEEE Military Communications Conference (MILCOM '86)** — Oct. 5-9, Monterey, CA. Contact: Kenneth L. Rose, Ford Aerospace and Communications Corporation, 3939 Fabian Way, Palo Alto, CA 94303. (415) 852-5550.
- **1986 Canadian Conference on Communications and Energy** — Oct. 8-10 Queen Elizabeth Hotel, Montreal, Canada. Contact: IEEE Canadian Region Office, 7061 Yonge Street, Thornhill, Ontario, L3T 2A6, Canada. (416) 881-1930.
- **Int'l Telecommunications Energy Conference (INTELEC '86)** — Oct. 19-21. Royal York Hotel, Toronto, Ontario, Canada. Contact: Don Reid, Bell Northern Research, P.O. Box 3511, Station C. Ottawa, Ontario K1Y 4H7, Canada, (613) 596-2145.
- **IEEE Holm Conference on Electrical Contacts** — Oct. 27-29. Copley Plaza Hotel, Boston, MA. Contact: Ms. Fern Katronetsky, IEEE Headquarters, 345 East 47th Street, New York, NY 10017. (213) 705-7405.
- **International Test Conference** — Oct. 28-30. Franklin Plaza Hotel, Philadelphia, PA. Contact: Int'l Test Conference, P.O. Box 639, Silver Spring, MD 20901, (301) 589-8142. TWX: 7108250437 IEEECOMPSON.
- **JINA '86 — International Symposium on Antennas** — Nov. 4-6. ACROPOLIS Convention Center, Nice, France. Contact: Secretariat JINA '86, CENT-PAB Centre de la Turbie, 06320 CAP D-AIL, France, M. GUIRAUD/Mme. CERBONI Tel: 33 (93) 41.15.30, Telex: 250317F.
- **1986 Ultrasonics Symposium** — Nov. 17-19. Conference Center, Williamsburg, VA. Contact: R.A. Moore, Westinghouse Defense and Electronic Center, P.O. Box 756, MS 335, Baltimore, MD. 21203. (301) 765-4027.
- **GLOBECOM '86** — Dec. 1-4. Houston, TX. Contact: Mr. Ross Anderson Southwestern Bell, Room 706, 3100 Main Street, Houston, TX 77001. (713) 521-8244.



DID YOU KNOW THAT . . .

. . . **drinking milk** may help protect you against certain types of cancer? A recent study of 1,954 manufacturing workers found that those who drank no milk were nearly three times more likely to develop colon or rectal cancer than those who drank at least two glasses a day. *Key:* Raising the body's vitamin D and calcium levels. *Recommended:* Nonfat, vitamin-D-fortified milk or yogurt. Vitamin D supplements are *not* advised, because large doses can be toxic.

Study by Dr. Cedric Garland, assistant professor of community and family medicine, University of California at San Diego, San Diego 92037.

Snoring update. Snoring is caused by the rattling of the walls of air passages, which usually occurs when nasal passages are dry or when sleepers lie on their backs. *Techniques:* Attach a rolled-up sock to the body of your sleepwear to keep from lying on your back. Check your bedroom's humidity level. Low humidity dries out mucous membranes . . . a humidifier can be helpful. See a specialist to determine if you have a nasal obstruction—adenoids that might need to be removed, a deviated septum or enlarged tonsils, all of which cause snoring.

University of California Wellness Letter, Box 10922, Des Moines, IA 50340, 12 issues, \$18/yr.



THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

INCORPORATED

1986 INTERNATIONAL RELIABILITY PHYSICS SYMPOSIUM

March 31 - April 4, 1986 • Anaheim Marriott Hotel • Anaheim, California

CALL FOR PAPERS

The twenty-fourth Annual Symposium, co-sponsored by the IEEE Reliability and Electron Devices Societies, emphasizes device reliability as the dominating influence in the development of new VLSI technologies and circuit designs. With the awareness that today high reliability is the norm for VLSI, the 1986 Symposium will emphasize the role of design, processing, packaging and testing for building-in high reliability. Papers are especially solicited in this area; however, work in all areas of reliability physics will be included in the program.

