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EDITOR'S NOTES



by Peter W. Staecker

Another MTT-S International Microwave Symposium is history...Steve March will tell you in this issue the details of all the new worlds records that this year's gathering in Las Vegas set — only to be broken next year by Chuck Buntschuh in New York, etc., etc. Martin Schneider, Steve Temple and Al Estes will tell you in the following that at the growth rate the figures suggest, we will be over 10,000 members by the end of the year, and that we are relentlessly pushing our way into being the fastest growing Society in the IEEE. We are all getting pretty bored with this sort of thing, right?

Consider, however, our not too recent past: when AdCom meetings were devoted to the single issue of how to raise enough money to finance the coming year's Transactions. When the surplus from our annual symposium would buy a good used car. MTT-S is presently financially comfortable, but there are other IEEE Societies which recently have seen their yearly boring surpluses dwindle and vanish. What is so special about us?

The dynamics of an organization such as IEEE, and MTT-S in particular, relies on its membership of engineering professionals: a unique situation where an excellent product is the bottom line and the efforts of talented individuals are free. Compound this with prudent fiscal management and surpluses will result. We are fortunate to have as active AdCom members, survivors of leaner years who remind us of the difference between surplus and excess. In addition, Dave McQuiddy's tenure as AdCom President has stressed the establishment of a firm financial base for the continued fiscal security of the Society.

Meanwhile, in the spirit of "success needn't be boring," we extend our congratulations to Steve and his Symposium Committee for MTT's latest triumph, and to all the other tireless volunteers who make this Society a real prize.

Special Articles Editor

John Horton is retiring as special articles editor after 3 years of hard work, but will continue in a transition role as the articles he has secured for future release are published. Zvi Galani is our new special articles editor and has already started looking for appropriate subjects and authors. Interested? See page 52.

PRESIDENT'S REPORT



by David N. McQuiddy, Jr.

The 1987 International Microwave Symposium in Las Vegas was very successful. Steve March and his Steering Committee did a good job in organizing and conducting our "Microwave Week". This is the first Symposium held without a local chapter providing any personnel for the Steering Committee. The Symposium has attracted more attendees and industrial exhibitors each year and now requires more planning to arrange the necessary accommodations and facilities. Unfortunately, the increase in size of the Microwave Symposium has meant limiting Symposium sites to only a few large cities that have the required facilities and a good volunteer base. We now can have more flexibility in future site selections and can increase the overall member participation in the Symposium by following the lead developed by Las Vegas.

MTT-S continues to be a strong vigorous organization. The membership growth over the last five years has been steady and sustained at an average rate of increase of 7.3%. This has placed MTT-S second in growth in 1986 among the 36 Societies and Councils of the IEEE. The total membership at the end of 1986 was 9445 and is broken down in the table below.

Table 1. 1986 Year-End Membership

Fellows	318
Senior Members	953
Members	6761
Students	1412
Total	9445

Fellows and Senior Members comprise over 13% of our Society. This is a large ratio for an IEEE Society and reflects the substantial maturity of MTT-S. The ratio of Fellows to total MTT-S membership is about 1 to 30 or around 3.4% as compared to the total IEEE Fellow membership of 1.3% at the end of 1986. Students comprise about 15% of our total (or about 1 of 6) and will play a key role in our future.

Along with the membership growth, eight new chapters were formed last year and two more were in the process of being formed. At present, we now have 53 chapters world-wide with 37 (70%) located in the continental USA. It appears that about 2700 MTT members are not involved in a local chapter.

We've had a membership drive for several years,

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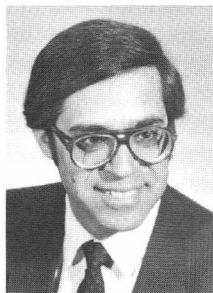
PRESIDENT'S REPORT (continued from page 2)

offering inducements to attract new members. There has been some concern expressed about the cost versus growth benefits of the membership drive as it departs somewhat from our historical practices and conservatism. Obviously, growth just for growth's sake is no justification. The proponents justify a drive to recruit new members as a chance to grow further and to offer more services in the future. We are certainly in a good position to encourage membership growth because of our healthy financial posture and because we have a good range of activities and volunteers to support future expansion. Perhaps the key question still largely unanswered is whether these new members will continue their membership and service to the Society in succeeding years and thus justify the effort and cost expended to recruit them. I, for one, support our "experiment". We can afford it and if the results are negative or inconclusive, we will refocus our membership drive in the future. Generally, it is difficult to determine realistic growth limits or goals. Hopefully, we will be able after this year to set realistic growth goals.

This year, we have awarded two scholarships, our first two graduate fellowships, and one grant-in-aid. AdCom is planning a Visiting Fellow program and hopefully we will firm this up during the next year. Also, John Bryant is planning to bring replicas of Hertz's experimental apparatus to the 1988 International Microwave Symposium in New York next year for a special observance of the Hertz Centennial. This will be the first time these replicas have been exhibited in the USA.

In summary, MTT-S is still experiencing a healthy growth in membership and chapter activities as well as planning for the future. We are continuing a sound conservative approach in our fiscal management and we are maintaining a cautious attitude in instituting new programs.

AdCom HIGHLIGHTS



by Barry E. Spielman

The cornerstone of David McQuiddy's term as AdCom President addresses improvements in the budgeting process used for the Microwave Theory and Techniques Society operations. At this meeting Dave discussed the preliminary FY 88 budget which he has

put together using inputs provided by the chairpeople for the various committee operations. These committees include:

- Membership Services
- Operations
- Education
- Meetings and Symposia
- Publications and Standards
- Intersocietal Relations/Planning
- Technical Committees

Dave has also requested that the Long Range Planning Committee, constituted in large part by past AdCom presidents, provide an assessment and recommendation to AdCom for prioritizing expenditures.

In the professional activities area, Bob Moore summarized his efforts leading to a special Microwave Symposium session on financial planning for engineers. This session created a focus on implications of changes in the tax law. Session principals included John D. Barret (Coopers and Lybrand) and David G. Kreeft (New York Life).

Charles T. Rucker, Chairman of the Awards Committee, reported on the following items leading to ratification by the AdCom:

1) 1988 Microwave Prize —

M. Modihian and K. Honjo "GaAs Monolithic ICs for X-Band PLL-Stabilized Local Source," IEEE Transactions on Microwave Theory and Techniques, MTT-34, pp. 707-713, June 1986, pp. 707-713.

This paper will also be recommended for the IEEE W.R.G. Baker Prize Award.

2) IEEE Donald G. Fink Prize Award for the outstanding survey, review, or tutorial —

E.A. Gerber, T. Lukaszek and A. Ballato, "Advances in Microwave Acoustic Frequency Sources," IEEE Transactions on Microwave Theory and Techniques, MTT-34, pp. 1002-1016, October 1986.

John Bryant reported on his activities on behalf of the AdCom to bring the "Hertz Exhibit" to the 1988 International Microwave Symposium to be held in New York. The exhibit is being assembled by the London Museum of Science in honor of the Hertz centennial. It is intended for this exhibit to serve as a centerpiece for the Microwave Symposium in 1988.

Finally, competing sites for the 1993 Microwave Symposium were offered to AdCom. After proposal offerings were evaluated, the Atlanta proposal was prioritized highest, followed by the Orlando offering. Final negotiations and selections will be made consistent with these priorities by the Site Selection Committee.

REPORT OF DIVISION IV DIRECTOR



by Gary A. Thiele

The Board of Directors of the IEEE held its second meeting of the year in Los Angeles on June 22 and 23. As is normal, the Board of Directors' meetings were preceded by the TAB meeting on June 19 and by the TABopCom meeting on June 18. The TAB meeting members consist of all the Society Presidents as well as some of the Vice-Presidents and the TAB committee chairmen. There are over 50 people present for the TAB meeting. The TABopCom, or TAB operating committee, consists of the ten Division Directors, the TAB Vice-President and the Chairmen of three TAB committees. From just this short description you can easily see that the IEEE is a large organization, not just in terms of the number of its members, but also in terms of its administrative structure.

IEEE Budget Concerns

I'd like to report on two of the larger issues that arose at the Los Angeles meetings. First, in the Board of Directors' meeting, considerable time was devoted to the budget of the Institute and, in particular, areas of operation where revenues have not matched earlier expectations. One of these is continuing education. It was clear that this is perceived by the Board as an important activity for the Institute to undertake. Yet, there is concern that the revenues are falling short of both expectations and expenses.

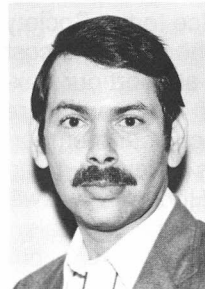
IEEE Operations

The second major issue arose in the TAB meeting and was brought before the Board by the TAB Vice-President and the Division Directors. This issue was the operation of the IEEE, the efficiency of its structure and the responsiveness of that structure. The Board asked the IEEE President to draft a plan for correcting any deficiencies that might exist and to present that plan to the Board at its November meeting with an interim report to be presented at the August meeting. In my opinion, the IEEE staff, as well as the volunteers, are just as dedicated as ever, but it may be that the moderate but steady growth of the past ten years has reached a point where the structure of the Institute, including the number of staff, has fallen behind the demands placed upon it. I'll keep you informed of progress on this issue in a future newsletter article.

I had the opportunity to attend the MTT-S Symposium in Las Vegas. It was certainly an impressive symposium

in many respects and I wish to congratulate Steven March and his fine committee for a job well-done. I had the privilege of presenting the first MTT-S Fellowships at the Awards Banquet. I hope MTT-S will continue this fellowship program in the years ahead.

THE 1987 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM



by Steven L. March

Recently, Las Vegas, Nevada was the site of the 1987 IEEE MTT-S International Microwave Symposium. This year marked the thirty-first occasion that the MTT Society's Microwave Symposium was held and the first time that the annual conference was held in a location void with no local MTT Society Chapter.

The Symposium's technical activities, the historical exhibit, and the commercial exhibition were all accommodated in the spacious Bally's Grand Hotel. Several social functions and some of the numerous corporate activities, which typically surround the International Microwave Symposium, took place diagonally across the intersection of Las Vegas Boulevard and Flamingo Road at the magnificent Caesars Palace. Besides these two properties, Symposium attendees also occupied rooms at the Flamingo Hilton, the Dunes Hotel, and other hotels located along the Las Vegas "Strip". The majority of these hotels were within short walking distance of the Symposium headquarters hotel, a definite plus considering the daytime temperature exceeded 100 degrees F.

MICROWAVE WEEK

Microwave Week activities began on Sunday evening, June 7, with a reception for the 1987 IEEE Microwave and Millimeter-wave Monolithic Circuits Symposium attendees and their guests. This event was held in the ornate and spacious Nero and Galba Rooms in Caesars Palace. The International Microwave Symposium was held Tuesday, June 8, through Thursday, June 11. The Monolithic Circuits Symposium, attended by a record 950 persons, met all day Monday, June 8, and jointly with the MTT-S Symposium on Tuesday morning, June 9. During Microwave Week, there were

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1987 MTT-S Symposium (continued from page 4)

numerous other technical activities, including four mid-day panel discussions with box lunches available on the three days of the International Microwave symposium. Eight specialist workshops surrounded the Symposium; three were held on Monday and five took place on Friday, June 10. The week's technical activities continued through Saturday when the 29th Automatic RF Techniques Group Conference, for which 149 technologists registered, concluded its one and one-half day meeting.