Papers should deal with work on:

- Physics of Failure Mechanisms - Quantitative models and mechanisms of component failure.
 - Hot Electrons
 - Electromigration
 - Oxide Breakdown
 - Contact Degradation
 - Metallization Fatigue
 - Soft Errors
- Failure Analysis Techniques - Advanced or simplified, as they are applied to specific problems.
- Accelerated Testing and Screening - Emphasizing the physical mechanisms which validate testing and screening techniques.
 - Burn-in
 - Smart Oven Testing
 - Wafer Level Testing
 - Correlation with Observed Reliability in the Field
- Design and Process Control For Reliability - Relating specific design concepts and process controls to part reliability.
 - Latent Defects
 - Particle Control
 - Computer Aided Manufacturing
 - Statistical Process Control
 - Starting Material and Processing Material Controls
 - Margin Testing and DRAM Repair Criteria
 - Oxide and Metal Process Monitor and Reliability Testing
 - Design Rules for Improved Reliability

In the following or related areas:

- VLSI (Microprocessors, Memory, PLA, DRAM, Redundancy, and Repair, etc.) - MOS, Bipolar, CMOS, I²L, SOS
- Semiconductor/Insulator Interfaces, Contacts and Metallization
- Packaging, Bonding, Die Attach, Coatings and Encapsulation
- Hybrids (Materials, Processes and Components)
- Displays, Sensors, and Solar Cells
- Microwave, Optoelectronic, and SAW Devices
- GaAs Devices and Interface Effects on III-V Devices
- New Devices and Technologies
- Passive Components
- Attachment of Leadless Ceramic Chip Carriers and other Surface Mount Technologies
- Medical Electronics
- Automotive Electronics
- Low Temperature Operation

The deadline for submission of abstracts is October 10, 1985. Prospective authors are requested to notify the Technical Program Chairman before September 10, 1985 of their intention to submit an abstract and the topics to be discussed. Authors must submit a 50-word descriptive abstract and 300-500 word summary appropriate to describe a 20-minute paper. Authors are encouraged to obtain presentation releases prior to submission of summaries on October 10, 1985.

GaAs IC SYMPOSIUM

IEEE GALLIUM ARSENIDE INTEGRATED CIRCUIT SYMPOSIUM
Sponsored by the IEEE Electron Devices Society
and cooperatively sponsored by the IEEE Microwave Theory and Techniques Society

FINAL CALL FOR PAPERS FINAL CALL FOR PAPERS

The 1985 Gallium Arsenide Integrated Circuit Symposium will be held in Monterey, California, November 12-14, 1985. Papers are invited on topics related to Gallium Arsenide Integrated Circuits, including:

- Monolithic Linear and Power Integrated Circuits
- Monolithic Digital Integrated Circuits
- Electro-Optical Integrated Circuits
- Systems Applications and Affordability
- Device Physics, Modeling, and Simulation
- Materials Considerations and Advances
- Processing Technology
- Radiation Effects and Reliability
- Packaging and Testing
- Novel Devices for Integrated Circuits

MEETING OBJECTIVE: To accelerate the successful development of gallium arsenide and related III-V compound integrated circuits by providing a forum for the interchange of technical information relative to the design, fabrication, packaging and application of such ICs. Attendees should be prepared to discuss the technical aspects of these topics.

CALL FOR ABSTRACTS . . . DEADLINE FOR RECEIVING ABSTRACTS IS MAY 24, 1985.

Authors wishing to submit abstracts should mail the original and twenty five (25) copies of a one page abstract to:

JAMES A. HUTCHBY
Technical Program Chairman
Research Triangle Institute
Herbert Building, Room 151
P.O. Box 12194
Research Triangle Park, NC 27709
(919) 541-5931
TELEX: 802509

The one page abstract should clearly state: (a) the purpose of the work; (b) how much it advances the art; (c) **and what specific results have been obtained.** Additional supporting material (for review purposes) may be submitted at the discretion of the author(s). The abstract, which should be typewritten on one side of the page only, must include the title, name of the author(s), telephone number, mailing address, company affiliation, company address and application area (as listed above). **USA authors should obtain company and government clearances prior to submission of abstracts.** Notice of acceptance or rejection will be mailed to authors by June 28, 1985. Authors of

accepted papers will be required to submit an extended abstract by August 19, 1985 of up to four pages, including figures, in camera ready format for publication in the Symposium Technical Digest. The accepted one page abstracts will be used for publicity purposes and portions of these abstracts may be quoted in subsequent magazine articles publicizing the Symposium. Please contact the Publicity Chairman, Richard Koyama, if this is not acceptable.



FEBRUARY 19-21, 1986

1986 IEEE International Solid-State Circuits Conference

ANAHEIM

CALIFORNIA

33rd Call-for-Papers... 33rd Call-for-Papers... 33rd Call-for-Papers...

33rd Call-for-Papers... 33rd Call-for-Papers... 33rd Call-for-Papers...

The IEEE International Solid-State Circuits Conference, the foremost global forum for the presentation of new advances in all aspects of solid-state circuits, celebrating its 33rd year, will be held in Anaheim, California, Feb. 19-21, 1986, under the sponsorship of the IEEE Solid-State Circuits Council, the IEEE Los Angeles Council, IEEE Orange County Section, and the University of Pennsylvania. Papers covering the design, performance, fabrication, testing and application of new solid-state circuits, device structures, phenomena and systems are invited . . . All papers should be suitable for a 20-minute presentation. Texts/illustrations must not have been presented, submitted to other conferences or published or announced in any form prior to or during ISSCC 86.

Deadline for submission of papers—abstract/summary as described below—is Friday, Sept. 20, 1985

Areas of Interest Include, But Are Not Restricted To:

DIGITAL: design, fabrication, testing of digital LSI and VLSI systems; logic arrays; high-speed digital techniques; computers and computer peripherals; microprocessor circuits, architecture and applications; digital signal processing.

ANALOG: amplifiers, filters, correlators; A/D and D/A conversion and data acquisition; detectors, comparators and reference circuits; high frequency and microwave amplifiers, modulators and detectors; phased-locked loops; combined analog/digital signal processing; telecommunications circuits.

MEMORY: design, fabrication and testing of semiconductor memories; memory architecture; redundancy techniques; static and dynamic memories, nonvolatile memory design and fabrication techniques; special-purpose memories; high-speed memory technologies.

OTHER AREAS: circuit design and testing, including computer-aided techniques; device modeling, circuit analysis and simulation; mask layout checking, test generation, diagnosis and fault location; optoelectronics, including image sensing, scanning and processing, and displays; medical and environmental electronics, including transducers, controls, sensory aids and telemetry; consumer and automotive electronics.

Summary/Abstract Format To Be Submitted

Authors must submit 30 copies of both a 35-word factual abstract and a 300-500 word summary which will be used to select papers for the conference.

The summary must describe clearly what new and significant results—both theoretical and experimental—have been obtained, citing if the development is based on an operational prototype, and, where applicable, should include illustrations, such as circuit diagrams, photographs and performance curves . . . Summaries must be prepared in single-side, double-spaced typewritten form, with the surname(s) and given name(s) of author(s), affiliation, complete return address and telephone contact on the first page, and the author(s) name(s) and title on each subsequent page . . . Author(s) of accepted papers will be asked to prepare an illustrated final version for publication in the ISSCC DIGEST of TECHNICAL PAPERS, by November 25, 1985.

The 35-word abstract, adaptable for publication in the advance program, should be typed on a separate sheet, and should include the title of the talk, surname(s) and given name(s) of the author(s), affiliation, complete return address and telephone number. Abstracts may be edited by the program committee without consultation to accommodate the program format. The new and significant results to be reported must be clearly described in the abstract.

All authors* must forward — by the deadline (receipt) noted below — both the abstract and the summary to:

Lewis Winner, 301 Almeria Avenue, Coral Gables, FL 33134. (USA) . . . Tel: 305-446-8193/4

*See reverse side of this announcement for detailed instructions to European/Asian authors

NOTE: AS INDICATED ABOVE—THE DEADLINE DATE (RECEIPT) FOR ABSTRACTS/SUMMARIES IS FRI. SEPT. 20, 1985

Late-News Papers

A limited number of late-news papers (for 10-minute presentation), reflecting important new developments and results achieved after the regular paper deadline will also be considered. Required are 20 copies of a 600-800 word explicit summary, with surname(s) name(s), of author(s), affiliation, complete return address, telephone number, plus pertinent illustrations for committee review. Submitted test will be adapted for publication in the DIGEST to meet its editorial format: one set of original 9"x12" inked diagrams and 9"x12" glossy print photos, both suitable for a 2/3 reduction, must also be included for direct reproduction. Summaries and illustrations should be mailed to Lewis Winner.

Deadline for the receipt of the late-news summaries and illustrations is Monday, December 2, 1985



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