ATTENDANCE

The attendance at the 1987 Microwave Symposium broke all previous attendance records, except one. The final count showed a total attendance of 6604, a slight decrease from last year's record attendance of 6671. The small drop of participation was due to the lack of local microwave activity which was reflected in the number of people who attended the Symposium using complimentary, exhibits-only passes, provided by the exhibitors. In Baltimore, 1252 individuals used this venue for attending the conference; in 1987 only 833 availed themselves of the complimentary exhibits-only registration — one-third less than 1986.

The excellent technical program attracted 2077 engineers and scientists to the 1987 Microwave Symposium. This is the first time the participation at an MTT-S Symposium exceeded two thousand technical attendees. As mentioned above, 950 registered for the Monolithic Circuits Symposium and 149 registered for the ARFTG Conference, both numbers establishing new attendance records. The eight workshops were attended by 767 participants, 230 on Monday and 537 on Friday. The Awards Banquet attracted 703 persons, while the Industry-Hosted Cocktail Reception, which preceded the banquet, attracted an estimated 1100 conference attendees, exhibitors, and their guests.

In addition, the commercial exhibition drew 3226 exhibitors and manufacturers' representatives, while an additional 297 paid to attend the commercial exhibition only.

PLENARY SESSION

The 1987 International Microwave Symposium was officially opened Tuesday morning by Steering Committee Chairman, Steven L. March, at a well-attended plenary session in the Ziegfield Room of Bally's Grand Hotel. Dr. David N. McQuiddy, Jr., MTT Society President, offered additional welcoming remarks and commented on the health and financial status of the MTT Society and on recent activities of the Society's Administrative Committee. This was followed by an address by 1986 IEEE President, Dr. Bruno O. Weinschel. Dr. Weinschel related some of the findings and concerns relative to productivity and the health of the electronics industry in the United States as expressed, discussed, and reported during the 1987 IEEE Annual Meeting.

The Keynote Address was delivered by Les Besser, President of Besser Associates and Vice Chairman of the Symposium. Mr. Besser delivered a series of biographical sketches on key microwave engineers from the 1930s to date. His address was laced with humorous anecdotes from the lives of each of these individuals. Those whose career were highlighted included, Philip Smith (1930s), William Hewlett and David Packard (1940s), Dean Watkins and Richard Johnson (1950s), Leo Young (1960s), Charles Leichti (1970s), and Robert A. Pucel (1980s).



Symposium Chairman Steven March receiving gubernatorial proclamation declaring *Microwave Week* in Nevada.

A gubernatorial proclamation declaring the week of June 7 through June 13 as Microwave Week in the State of Nevada was presented to Chairman Steven March by Ms. Jenny Devaux, Administrative Assistant to Nevada Governor Richard H. Bryan. Mr. Richard Blue from the Office of the Mayor of Las Vegas presented the Key to the City to Mr. March, who accepted on behalf of the Symposium and its attendees. Dr. Reynold S. Kagiwada, the MTT-Symposium Technical Program Committee Chairman, summarized the technical activities taking place during the Microwave Symposium and the other technical events which comprise Microwave Week.

TECHNICAL PROGRAM

When all of the submissions were finally counted, the Symposium's Technical Program Committee had received 416 potential papers from 21 countries. From this record number of submissions, the 105 member Technical Program Committee ultimately selected 212 best papers from 18 countries for presentation at the Microwave Symposium.

In addition, the Program Committee added an additional 10 invited papers to round out the technical presentations. When twelve papers, presented jointly by the International Microwave Symposium and the Monolithic Circuits Symposium are also included, a record 235 papers were finally accepted for presentation at the MTT-S Symposium. This total includes one

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1987 MTT-S Symposium (continued from page 5)

late paper accepted only one week before the conference. The papers were presented in 32 separate technical sessions, not counting the Tuesday morning plenary session. The two Open Forum Sessions, on Tuesday and Wednesday afternoons, contained 46 papers in each session. Of the remaining 143 papers, 110 were 20 minutes long and 33 were 10 minutes long.

Contained within the technical program were four Focused Sessions covering two technologically hot areas — the frontiers of millimeter-waves with emphasis on 60 GHz and above and the exciting field of microwave/optical interactions. The four Focused Sessions were: Optical Techniques for Microwave Applications, Optical Generation and Control of Microwaves and Millimeter-Waves, Advances in Millimeter-Wave Technologies, and Advanced Millimeter-Wave Systems. As part of the reciprocal exchange between the International Microwave Symposium and the European Microwave Conference, the program included one session consisting of three invited papers by prominent European scientists from France, Sweden, and the Federal Republic of Germany.

In addition to the twelve papers presented jointly by the Microwave Symposium and the Monolithic Circuits Symposium, the 1987 Microwave and Millimeter-wave Monolithic Circuits Symposium contained an additional 20 presentations. In order to accommodate all thirty-two papers, the MMIC Symposium held, for the first time, parallel sessions on the Monday afternoon.

By the time the 29th Automatic RF Techniques Group Conference concluded on Saturday afternoon, the 149 attendees had heard a record 25 technical presentations centered around the Conference theme, Noise Parameter Characterization.

WORKSHOPS AND PANEL SESSIONS

Eight workshops and four panel discussions complemented the technical program. Three of the workshops (M-1, M-2, and M-3) were held on Monday, June 8, while the remaining five (F-4 through F-8) took place on Friday, June 10. The workshop and panel session topics (P-1 through P-4) are listed below. Attendance figures are shown in parentheses.

- M-1: Numerical Techniques for Microwave Field Problems and Their Implementation on Personal Computers (139)
- M-2: Amplification in High Power Systems (57)
- M-3: Non-Invasive Microwave Sensing of Physiological Signatures
- F-4: Optical-Microwave Interactions (105)
- F-5: Nonlinear CAD and Associated Modeling (219)
- F-6: Quasi-Planar Millimeter-Wave Components and Subsystems (79)
- F-7: Dielectric Resonators in Microwave Oscillators (86)
- F-8: Planning and Packaging for the Next Generation of Integrated Circuits (48)
- P-1: GaAs Microwave Monolithic Integrated Circuits (400)

- P-2: Financial Planning for Engineers — Implications of the New Tax Law (150)
- P-3: Applications of HEMT Devices and Circuits (300)
- P-4: Solutions to Problems Existing in Educating Microwave Engineers (175)

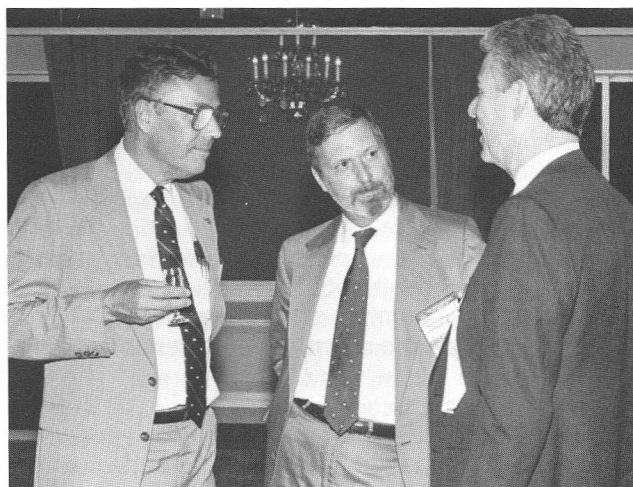
1987 TECHNICAL PROGRAM COMMITTEE

The Technical Program Committee, under the able leadership of Dr. Reynold S. Kagiwada, did a magnificent job in soliciting submissions and selecting the "cream of the crop", those 235 papers which describe the most significant advances in the state-of-the-art in microwave technology. Due to the record 416 submissions this year, the 105 member Technical Program Committee, divided into 19 areas of specialization, had a difficult task evaluating and selecting the papers for presentation. The quality of this year's Technical Program is a tribute to the hard work performed by the Technical Program Committee.

SOCIAL PROGRAM

In addition to the Technical Program, an excellent Social Program was planned to acquaint Symposium guests with some of the scenic and cultural aspects of Las Vegas and to provide them with an enjoyable time when they were not working.

On the Sunday evening prior to the Symposium, over 500 Monolithic Circuits Symposium registrants and their guests attended a reception at Caesars Palace.



Harlan Howe, Fred Rosenbaum and Bert Berson in a serious discussion during a cocktail reception.

The following evening, nearly 1000 people attended a complimentary poolside reception hosted by the Microwave Journal. Complimentary continental breakfasts were served to all technical attendees each morning prior to the start of the technical sessions and the workshops. This feature of the Symposium has proved to be very successful. The Industry-Hosted Cocktail Reception preceding the Annual Awards Banquet on Wednesday evening was attended by over 1100 people.

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1987 MTT-S Symposium (continued from page 6)

The guests' activities contained a complete daytime program of exciting tours, which include a visit to the world-famous Hoover Dam, one of the seven man-made Wonders of the World. Other locations that the Symposium guests had the opportunity to visit included the Liberace Museum, the scenic Red Rock Canyon area, the Ethel M. Chocolate Factory and Cactus Garden, and backstage at one of Las Vegas' fabulous revue shows. Each tour was well attended, with a total of 313 participants during the three days.



MTT-S AdCom members Tatsuo Itoh and Martin Schneider during a Symposium break.

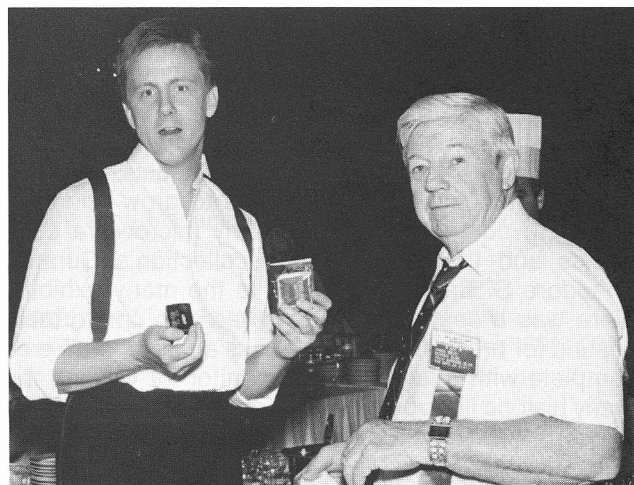
AWARDS BANQUET

The Annual Awards Banquet was the highlight of the social events during the Microwave Symposium. It was held in the Garland Ballroom of Bally's Grand Hotel on Wednesday evening, following the Industry-Hosted Cocktail Reception. The gala Awards Banquet was attended by 709 persons, all of whom dined well, enjoyed string quartet music during the gourmet dinner, and witnessed the presentation of awards to those who have generously served our profession and contributed to our industry. Details of the Awards ceremonies are discussed in Charlie Rucker's article in this issue.

Following the award presentations, the audience was treated to the comedic and magical talents of Harry Anderson, star of the popular television show, Night Court.

HISTORICAL EXHIBIT

The Microwave Historical Exhibit, located in a place of prominence within the commercial exhibition, proved to be very popular with both the exhibitors and the technical registrants. The number of artifacts contained in the Historical Exhibit continues to grow annually, thanks to contributions from many microwave companies and the effort of the collection's Curator, Theodore S. Saad. In addition to the many exhibits, there was a separate reading area with comfortable seating for browsing through books and a cinema area complete with a large screen monitor for viewing the many historic films presented throughout the day. Fresh popcorn was served all day in the cinema area.



1989 Symposium Chairman Chuck Swift hams it up with Harry Anderson, the Awards Banquet entertainer.



At the International Microwave Symposium's Award Banquet.



T. Scott Martin receives the first MTT-S Graduate Fellowship from IEEE Division IV Director Gary A. Thiele.

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1987 MTT-S Symposium (continued from page 7)

HISTORICAL EXHIBIT

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COMMERCIAL EXHIBITION

The commercial exhibition allowed manufacturers an opportunity to display and discuss the latest advances in microwave hardware, software, and services. This year's Microwave Exhibition was the largest ever, with 271 companies occupying 437 booths. In fact, over a dozen additional exhibitors had to be denied space due to a lack of room. This massive exhibition occupied both the Grand Ballroom and the Goldwyn Ballroom in Bally's Grand Hotel with all available booth space being occupied. Howard Ellowitz of Horizon House — Microwave is to be commended for organizing and skillfully managing the Commercial Exhibition, an important part of the Microwave Week activities. Even though the Symposium was not held in an area of intense microwave activity and a large local attendance was not expected, most of the exhibitors felt that the quality of the traffic through the exhibit area more than compensated for the slightly reduced attendance.

SYMPOSIUM DIGEST

The Symposium Digest was edited and prepared by the Publications Committee under the leadership of Dr. Jeffrey B. Knorr of the U.S. Naval Postgraduate School, Monterey, CA. Because of the large number of papers presented at this year's Symposium, the digest was, for the first time, divided into two volumes. Additional copies of the Digest are available from the Institute of Electrical and Electronic Engineers, Incorporated, Publications Order Department, 445 Hoes Lane, Piscataway, NJ 08854. The IEEE Catalog Number is 87CH2395-2.

1987 SYMPOSIUM STEERING COMMITTEE

The success of the 1987 IEEE MTT-S International Microwave Symposium was made possible by the outstanding work and dedication of the members of the Steering Committee. Those of us who attended this year's International Microwave symposium and witnessed the fruits of their labors owe all of them our sincere gratitude for their professionalism, devotion, and desire to make the 1987 International Microwave Symposium the Best Ever and the one to which all future Symposia will be compared. I think they succeeded and I thank all of them for the excellent job they did.

I feel honored and privileged to have worked with this wonderful group of people and to have served as their Chairman. A list of the Steering Committee members and their employers follows:

Chairman:	Steven L. March
Vice-Chairman:	Les Besser Besser Associates Palo Alto, CA
Consultant:	Al Clavin Del Mar, CA
Technical Program Chairman:	Reynold S. Kagiwada TRW ESD Redondo Beach, CA
TPC Vice-Chairman:	Ken Yano TRW ESD Redondo Beach, CA
Special Sessions Chairman:	Tatsuo Itoh Univ. of Texas Austin, TX
Open Forum Chairman:	James C. Rautio Syracuse University Syracuse, NY
Focused Sessions Chairman:	John B. Horton TRW Space Tech. Group Redondo Beach, CA
Local Arrangements Chairman:	John M. Owens University of Texas Arlington, TX
Local Arrangements Vice Chairman:	Ronald L. Carter University of Texas Arlington, TX
Local Arrangements Committee:	Krishna K. Agarwal Sage Laboratories Natick, MA John Wassel Texas Instruments Dallas, TX Karl R. Varian Texas Instruments Dallas, TX Alan Davis University of Texas Arlington, TX
Guest Program Chairperson:	Gail March Alta Loma, CA
Guest Program:	Darlene Payette Maury Microwave Corp. Cucamonga, CA Nance Cohen Calabasas, CA
Gifts Chairman:	Ron Ham Clemson University Clemson, SC

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1987 MTT-S Symposium (continued from page 8)

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Registration Chairman: Ferdo Ivanek
Communications Research
Palo Alto, CA

Registration Committee: Robert L. Eisenhart
Hughes Aircraft Co.
Canoga Park, CA

Historical Exhibit
Chairman: Clifford M. Krowne
Naval Research Laboratory
Washington, DC

Historical Exhibit
Co-Chairman: George Jerinic
Raytheon Company
Wayland, MA

Exhibits Manager: Howard I. Ellowitz
Horizon House — Microwave
Canton, MA

Exhibits Chairman: Harlan Howe, Jr.
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MMIC Symposium Liaison: Yalcin Ayasli
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European Microwave
Conference Liaison: Rolf H. Jansen
Industrial Microwave and RF
Techniques
Ratingen, West Germany

Conference Management: Lawrence R. Whicker
LRW Associates
Arnold, MD

Conference Management
Liaison: Barry E. Spielman
Naval Research Laboratory
Washington, DC

POST-SCRIPT

In January 1983, a group of concerned MTT Society Administrative Committee members decided to propose a radical departure from the conventional venue for the Society's annual Symposium. They decided to attempt to garner MTT-S Adcom approval to hold the 1987 International Microwave Symposium in a controversial location having only a handful of MTT Society members — in Las Vegas. In late May 1983, the Society's Administrative Committee agreed to gamble on both the proposed location and the nucleus of the Symposium Steering Committee and voted to select Las Vegas as the site for the 1987 edition of the MTT-S Symposium. It should be remembered that the members of the Steering Committee were located in all parts of the country and that regular Steering Committee meetings would be virtually impossible.

The May 1983 gamble paid off. The Steering Committee grew from its original nine members to a final membership of 45 dedicated, hard-working individuals. The MTT-S Administrative Committee was not disappointed. Their faith in the 1987 Symposium Steering Committee was rewarded a few months ago when they and the 6604 technical registrants, exhibitors, and guests who gathered in Las Vegas for Microwave Week experienced The Best Ever — The 1987 IEEE MTT-S International Microwave Symposium.

**MTT-S NEWSLETTER
COPY DEADLINE INFORMATION**

<u>Issue</u>	<u>Copy Deadline*</u>
Spring	February 28
Summer/Fall	July 2
Winter	December 1

* For special technical articles, submit 8 weeks earlier.

REFLECTIONS ON THE 1987 INTERNAL MICROWAVE SYMPOSIUM TECHNICAL PROGRAM



by Reynold S. Kagiwada

Reflecting upon the Symposium, the one thing that leaves a deep impression on me is the high degree of commitment that was demonstrated by the Symposium Committee. They worked so hard under challenging circumstances to make the 1987 International Microwave Symposium a rousing success. The technical program committee had to review a record number of papers and put together an outstanding program. The many minor glitches were quickly resolved by the Steering Committee so that the Technical Sessions ran smoothly throughout the symposium.

For the first time over two thousand people attended the technical sessions. Eighteen different countries were represented and two hundred thirty-four papers were presented. The quality of the technical program was outstanding and every session was well-attended.

The format of the technical program followed previous years which was well-suited for our Society. The ninety minute session lengths again worked well providing good homogenous session. One out of three papers presented were in the short paper category, demonstrating the short paper concept has now been accepted by both authors and Technical Program Committee. It allowed the Session Chairmen maximum flexibility in structuring their session.

The Open Forum was again very successful thanks to the hard work of Jim Rautio. Over ninety papers in two sessions were presented. The sessions had excellent attendance and provided excellent interchange between authors and attendees. Authors are now very proficient in this informal presentation format.

The Special Sessions (Panel Sessions and Workshops) greatly enhanced the technical program. The topics were well-selected and well-coordinated by Tatsuo Itoh.

1987 marks the second year, that Focussed Sessions were part of the Symposium Technical Program. This year, the organizers were John Horton, Chi Lee and Jim Wiltse, who developed topics with two sessions each on "Millimeter Wave Technology and Applications" and "Optical Techniques for Microwave Applications." The purpose of these focussed sessions was to place greater emphasis on "hot areas" in our cur-

rent technology which will have significant impact in the future.

Three invited papers by eminent microwave researchers were represented at the European Microwave Session. The three papers were well-received and fit well in main focus of the symposium.

In looking at the 1987 Symposium, I believe that the Microwave Symposium has evolved into a highly successful format. The ninety minute session, short and regular papers, Open Forum, Panel Session, Workshops and Focussed Session blend themselves exceptionally well. The only uncertainty for the future is the increase in the number of papers submitted. For the last two years the rate of submissions has increased by approximately fifty papers a year. Since the number of papers that can be accommodated is limited, should one reject more papers, or increase the number of slots? For the 1987 Symposium, close to fifty percent of the papers were rejected. This dilemma will have to be solved by the 1988 Technical Committee if this trend of more submitted papers continues.

I found the 1987 Symposium a very rewarding experience, and I enjoyed working with so many dedicated and talented people. If the sampling of the feedback I received was typical, people appreciated the program and felt that the technical content was outstanding.

Thank you again to many individuals, who contributed heavily to make the year's technical program a success.

1987 AWARDS BANQUET



by C.T. Rucker

Each year, during the Microwave Symposium, we make it a point to recognize those who have made major contributions to the Society by either extraordinary service or technical contributions. It is my pleasure to summarize the awards presented this year at the Symposium Banquet. President D.N. McQuiddy presented the following awards:

Microwave Career Award..... Robert W. Beatty
Microwave Prize..... Christen Rauscher
Distinguished Service Award..... Kiyo Tomiyasu
Distinguished Microwave Lecturers...John H. Bryant
Edward C. Niehenke

It is our practice to add the names of the Career and

continued on page 11

1987 AWARDS BANQUET (continued from page 10)



Robert Beatty receiving the Microwave Career Award from MTT President David N. McQuiddy, Jr.



Dr. Kiyo Tomiyasu receives the Distinguished Service Award from MTT President David McQuiddy, Jr.

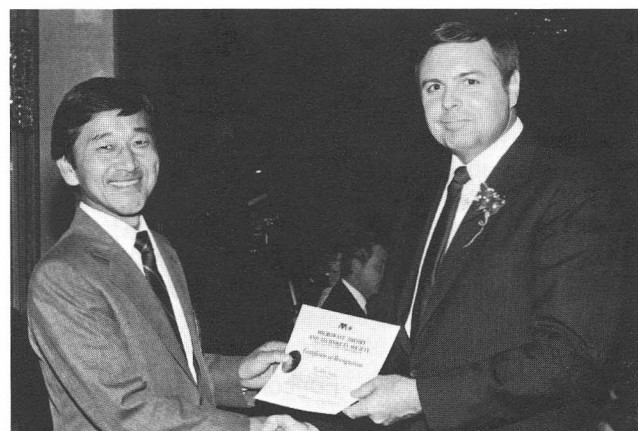


Dave McQuiddy presents Distinguished Microwave Lecturer citation to Dr. John H. Bryant.

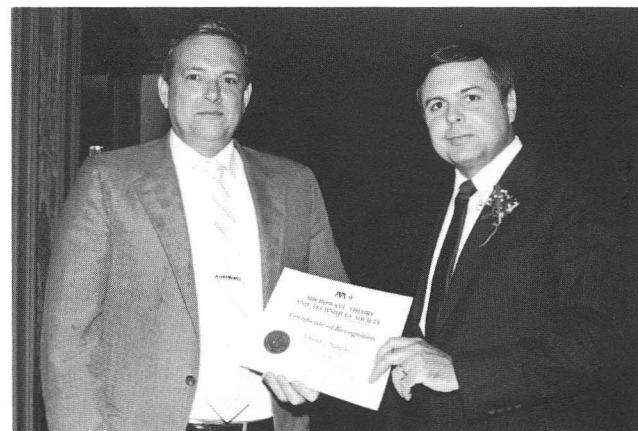
Distinguished Service Awards recipients to the MTT-S Honor Roll. It was a pleasure to see the name Robert W. Beatty added to that roll. Kiyo Tomiyasu's name already appeared on the Honor Roll because he is an Honorary Life Member of MTT-S and because he previously received the Microwave Career Award. We are happy to add to his list appearing on the Honor Roll.

Other awards presented by the President were the Past President's Pin to Reinhard Knerr, 1986 Society President; the Meritorious Service Award to Don Parker for his many years of service to MTT-S and Certificates of Recognition to:

- John Kuno Retiring AdCom Member
- Edward C. Niehenke 1986 Symposium Steering Committee Chairman
- Hal Schrank 1986 Symposium Steering Committee Vice-Chairman
- Marvin Cohn 1986 Symposium Technical Program Committee Chairman
- Bernard Geller 1986 Symposium Technical Program Committee Vice-Chairman



John Kuno receives award for service on the MTT Administrative Committee.



MTT President, David McQuiddy, Jr., presents Distinguished Microwave Lecturer certificate to Edward C. Niehenke.

In addition to the Society Awards, three new IEEE Fellows chose to receive their Fellow Certificates at the Symposium. Their names and citations are noted below:

- Ali E. Atia..... For developments in microwave filter design for communication satellites.

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1987 AWARDS BANQUET (continued from page 11)

- Donald M. Bolle For contributions to nonreciprocal components for microwave and millimeter-wave systems.
- Albert E. Williams For contributions to the theory and development of dual-mode, optimal performance microwave filters.

We were honored to have Dr. Bruno Weinschel, Past President of IEEE, in attendance at the Symposium to present the Fellow Certificates.

Five additional MTT-S members were elected to the grade of Fellow with the endorsement of MTT-S but received their certificates elsewhere. They are:

- Prof. Fred E. Gardiol.... For contributions to the design of ferrite microwave devices.
- Dr. Bernard Glance..... For contributions to the advancement of phase-locked circuits in communications systems.
- Dr. Kazuhiro Miyauchi.. For contributions to the development and application of high speed digital transmission technology in communications.
- Dr. Adel A.M. Saleh..... For contributions to the theory of microwave mixers.
- Dr. C. Burke Swan..... For contributions to the application of microwave and optical devices.



1986 IEEE President, Dr. Bruno O. Weinschel, during the Symposium's Award Banquet.

Other 1987 Recognition

The Microwave and Millimeter-Wave Monolithic Circuits Symposium has become an important part of our yearly endeavor. Therefore, this year, MTT-S chose to recognize the 1982-1986 General Chairpersons of this relatively new activity. Certificates of Recognition were presented by MTT-S President D.N. McQuiddy to Barry

Spielman, 1982; John Kuno, 1983; Jim Oakes, 1984; Bill Wisseman, 1985 and Roger Sudbury, 1986. We sincerely appreciated the efforts of all who have made the Microwave and Millimeter-Wave Symposium such an important contribution to MTT-S activities.

Chapters are the critical element in insuring the long-term viability of MTT. Each year, at the Chapter Chairman's Meeting held during the Symposium week, we recognize those serving in the trenches as Chapter Chairpersons. This year, it was a great pleasure for me to participate in the awarding of fifty-three Certificates of Recognition to our Chapter Chairpersons. Theirs is not always an easy job.

Awards, The Future

Your Awards Committee has already finished evaluation of Fellow candidates to be elected as of January 1, 1988. In addition, an ad hoc committee is busily working to select recipients of the 1988 Career, Distinguished Service and Applications Awards.

Regarding awards, Don Parker noted a year ago in this Newsletter that "In the beginning I (he) didn't fully realize the amount of work involved in the assignment." He also said "...it was very gratifying each year to see the fruits of the Committee's labor..." Well Don, my greenhorn feet are very wet and I agree with both of the above. You did a super job with our awards. Here's hoping I can live up to the legacy.

PEER

The Professional Engineering Employment Registry Service Center has a new address and new telephone numbers.

PEER, a resume data bank, was designed and is controlled by IEEE in cooperation with other technical and professional societies. Names, addresses and current employers of individuals on the system are coded to ensure complete confidentiality. Employers can search the data base by specifying requirements for particular job openings.

Members interested in the PEER registry may request information in the following ways:

- Write or call the PEER Service Center directly at 138 Old River Road, Andover, MA 01810; Telephone (617) 683-0098.
- Use a touch-tone telephone to access the talking computer. Call (617) 263-6823. When requested, enter the user ID, **200#225#**, and the password, **PEER#** (be sure to enter the '#' sign, as shown).
- If you have a personal computer (or terminal) and a modem, you can enter your resume by calling the On-Line Career Network, (617) 263-3857. Press your **RETURN** key twice and enter the password **PEER** to log on.

1987 MONOLITHIC SYMPOSIUM TECHNICAL CHAIRMAN'S REPORT



by Derry Hornbuckle

The 1987 IEEE Microwave and Millimeter-Wave Monolithic Circuits Symposium was held June 8 and 9 in conjunction with the '87 MTT International Microwave Symposium at Bally's Grand Hotel, Las Vegas, Nevada. The technical program consisted of 32 papers, a growth of 50% relative to prior years, even though the paper acceptance ratio continued to be held below 50%. The Symposium schedule was expanded in two ways to accommodate this growth: parallel sessions on the afternoon of the first day, and third joint session with MTT-S on the second day. Attendance also reflected the rising interest in monolithic circuits, growing over 25% from 750 in 1986 to 950 this year.

The Symposium was preceded Sunday evening by a reception for all participants and their guests, which was well-attended and full of lively discussions.

Opening Ceremony

General Chairman Yalcin Ayasli began the program with opening remarks and a summary of Symposium activities. He introduced MTT-S AdCom President David N. McQuiddy, Jr., who presented certificates of recognition to the first five General Chairmen of the Monolithic Symposium. In order of service, from 1982 to 1986, they are:

- Dr. Barry Spielman, Naval Research Laboratory (1982)
- Dr. H.J. Kuno, Hughes Aircraft Company (1983)
- Dr. James Oakes, Raytheon Company (1984)
- Dr. William Wisseman, Texas Instruments (1985)
- Dr. Roger Sudbury, MIT Lincoln Laboratory (1986)

Technical Program

Following the Technical Chairman's introduction, the technical program began with an invited talk by Peter Asbeck of Rockwell Science Center. Dr. Asbeck's outstanding presentation on "Heterojunction Bipolar Transistors for Microwave and Millimeter-Wave Integrated Circuits" generated much interest. His discussion of exciting advances in HBTs included a few lighthearted references to the local surroundings — an early slide of money at the gaming tables, with betting

areas labeled in terms of competing device technologies, and a concluding slide recommending "Put your money on HBTs."

The morning's sessions covered other advanced devices and broadband circuits. While there is not space here to adequately describe the technical program, readers who did not attend the Symposium are referred to the end of this article for information on ordering a copy of the Digest of Papers.

On Monday afternoon, the first parallel session in the Monolithic Symposium's history was held. An overflow crowd for the millimeter-wave session indicated the growth of interest in this frequency range.

Joint MTT Session

Tuesday the Symposium ran jointly with the MTT Symposium. The day began with the MTT plenary session, described elsewhere. The joint technical program opened with an invited paper by Don Estreich of Hewlett-Packard, Microwave Technology Division, on "Nonlinear Modeling for MMICs." Dr. Estreich discussed the needs for distributed, nonlinear modeling, the time- and frequency-domain approaches and examples. From the comments and questions, the presentation appeared ideally aimed for the large contingent of circuit designers in the audience, synthesizing and clarifying a number of important issues, and offering hope that CAE vendors are working to address these needs. It also served as a good introduction to the topic for those staying to attend the MTT workshop on this subject later in the week.

The remaining sessions on Tuesday covered Nonlinear Circuits, Low Noise Techniques, and Manufacturability. The day went smoothly, with good attendance throughout.

The two-day program included technical advances like a 40 GHz SPDT switch (Raytheon), an attenuator with control linearization (Pacific Monolithics), and a number of advances in broadband circuits. Also represented were manufacturability and reliability studies, including die-attach (Texas Instruments), testing/packaging (TRW), and MMIC as well as digital reliability (both NEC). For complete information, order a copy of the digest, available as IEEE catalog no. 87CH2478-6 from: IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854.

A Note of Appreciation

Many people worked to make the Symposium a success. While it is not possible to mention all of them, I would particularly like to thank the Monolithic Symposium Technical Program Committee, the Steering Committee and Chairman Yalcin Ayasli, along with Vice-Chairman Alejandro Chu, the MTT Symposium Committee and its Chairman Steve March, Technical Chairman Reynold Kagiwada, Local Arrangements Chairman John Owens, and MTT Monolithic Session Subcommittee, represented by Jim Schellenberg. The Monolithic Symposium Digest was made possible by editor Charles Huang; registration and local ar-

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1987 TECHNICAL CHAIRMAN'S REPORT

(continued from page 13)

rangements were handled by John Kuno; publicity by Dale Dawson; meeting minutes by Octavius Pitzalis; contracted services by Larry Whicker and LRW Associates; and we could not have paid the bills without the diligence of Finance Chairman Reynold Kagiwada. Finally, special thanks is due to the founding members who are retiring from Symposium Steering Committee duties this year; in addition to first four General Chairman listed previously, they include:

Max Yoder, Office of Naval Research

Walt Gelnovatch, U.S. Army LABCOT

Dr. Richard Decker, Lehigh University

Dr. Daniel Chen, Microwave Monolithics

All eight received plaques at our June Steering Committee meeting honoring their service to the Monolithic Symposium, but awards do not adequately convey the debt of gratitude we owe them.

NEW USAB AWARDS

Nominations are being sought for the United States Activities Board's first annual competition for *Distinguished Literary Contributions Furthering Public Understanding of the Engineering Profession* that have been published, presented or aired during 1987 that endeavored to further public understanding of the engineering profession.

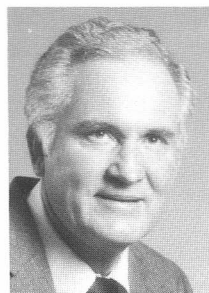
Nominations, which must be received by the IEEE Washington Office by March 30, 1988, must be made by an IEEE member residing in the United States or by the publisher, author, radio or television station responsible for the effort. The entries are limited to those appearing in the public press or broadcast media and to periodicals produced by individual groups other than professional engineering organizations in the United States.

USAB is also seeking nominations for its new award for *Distinguished Contributions Furthering Engineering Professionalism*. This award will recognize individuals for outstanding literary contributions that seek to advance the professional objectives of IEEE. Consideration will be given to the quality and contribution made as the result of a single important literary effort or of contributions made over a period of time or a career that, taken as a whole, reflect exceptional effort to communicate successfully and enhance engineering professionalism.

Nomination forms, which include all requirements, are available from the IEEE Washington Office, 1111 19th Street, N.W., Suite 608, Washington, DC 20036, USA, (202) 785-0017.

FOCUSED SESSIONS

1987 International Microwave Symposium



by John B. Horton

Focused sessions were included in the 1987 International Microwave Symposium to highlight currently emerging microwave technology areas. The two technical areas featured this year were optical techniques and high millimeter-wave (60-230 GHz) technology applications. Application of optical techniques in microwave systems has progressed very rapidly since 1980, and the outlook for the future is even more promising. Millimeter wave technology and systems applications are currently showing a rapid growth, and much of the technology developed at 20-60 GHz in the sixties and seventies is now being extended into the high millimeter-wave region (60-230 GHz). Both the optical and millimeter-wave technical areas are expected to continue to grow in the near future. Some of the major areas emerging this year are highlighted below. Additional information can be found in the 1987 IEEE/MTT International Microwave Symposium Digest (IEEE Catalog No. 87CH2395-2)

OPTICAL TECHNIQUES FOR MICROWAVE APPLICATIONS

Session I

Chairman — T. Itoh, University of Texas, Austin, TX

1. "Optical Generation and Control of Microwaves and Millimeter-Waves", C.H. Lee, University of Maryland, College Park, MD.
2. "Microwave Performance of an Optically Controlled AlGaAs/GaAs High Electron Mobility Transistor and GaAs MESFET", R.N. Simons and K.B. Bhasin, NASA Lewis Research Center, Cleveland, OH.
3. "A High-Speed Phase Shifter Based on Optical Injection", L.R. Brothers, Jr. and C.H. Cox, III, Lincoln Laboratory, Lexington, MA.
4. "Phase and Frequency Coherency of Multiple Optically Synchronized 20 GHz FET Oscillators for Satellite Communications", A.S. Daryoush, P.R. Herczfeld, R. Glatz and A.P.S. Khanna, Drexel University, Philadelphia, PA and Avantek, Santa Clara, CA.

In the first paper, Chi Lee first reviewed the state-of-the-art in the general area of interactions between

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FOCUSED SESSIONS (continued from page 14)

microwaves and optics. He then presented recent progress in the area of optical generation and control of microwaves and millimeter-waves. Laser-controlled phase shifters, switches and modulators at 94 GHz have been demonstrated. A photoconductor material has exhibited picosecond response time. This material can be used in a wide range of applications ranging from high speed switching to high power pulse generation. Picosecond switching techniques can be used for generation of a high voltage microwave burst. A CW microwave signal can be generated from a picosecond source. Prof. Lee concluded with discussing 94 GHz phase shifter and control devices using an optical plasma generated in a dielectric waveguide.

The second paper reported experimental investigations of HEMTs and GaAs MESFETs under optical illumination. Under optical illumination, the light-induced voltage is obtained and the gain increases. It is observed that the scattering parameters are affected by illumination. This effect is pronounced near pinch-off. Studies indicate a number of unique opportunities for applications of optically illuminated HEMTs, including variable gain amplifiers, high-speed, high-frequency photo detectors and mixers.

The third paper reported a demonstration of an optoelectronic analog phase shifter. Without an external bias, 190 degrees of phase shift has been obtained from an optical varactor. In this approach, control of the capacitance is achieved by the amount of charge optically injected into the depletion region of an InGaAs photodiode. The diode is illuminated by a high power GaAs semiconductor laser via an optical fiber. The experiment has been carried out at 260 MHz for ease of operation. However, with approximate scaling the optical varactor phase shifter can be designed to work at microwave frequencies through X-band.

The fourth paper provided a potential solution for accurate phase and frequency control of a large aperture phased array to be used in future communication satellites. The fiber-optic distribution mechanism is used for phase and frequency reference. An indirect subharmonic optical injection locking technique seems practical. Two FET oscillators at 21.5 GHz were injection locked in the experiment reported in the paper. Locking range of 84 MHz was achieved for a subharmonic factor of 1/4 with respect to the master source.

This session was attended by a large crowd exceeding the room capacity. Very lively discussions followed each presentation of a paper.

OPTICAL TECHNIQUES FOR MICROWAVE APPLICATIONS

Session II

Chairman — N.R. Dietrich, AT&T Bell Labs
Allentown, PA

1. Microwave Measurements of GaAs Integrated Circuits Using Electro-optic Sampling, K.J. Weingarten, R. Majidy-Aky, M.J.W. Rodwell, D.M. Bloom and B.A. Auld, Stanford University, Stanford, CA.

2. Picosecond Reflectometry Technique for On-Chip Characterization of Millimeter-Wave Semiconductor Devices, C. Rauscher, Naval Research Laboratory, Washington, D.C.
3. Direct Fiber Optic Transmission of a Wideband Multi-Carrier Microwave Signal Spectrum to and from Satellite Earth Station Antennas, J.W. Carlin, J.E. Bowers, A.C. Chipalowski and S. Boodaghians, AT&T-Bell Laboratories, Holmdale, N.J.
4. Optical Feedback on Linearity Performance of 1.3 μm DFB and Multimode Lasers Under Deep Microwave Modulation, W.I. Way and M.M. Choy, Bell Communications Research, Red Bank, N.J.

This session included two papers on two new measurement techniques, one paper on a fiber optic transmission link for satellite earth stations, and one paper exploring the linearity of lasers under deep microwave modulation.

In the first paper the authors described an electro-optic sampling system at Stanford University which performs non-invasive microwave circuit measurements on internal nodes of GaAs ICs. The circuits were probed with a light beam and the electro-optically induced polarization changes were observed. The technique provides picosecond time resolution. Measurement results to 40 GHz were reported.

In the second paper the author described a measurement technique aimed at overcoming some of the impediments encountered with conventional hollow waveguide measurement systems for characterization of devices and circuits at MM-wave frequencies. A miniature multi-sampler reflectometer system incorporating photoconductive circuit elements is integrated with the device or circuit. The approach is illustrated with a GaAs 150 GHz bandwidth example.

In the third paper an experiment that evaluates the optical fiber link between antenna and terminal of a satellite communications system was described. A 500 MHz bandwidth C-band composite signal including several modulation formats and spectral density variations of 15 dB was transmitted over 20 km of low-loss fiber with 1 dB or less degradation in the signal to noise ratio.

In the last paper the effect of optical feedback on linearity performance was examined for both single- and multi-mode laser structures. The lasers are modulated by large signals (current modulation index 50 to 80 percent) at frequencies above 1 GHz. These lasers were shown to be relatively insensitive to high level optical feedback provided they were properly biased and modulated by large signals.

ADVANCES IN MILLIMETER-WAVE SYSTEMS (60-230 GHz)

Chairman: J.C. Wiltse, Georgia Tech Research Institute Atlanta, Georgia

This session featured four applications of millimeter-wave technology to current systems and subsystems. Papers presented were:

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FOCUSED SESSIONS (continued from page 15)

1. Recent Advances in Millimeter Wave Instrumentation for Radio Astronomy, J.M. Payne, National Radio Astronomy Observatory, Tucson, AZ.
2. A survey of Advanced Developments in Millimeter Wave Seeker Front Ends, T.T. Fong, TRW Electronic Systems Group, Redondo Beach, CA.
3. A High Power Coherent 94 GHz Radar (HIPCOR-95), J.C. Butterworth, Georgia Tech Research Institute, Atlanta, GA.
4. Recent Advances in Gyrotrons and Free Electron Lasers, R.J. Temkin, Plasma Fusion Center, MIT, Cambridge, MA.

In the first paper, J. Payne described five new millimeter-wave telescopes that are being built for use in radio astronomy. These telescopes operate in frequency bands near 90 GHz, 115 GHz and 230 GHz. Antenna sizes vary from 12m to 45m. All systems use cooled low noise front ends. This paper contained a large amount of information on the new telescopes, including performance and data return. A map of Orion taken at 230 GHz was presented.

T. Fong's presentation on millimeter-wave sensors illustrated a unique application of advanced technology to a 94 GHz seeker front end. The seeker circuitry includes pulse compression, transmit and receive functions. Initial work was done using hybrid IC and waveguide. Current version is in hybrid IC, with future configurations in monolithic design. Volumes for these designs are: 1984-59 cu in; 1987-5.4 cu in; 1991-2.7 cu in.

The HIPCOR-95 radar system presented by C. Butterworth illustrates the continued application of high power devices to millimeter-wave systems. The radar is coherent and operates in two transmit modes, 80 W and 1kW peak at 0.001 duty factor. The system is frequency agile with a range resolution of 0.5 ns. A TWTA is used for low power and an extended interaction klystron amplifier is used for high power.

R. Temkin's paper on extremely high power at 140 to 240 GHz covered gyrotrons, free-electron-lasers (FEL) and free electron masers (FEM). Power and efficiency curves were presented. Recent results from the U.S. and USSR were presented. Fundamentals of the FEL and its tuning equation were discussed. The presentation concluded with a discussion of the FEM and a test bed currently under development.

ADVANCES IN MILLIMETER WAVE TECHNOLOGY (60 – 230 GHz)

Chairman: J.C. Wiltse, Georgia Tech Research Institute Atlanta, Georgia

Four examples of advancing technologies in the millimeter-wave region were presented in this session. These areas are expected to continue to affect millimeter-wave technology applications in the future.

1. Millimeter Wave Material Properties and Measurements, G.J. Simonis, U.S. Army Harry Diamond Laboratories, Adelphia, MD.

2. Advances in HEMT Technology and Applications, P.M. Smith, P.C. Chao, K.H. Duh, L.F. Lester, B.R. Lee, and J.M. Ballingall — General Electric Company, Syracuse, NY.
3. Imaging Antenna Arrays, D. Rutledge, California Institute of Technology, Pasadena, CA.
4. GaAs Schottky Barrier Diodes for High Sensitivity Millimeter and Submillimeter Wavelength Receivers, T.W. Crowe and R.J. Mattauch, University of Virginia, Charlottesville, VA.

The opening paper by G. Simonis stressed the growing need for characterization of materials for applications at millimeter-wave frequencies and sub-millimeter-wave frequencies (beyond 1 THz). The immediate need is to have reliable data at 60-600 GHz for basic materials such as liquids, biological materials, ceramics, amorphous solids, polymers, crystal dielectrics, semiconductors and magnetic materials. Several measurement techniques were presented. Data taken as high as 1.5 THz were presented for selected materials.

P. Smith's presentation on advances in HEMT technology provided an in-depth review of current devices, low noise and power, above 60 GHz. Devices currently use 0.25 μm gate-length, with gain up to 100 GHz ($F_{\text{max}} = 200$ GHz). Examples of a two-stage 62 GHz amplifier were presented. DC life tests on the 0.25 μm devices are being conducted at 110°C junction temperature. Current research includes: 0.1 μm devices, InGaAs materials, higher power levels, and reliability. MTBF is 10^6 hrs for 150°C junction temperature. Currently it is believed that HEMTs are ready for MMIC. Predictions for future performance are: noise figures of 0.5 dB at 18 GHz, 1.0 dB at 30 GHz; device power output of 200 mW at 60 GHz, 50 mW at 94 GHz.

The third paper in this section, presented by D. Rutledge, covered array antennas to be used for deep space probes. An example of image returns was presented (Scientific American, May 1986, Vol. 254, No. 5, Pg. 96). This paper contained an in-depth discussion of fully integrated antenna/front-end designs. Pattern measurements for a 240 GHz horn were presented. Bow-tie and log-periodic antenna designs were discussed (700 GHz). Schottky barrier diodes and superconducting tunnel diode detectors are currently used. SIS junctions are planned for the future.

T. Crowe presented an in-depth discussion of GaAs Schottky barrier mixer diodes, and techniques for using these devices at frequency ranges from 100 to 1000 GHz. Analyses were presented for the graded doped barrier, the planar doped barrier, and the heterojunction barrier diodes. All types are for supercooled application at 20°K. Performance curves were presented for single-sideband-band noise temperature for 100 through 1000 GHz.

continued on page 17

FOCUSSED SESSIONS (continued from page 16)

Summary/Sources of Information

The focussed sessions this year were well attended and often contained discussions after the sessions. Information not in the 1987 Symposium Digest can be obtained from the authors and/or the session chairmen. The following may be contacted by telephone.

Optics:	T. Itoh	(512) 471-1072
	N.R. Dietrich	(215) 439-6797
	C. Lee	(301) 439-6852
MMW:	J.C. Wiltse.....	(404) 894-3494
	J.B. Horton.....	(213) 536-3190

1988 SYMPOSIUM TECHNICAL PROGRAM



*by Jesse Taub
and James
Whelehan, Jr.*

Technical Overview

The planning for the 1988 MTT-S International Microwave Symposium Technical Program is well underway. The First Call for Papers was published in the Spring Newsletter. The Symposium will take place in New York on May 25, 26, and 27 in the Jacob Javits Convention Center. We expect our program to reflect the growth and changes in our field. Some of the areas that we wish to highlight are:

1. Microwave Applications of High Temperature Superconductivity
2. MMIC Subsystems
3. Microwave Applications to Light Wave Technology
4. High Speed Signal Processing
5. Microwave History

Microwave engineers have been interested in superconductivity for many years to obtain very high Q resonators and high magnetic fields. The exciting prospect of producing superconductors at liquid nitrogen or higher temperatures is sure to produce many interesting microwave applications. We hope to see a few papers dealing with this new technology.

The annual Microwave and Millimeter Wave Sym-

posium has chronicled many advances in monolithic chips. While this technology is not mature, examples of groups of chips being used to perform subsystem functions are starting to emerge. Papers in this area will be most timely and we strongly encourage them.

We expect to follow in Baltimore and Las Vegas' footsteps and continue to focus on microwave applications to light wave technology. The technology continues to be exciting and was strongly supported in Las Vegas.

Significant advances are being made in the field of Signal Processing. Processing speeds are becoming extremely fast requiring use of microwave techniques in the digital portions. Processing hardware is getting closer to the antenna. This in turn produces system architecture changes. More sophisticated and challenging systems are expected to emerge. We would very much like to encourage papers in this area.

The above sessions stress our future. We are also going to celebrate our origins with a special historical session on the 100th anniversary of Hertz's demonstration of electromagnetic waves. The Spring 1987 edition of the Newsletter covered this in some detail.

We are looking forward to receiving a bumper crop of excellent submissions. To maximize the rating of your paper, we would like to offer a few guidelines which, if carefully followed, will greatly improve the chances for acceptance and enhance the overall quality of our Symposium's Technical Program. These guidelines were written by Dr. E. James Crescenzi, Jr. of Watkins Johnson. He has also summarized typical reviewer objectives and concerns.

Paper Summary Guidelines

1. State concisely the essence of your work and a statement of what is new, its significance, its relation to previous work (include current references), and how it represents an advance over the current state-of-the-art, as well as its intended application.
2. Demonstrate a willingness to explain clearly your fundamental techniques and/or technology. Don't be vague. For experimental papers, show your circuits or other physical realizations, explain the critical elements of your approach, and include detailed quantitative results in figures. For theoretical papers, demonstrate an ability to communicate the essentials of your theory in the format of the MTT-S Symposium, i.e., in a brief oral presentation. Include applications of the theory where appropriate.
3. Clearly differentiate between calculated data, measured data, and areas of conjecture or planned future exploration. Be forthright in describing what has been accomplished to date.
4. Abide by the text limits stated in the Call for Papers (usually 500 words minimum/1000 words maximum). Make sure to use effective figures.
5. Finish your draft early enough to review, correct and improve it over a several day period. Use a critical colleague as a reviewer.

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1988 SYMPOSIUM TECHNICAL PROGRAM

(continued from page 17)

Typical Reviewer Objectives and Concerns

1. Does the paper contribute to the state-of-the-art? Are the objectives and results of interest to MTT membership?
2. Will the authors disclose enough of their work so as to be informative to those in attendance at the Symposium? Will the paper and oral presentation be substantive? Note that the purpose of paper selection is not to recognize the authors and their organizations, but rather primarily to assure that topical information is presented to Symposium attendants.
3. How much of the work reported (or alluded to) in the summary has really been accomplished? For the cynic (reviewers are obligated to be critical), those results or benefits of the approach espoused that are not clearly documented must be assumed to be unsubstantiated. It is unfair to other prospective authors to grant too much "benefit of the doubt" to a particular paper.
4. The Call for Paper instructions should be followed so that all submissions can be evaluated on an equal basis. Excessively brief summaries without supporting figures imply a lack of demonstrable results, and often defy objective evaluation. Excessive length of submission suggests verbosity as a substitute for content.

Final Note to Prospective Authors

All reviewers complete an evaluation form, prior to attending the TPC meeting, in which papers are rated in four areas:

1. Originality, Contribution to state-of-the-art
2. Quantitative Content
3. Quality of Technical Content
4. Interest to MTT, Applicability

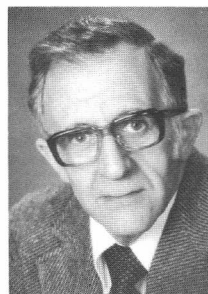
Each submission is reviewed by typically six members of the Technical Program Committee. The reviewers are generally all present at the general TPC meeting and they conduct their selection process in small working groups with a very free exchange of views. This results in a refreshingly open and fair selection process. Our experience is that the sense of responsibility and dedication to fairness of the reviewers is exemplary.

We are looking forward to a good response to our Call for Papers and hope that these guidelines help you. We are looking forward to seeing many of you in New York in a few months.

Always put your room key in the same place when you're in your hotel (for example, on top of the TV) so you can grab it quickly in case of fire. And take your key if you evacuate, since you may need to return to the room if you run into a problem in the hallway.

Business Traveler's Letter, 10076 Boca Entrada Blvd., Boca Raton, FL 33433, monthly, \$60/year.

THE MTT-S HISTORICAL COLLECTION AND EXHIBIT



by Theodore S. Saad

The historical exhibition in Las Vegas was notable for a number of things, but most importantly for the fact that the permanent collection made up over 90% of the total exhibit. And it was our largest display yet.

Attendance was good and the popcorn, wine, soft drinks and coffee gave the entire exhibition a relaxed and friendly atmosphere.

Our historical collection has been growing steadily over the last few years. Between the 1986 meeting in Baltimore and the 1987 meeting in Las Vegas, the number of artifacts increased by more than a third (90 to 123 pieces). In addition, four more excellent artifacts were delivered to us in Las Vegas. This year, we were fortunate to add a completely new section to our collection. This new section is made up of actual chips and posters on the history of MMIC. This is to be a regular addition to our collection and will be maintained by Bob Pucel of Raytheon, our 1980 National Lecturer. Bob solicited contributions from several companies active in the field and will continue to do so on an annual basis.



Ted Saad (R) and Bill Brown (L) discuss the QK 403, the first device to successfully convert the magnetron oscillator into a broadband amplifier, in the presence of Joseph Hilton (C) of Raytheon who made a presentation of the microwave tube to the MTT-S Historical Collection.

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HISTORICAL EXHIBIT (continued from page 14)

In addition to our permanent artifacts, books and tapes, we had on-loan displays from Ball Aerospace, Farinon/Harris, Motorola, Varian, Raytheon EDS and an active EESOF Computer display. We thank the companies and those individuals who were instrumental in arranging the displays.

Up until the Baltimore Symposium I had been encouraging people to send me artifacts without restrictions. That policy has to come to an end. Not only does space limitation become a factor, but recently I am finding that some artifacts are being supplied with no information. For example, one individual sent a box with 12 items with only fragmentary descriptions of two of the items. Fortunately, I found someone who could help identify the other 10 items.

On the other hand, most people who have supplied artifacts in recent years have provided the proper information and have treated the artifacts with the care and respect they deserve. A good example is the contribution made by Bill Brown of Raytheon of the QK403 #3, the first reentrant beam crossed field device to exhibit directional gain.

The historical collection was initiated at the request of Steve Adam, the then AdCom President. He suggested a display of historical items for the 1980 MTT-S Symposium in Washington, D.C. That first collection was made up of mostly borrowed items from M.I.T., Raytheon, M.O. Valve, Westinghouse, NRL and others. It only required a small space. The permanent artifacts fit into the trunk of a compact car, along with three large suitcases. Today, however, the size of the collection has become so large, it needs a better home and more professional guidance than I am able to provide. To that end, I have been in discussion with Warren Cooper and Bob Dwight, both of whom are active in the Westinghouse-funded Historical Electronics Museum, Inc. in Baltimore, Maryland. Bob is president and a director of the museum, and Warren is a director. They have indicated a serious interest in taking over the collection and displaying it between MTT-S Symposia in their (to be enlarged) facility in Baltimore. It has been further suggested that people from the MTT chapters in Baltimore and Washington may be willing to participate in the setting up and tearing down at the Symposium. Having visited the Westinghouse museum and having had the assistance of Westinghouse personnel during the 1986 Symposium in Baltimore, I am enthusiastic about the prospect.

The discussions have been very promising, but the details have to be ironed out and presented to the MTT AdCom at the next meeting.

Waterproof raincoats become uncomfortable, since they trap perspiration. *Better: Water-repellent coats.*

The Consumer's Guide to Menswear by Donald Dolce, Dodd, Mead & Co., 79 Madison Ave., New York, NY 10016, \$9.95.

THE MIT RADIATION LABORATORY 50th ANNIVERSARY CELEBRATION



by Theodore S. Saad

At the MTT-S 1991 Symposium to be held in Boston, one of the major activities being considered is a celebration of the 50th anniversary of the MIT Radiation Laboratory.

In preparation for that event, a small group of us in the Boston area have been meeting and working to formulate plans. The group is made up of Arthur Blaisdell, Al Hill, Harlan Howe, George Jerinic, Ted Saad and Peter Staecker.

Our initial thinking is that there will be two major functions. The first (which will actually begin long before the symposium) will be a series of videotaped interviews with surviving Rad Lab members. That project will start this summer. The second will be an evening reception, possibly with dinner, talks, etc., to be held during the Symposium. We hope also to have several papers on the history of Rad Lab at the Symposium.

One of the first major steps in this effort was to have a meeting with some Rad Lab people who are still in the Boston area. From a list provided by Al Hill, invitation letters were sent to 31 individuals to attend a reception and dinner. Despite a few wrong addresses, individuals who had moved out of town, and business conflicts, we had 14 enthusiastic ex-Rad Lab attendees, plus a number of wives, at a meeting on May 8. The evening was a great success. After we explained why we were holding the meeting, a stimulating exchange of ideas followed. The entire discussion was captured



Ted Saad addresses Rad Lab personnel at 50th anniversary planning meeting.

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RADLAB 50th (continued from page 15)

on video-tape — perhaps our first step in the taping project.

It is important to note who the attendees were and the fact that all of them participated in the after-dinner discussion.

The work done at the MIT Radiation Laboratory during World War II has never received the credit it deserves. Lee DuBridge, Director of the RadLab said that "Radar won the war, the Atomic Bomb ended it," and Rad Lab was probably the major hot spot of radar development during the war. But beyond its contribution to winning the war, it has had a profound and continuing impact on the worlds of electrical engineering, physics, research and solid state, an impact the world has never fully appreciated.

The contributions of the individuals at the Lab, plus their accomplishments that were so unique, have never been described in any great detail, nor have they received the honors they so richly deserve.

MTT-S, through this effort, hopes that it will be able to help correct that oversight.

The attendees:

Mr. & Mrs. William Allis
Mr. & Mrs. Kenneth Bainbridge
Mr. Robert Fano
Ms. Elizabeth Campbell
Mr. Albert G. Hill
Mr. Richard E. Hillger
Mr. Robert L. Khyl
Mr. Robert V. Pound
Mr. & Mrs. Nathaniel Rochester
Mr. & Mrs. William Schwann
Mr. & Mrs. Louis D. Smullin
Mr. & Mrs. Malcolm Strandberg
Mr. Herbert G. Weiss
Mr. Arthur Blaisdell
Mr. Harlan Howe
Mr. & Mrs. George Jerenic
Mr. & Mrs. Theodore S. Saad
Mr. & Mrs. Peter Staecker

NOTE: The last gathering of Radiation Laboratory engineers organized by Al Hill in 1976, used the following list of names, which we have attempted to keep current. In preparation for the 50th anniversary celebration of the Rad Lab, we are interested in maintaining or improving the accuracy of list by asking for additions or corrections to the information below. If you have any inputs, please contact:

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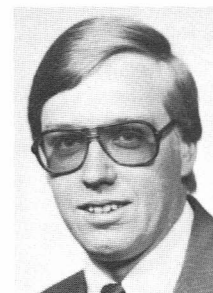
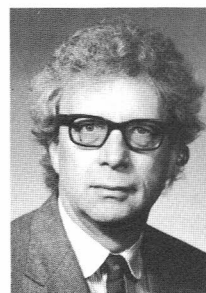
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MEMBERSHIP SERVICES



by Martin V. Schneider, Chairman
and Steven J. Temple, Co-Chairman

Chapter Activities

The technical activities of the MTT-S chapters increased substantially in 1987. For the first five months of the year, a total of 55 regular technical meetings were reported by the chapters. During the same period in 1986 only 27 meetings were held. The number of special meetings increased from three to five during these periods.

MTT-S Continues to Rank Second in Membership Growth

Thanks to the efforts of the Distinguished Lecturers and our Membership Development Chairman, the number of members has increased steadily. The membership rose by 6.6% over the last twelve months to 8,755. The Institute membership increased by 3.2% to 261,890. MTT-S is currently the second fastest growing Society among 33.

The four chapters which showed very high growth in 1986 were Baltimore (58%), the India Council (70%), Schenectady (63%) and West Germany (21%). Representatives from these chapters received a plaque and a check for \$200 at the International Microwave Symposium in Las Vegas in recognition for their successful membership drive efforts. The major growth in membership in 1986 occurred in areas which have a chapter. The average growth in chapter membership was 9.7% in the USA and 20.8% overseas.

Distinguished Microwave Lecturers

The 1986/87 Distinguished Lecturer, John Bryant, gave 47 talks on "The First Century of Microwaves: 1886-1986" to 1,870 attendees. A total of 41 lectures were presented in the USA and Canada. John also presented his lecture during the International Microwave Symposium at the ARFTG banquet on Friday, June 12, 1987.

Ed Niehenke gave 50 talks to 2,025 attendees on "Gallium Arsenide, Key to Modern Microwave Technology." A total of 21 meetings were held outside the US. Ed has scheduled two more lectures in Brazil and Japan in 1987.

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MEMBERSHIP SERVICES (continued from page 22)

The new 1987/1988 Distinguished Lecturers, David Barton and Rolf Jansen, have received forty requests for talks to chapters on "Technology Trends in Microwave Radar" and "CAD of Hybrid and Monolithic Microwave and Millimeter-Wave MICs." Rolf Jansen has already started his assignment by giving two well-attended lectures to the New Jersey Coast and Princeton MTT Chapters on June 4, 1987.

During its recent executive meeting in Las Vegas, AdCom appointed a 1988/89 Distinguished Microwave Lecturer who will be available to give talks on the timely topic of "Lightwave Communications." The new lecturer, Reinhard H. Knerr, is well-known to the microwave and lightwave communities for his technical contributions and expertise in this field. We are fortunate to have Reinhard as a new member of our transitional team of IEEE lecturers and we wish him success with his new assignment.

Cost of Membership Services

The current cost of the services which are received by each member for the current year is as follows:

1) IEEE Transactions on MTT (12 issues)	\$19.40
2) MTT Newsletter (three issues)	\$ 6.20
3) Distinguished Lecturer Program	\$ 2.40
4) Chapter Support for Technical Meetings	\$ 1.10
5) Support for Chairpersons to attend Symposium Meeting	\$.75
TOTAL	\$29.85

It should be noted that each member pays only \$8.00 per year in membership dues but receives a total of \$29.85 in services. Thus we are currently offering services substantially below cost. The discrepancy may be reduced if a substantial number of new MTT members can be recruited, since the differential cost of adding a new member to the Society is of the order of ten dollars per year.

New MTT-S Chapters

A new chapter has been formed in the United Kingdom and the Republic of Ireland. Two petitions have been prepared for starting new chapters in Taiwan and at the University of Massachusetts in Amherst.

Increasing Membership

At the last executive meeting, AdCom approved that the free MTT membership promotion program be extended from the December 1987 expiration date through February 1989.

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Fascinating Facts

- If you eat an orange you may get as much as 60% more vitamin C than if you squeezed it and drank the juice.
- When you run, the impact of each step on your shock-absorption system is 3 to 4 times your body weight. When you walk, the impact of each step is only 1 to 1.5 times your weight.

GALLIUM ARSENIDE — KEY TO MODERN MICROWAVE TECHNOLOGY



by Edward C. Niehenke

DISTINGUISHED MICROWAVE LECTURER (1986/1987)

It has been a pleasure presenting my lecture "Gallium Arsenide — Key to Modern Microwave Technology" to 50 groups and 2025 people so far. Since my last newsletter report, I covered the remaining northcentral and northeastern parts of the US. I want to personally thank each MTT chapter chairman or host for the hospitality extended to me during my visits. It was exciting meeting people at the lectures and presenting my lecture, even after 50 times.

Due to personal hospitalization, I had to cancel lectures to Syracuse MTT and ED chapters, Montreal McGill University, Montreal MTT chapter, Buffalo New York State University, and Buffalo IEEE section. My apologies to these groups; I'm in good health now. The report of my activities follows:

Dr. Fabian Josse, my host in Milwaukee, met me at the airport on March 17, 1987, and much to my surprise, Dr. John Bryant, the other 1986-1987 Distinguished Microwave Lecturer, was there also. We were both going to present our lectures on the same evening. Dr. Josse drove us to Marquette University, where he lectures. During the drive, we saw many German and Polish restaurants. Many people of these nationalities settled Milwaukee and set up restaurants there. When we arrived, we discovered that the University was founded some 104 years ago by Fr. Marquette, a missionary and explorer. At Marquette we were introduced to research people who showed us their projects.

Later we went to the IEEE meeting. This meeting was quite different and very refreshing since all student, chapter and section activities were held at the same location and on the same day with the following itinerary: The student meeting was held first, followed by a free snack at poolside. Next, four chapters had their talks at the same time. Dinner followed, and the evening was concluded with the section meeting. I was scheduled to talk at the chapter meeting and had to face stiff competition from three other excellent speakers and topics. I am happy to report that I packed the room and had the highest attendance (91) of my lecture series to that date, topping the previous high of 90 set in Rome, Italy. After dinner I enjoyed hearing

John Bryant's talk.

The next day, Dick Snyder was my host in North Jersey. We visited ITT for a tour before the talk. This company, involved with the development and manufacture of ECM systems, recently refurbished its plant. I presented my lecture at a dinner meeting held at a nearby country club for the North Jersey MTT chapter.

The following day, Ali Afrashteh, of Bell Communication Research, was my host and showed me developments at Bell. I was especially interested in the communication system using fiber optics and was impressed with the low attenuation using this transmission medium. Ali had to drag me away to get me to the luncheon meeting in time for the MTT New Jersey Coast Chapter. We had lunch at the Colts Neck Inn and I met many friends, including Martin Schneider, the MTT Membership Services Chairman, of AT&T Labs. After the lecture, I drove to the Princeton area for the next lecture. I met my host, Ben Epstein, at the David Sarnoff Research Center of SRI International (formerly RCA Labs). I was interested in developments that RCA Labs presented at the 1986 Microwave Symposium, including a very low-noise C-band DRO and an efficient Ku-band amplifier using radial line combiners. These devices were quite impressive. Barry Pearlman showed me the tuner developed at SRI used for load-pull-device characterization as well as computer program software developments for harmonic balance analysis. The room at Princeton University was full (43 people) when I arrived to present my lecture to the Princeton MTT chapter. There were a lot of questions and much activity at this meeting.

The final lecture of this trip was at the Sixth Annual Benjamin Franklin Symposium sponsored by the Philadelphia AP/MTT Chapter at Cherry Hill, New Jersey, just minutes from Philadelphia, my hometown. Ashok Agarwal, the Chapter Chairman, and his committee did an outstanding job organizing this most interesting event. I had my highest attendance to date of 120 persons at this symposium. I drove home to Baltimore that evening after quite a full week.

The next trip started on April 7 with a visit to the SE Michigan MTT Chapter meeting, jointly with the University of Michigan. Professors George Haddad, Dimitris Pavlidis, Mike Elta, Pallab Bhattacharya and Valdis Liepa gave me a first-class tour of the new Electrical Engineering and Computer Science building, which was quite impressive. This building is unique in architecture with an atrium that stretched from the ground floor to the glassed ceiling, some four stories high. In this facility, a solid state lab is being equipped to perform research on heterostructure GaAs structures and new semiconductor structures with the capability to fabricate the devices using the latest equipment. Molecular Beam Epitaxial (MBE) equipment will be used to form the precise heterostructure layers. An electron beam capable of defining 0.1 micron gate lengths for FET/HEMT structure is also found there. There were many students as well as faculty at the lecture.

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DISTINGUISHED MICROWAVE LECTURER —
E.C. Niehenke (continued from page 24)

The next day I lectured to the Long Island MTT Chapter, which will host the International Microwave Symposium in New York City next year. Again, the room was at full capacity with much interaction. Joseph Levy, the Chapter Chairman, and I talked about microwave design until midnight following the meeting.

The final lecture of this trip was in Troy, New York, the home of Uncle Sam, for the Schenectady MTT Chapter. Professor Jose Borrego, the Chapter Chariman, introduced me to his many students at Rensselaer Polytechnic Institute (RPI). They were doing fascinating research with GaAs using laser beams combined with microwaves. Microwaves were directed to the GaAs substrate and the reflected signal was analyzed as a function of substrate illumination with laser beams of varying wavelengths. Defects and traps, including trapping energy locations, were obtained with this system by analyzing the time responses of the reflected microwave response with pulsed laser illumination. The lecture at RPI was well attended, with much interest shown.

On April 16, I lectured to the MTT Chapter in Boston. Rich Jerome met me at the airport and set up tours at Sanders and M/A-COM before the lecture at Lincoln Labs. At Sanders, John Heaton and Ken Chin showed me their GaAs facility with much broadband monolithic circuitry. At the M/A-COM Lowell GaAs facility, we met T.B. Ramachandran, who gave us an in-depth tour from the growing of the GaAs from a crystal seed to the measurement of the final monolithic circuits designed and produced there. This facility is quite large with a high-volume capacity to produce GaAs circuits. The facility was quite busy, with the largest number of GaAs engineers I have ever seen in one location.

On May 15, I gave my lecture to the IEEE ED and UFFC Chapters held jointly with the Westinghouse Physics Colloquium at the Westinghouse Pittsburgh R&D Labs, with 100 in attendance. There was a lot of interest and many probing questions at this meeting. At the R&D Labs, Dr. Rowan Messham showed me the present Metal Organic Chemical Vapor Deposition (MOCVD) systems and explained to me Westinghouse's research plans to make possible high-volume processing of GaAs wafers with uniform and precise doping profiles using the next-generation MOCVD system. Dr. Noel Thomas showed me the many GaAs pullers and also described to me plans to study techniques to produce super-high-purity GaAs wafers. He also showed me new equipment to make high-resistivity silicon wafers for high-voltage and high-current applications. Finally, Dr. Chris Clarke showed me his GaAs vertical FET developments, which exhibit higher breakdown voltages and lower parasitics compared to the recessed planar FET, making them useful for switches and high-frequency applications.

The remaining lecture schedule is shown below. I look forward to meeting you when I am in your city.

Lecture	Chapter/Group	Date
56	MTT Chapter, Kikaishinkow-kaikan Tokyo, Japan	10/12/87
57	Fujitsu, Atsugi, Japan	10/13/87
58	NEC, Kawasaki, Japan	10/14/87
59	NTT, Yokosuka, Japan	10/14/87
60	ATR, Osaka, Japan	10/15/87
61	Mitsubishi, Amagasaki, Japan	10/16/87

MTT STUDENT PAPER CONTEST

The MTT Student Paper Contest is open to all undergraduate student members of IEEE, and follows the same basic guidelines as the IEEE Student Paper Contest, with the exception that the subject of the paper must fall within the areas normally covered by the Transactions of the MTT. Its objective is to increase awareness of undergraduate students of Microwave subjects, and to enhance their communication skills. Winners from local branch and area contests will be submitted to the national contest and the overall winner will be invited, at MTT expense, to present his paper at the MTT International Microwave Symposium. Prizes will be awarded at the local branch and area contests to the winners with \$200 being the maximum available individual prize money (determined by the number of papers involved). Limited travel expense money will be available. Judging of the local and area contests will be on the basis of both oral and written presentation, while the national contest will be judged solely on the basis of the written material by a subgroup of the International Microwave Symposium Technical Program Committee. Papers will be due from judging at the area level by December 1, 1987 and from the branch contests be November 14, 1987.

For information contact:

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The latest Chapter Chairperson's and Vice-Chairperson's records and a list of Chapter meetings are presented below. If the records of your Chapter are incorrect, please supply me with updated information. My address and telephone number are listed above.

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*Term of Office: 6/86-5/87**continued on page 31*

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*Term of Office: 1/87-12/88***TUSCON (MTT/AP/COM/EMC)****AdCom Liaison: F. Ivanek**

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(602) 538-4881

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*Term of Office: 1/87-12/87***TWIN CITIES (MTT)****AdCom Liaison: N.W. Cox**

Michael J. Gawronski
Honeywell Defense Systems
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*Term of Office: 1/87-12/87***UNITED KINGDOM/IRELAND (MTT/ED)****AdCom Liaison: Unspecified**

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Microwave Associates, Ltd.
Dunstable
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England

*Term of Office: Unspecified***UTAH/SALT LAKE CITY (MTT/AP/ED)****AdCom Liaison: H.G. Oltman, Jr.**

Magdy F. Iskander
University of Utah
Dept. of Elec. Engineering
3040 Merrill Engng. Bldg.
Salt Lake City, Utah 84112
(801) 581-6944

No Vice-Chairman

*Term of Office: 9/84-6/86***Chairperson****Vice-Chairperson****VENEZUELA (MTT/COM)****AdCom Liaison: E.J. Crescenzi**

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Universidad de Carabobo
Esc. Ing. Electrica
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Caracas 1050a
Venezuela
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*Term of Office: Unspecified***WASHINGTON/NORTHERN VIRGINIA (MTT)****AdCom Liaison: B.E. Spielman**

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College Park, MD 20740
(301) 454-9244

Ramesh Gupta
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22300 COMSAT Drive
Clarksburg, MD 20871
(301) 428-0141

*Term of Office: 6/87-6/88***WEST GERMANY (MTT)****AdCom Liaison: P.T. Greiling**

Prof. Peter Russer
Lehrstuhl für Hochfrequenz Technik
Technischen Universität München
Arcisstrasse 21, Postfach 202420
8000 München 2
West Germany

No Vice-Chairman

Term of Office: 6/87/5/88

To remove hanger humps from a sweater, sprinkle water lightly on the shoulders before you put it on. As your body heat dries the sweater, it will come back into shape.

Travel Smart for Business, 40 Beechdale Rd., Dobbs Ferry, NY 10522, monthly, \$125/year.

To test new shoes: Stand on one foot at a time. Wiggle your toes. There should be a half-inch of space between the tip of the shoe and the end of your big toe. Then stand on tiptoe. The shoe should bend where your foot bends.

Journal of the American Podiatry Association, 20 Chevy Chase Circle, Washington, DC 20015, monthly, \$24/year.

MTT-S CHAPTER MEETINGS (1985/1986/1987)

ALBUQUERQUE (MTT/AP/EMC)

DATE: 12-2-86 ATTENDANCE:

SPEAKER: Dr. Gene McGuire
Sandia National Laboratories

TOPIC: "Survey in the Progress of X-Ray Lasers"

DATE: 12-11-86 ATTENDANCE:

SPEAKER: Dr. Emanuel M. Honig
Los Alamos National Laboratories

TOPIC: "High Power Opening Switches"

DATE: 2-24-87 ATTENDANCE:

SPEAKER: Dr. Hassan Nabavi
Univ. of New Mexico, Albuquerque, NM

TOPIC: "High Energy Nanosecond Pulses"

DATE: 3-31-87 ATTENDANCE:

SPEAKER: Dr. Carl Baum
Air Force Weapons' Laboratories

TOPIC: "Norms and All That Jazz"

DATE: 4-16-87 ATTENDANCE:

SPEAKER: Dr. Louis Baker
Mission Research Corporation

TOPIC: "Artificial Intelligence and Ada"

ATLANTA (MTT/AP)

DATE: 11-18-86 ATTENDANCE: 28

SPEAKER: Edward C. Niehenke
Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer

TOPIC: "GaAs — Key to Modern Microwave Technology"

DATE: 1-9-86 ATTENDANCE: 20

SPEAKER: Helmut Schrank
Westinghouse Electric Corp., Baltimore, MD

TOPIC: "Low Sidelobe Reflector Antennas"

DATE: 1-20-87 ATTENDANCE: 17

SPEAKER: John H. Bryant
Univ. of Michigan, Ann Arbor, MI
1986/1987 Distinguished Microwave Lecturer

TOPIC: "The First Century of Microwaves — 1886-1986"

DATE: 3-3-87 ATTENDANCE: 22

SPEAKER: Paul Steffes
Dept. of Electrical Engineering, Georgia Tech

TOPIC: "Education: The Key to America's Future"

BALTIMORE (MTT/AP)

DATE: 10-8-86 ATTENDANCE: 24

SPEAKER: Paul E. White
Applied Engineering Consultants, Inc.

TOPIC: "Microwave Computer-Aided Engineering
and Design"

DATE: 11-5-86 ATTENDANCE: 44

Joint meeting with the Washington/No. Virginia Chapter
SPEAKER: Dr. John H. Bryant, University of Michigan
1986/1987 Distinguished Microwave Lecturer

TOPIC: "The First Century of Microwaves — 1886-1986"

DATE: 12-10-86 ATTENDANCE: 22

SPEAKER: Prof. Y.T. Lo
University of Illinois, Champaign-Urbana
1986/1987 Distinguished AP-S Lecturer

TOPIC: "POLART" — The Magic of EM Waves"

DATE: 3-25-87 ATTENDANCE: 50

SPEAKER: Dr. Robert Elliot, UCLA
TOPIC: "The Design of Microwave Arrays"

DATE: 4-22-87 ATTENDANCE: 26

SPEAKER: Ted Rzeszewski, AT&T Bell Labs, Illinois
TOPIC: "Communications Applications of Fiber Optics"

CENTRAL NEW ENGLAND/BOSTON (MTT)

DATE: 11-13-86 ATTENDANCE:

SPEAKER: B. Berson, Acrian
TOPIC: "MMIC Packaging"

DATE: 12-18-86 ATTENDANCE:

SPEAKERS: P.W. Staecker, M/A-COM, Inc., Burlington, MA
D. Masse, Raytheon Research Div., Lexington, MA

TOPIC: "Approaches to Solid State Millimeter Wave Power
Generation: Fundamental Sources and Frequency
Multipliers"

DATE: 1-22-87 ATTENDANCE:

SPEAKERS: U. Pittack
Raytheon Microwave Power Tube Division,
Waltham, MA
L. Schwartz
Sanders Associates, Nashua, NH

TOPIC: "TWTs: To Understand Them is to
Appreciate Them"

DATE: 2-4-87 ATTENDANCE: 45

SPEAKER: S.A. Roosild
DARPA/DSO

TOPIC: "SDIO/DARPA GaAs Pilot Production Project and
Technology Development"

DATE: 2-19-87 ATTENDANCE:

SPEAKER: John H. Bryant
Univ. of Michigan, Ann Arbor, MI
1986/1987 Distinguished Microwave Lecturer

TOPIC: "The First Century of Microwaves — 1886-1986"

DATE: 4-16-87 ATTENDANCE: 30

SPEAKER: E.C. Niehenke
Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer

TOPIC: "GaAs — Key to Modern Microwave Technology"

CHICAGO (MTT/AP)

DATE: 6-9-87 ATTENDANCE: 18

SPEAKER: Dr. Saad M. Saad, Andrew Corp.
TOPIC: "Advanced Developments in Waveguide
Components and Networks"

DATE: 9-18-86 ATTENDANCE: 28

SPEAKER: Edward C. Niehenke
Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer

TOPIC: "GaAs — Key to Modern Microwave Technology"

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MTT-S CHAPTER MEETINGS

(continued from page 32)

DATE: 10-20-86 ATTENDANCE: 18

SPEAKER: Prof. Robert S. Elliott
UCLA, AP-S Distinguished Lecturer
TOPIC: "Faraday and Maxwell"

DATE: 11-6-86 ATTENDANCE: 31

SPEAKER: Al Wilcox
Hewlett-Packard Co., Rohnert Park, CA
TOPIC: "A Designer's Guide to Shielding"

DATE: 2-23-87 ATTENDANCE: 13

SPEAKER: Dr. John H. Bryant
Univ. of Michigan, Ann Arbor, MI
1986/1987 Distinguished Microwave Lecturer
TOPIC: "The First Century of Microwaves — 1886-1986"

COLUMBUS (MTT/AP)

DATE: 10-13-86 ATTENDANCE:

SPEAKER: Robert Kouyomjian
Prof. Emeritus, Ohio State University
TOPIC: "George Ohm and His Law"
"Low Sidelobe Reflector Antennas"

DATE: 1-13-87 ATTENDANCE:

SPEAKER: Richard W. Ridgway
Battelle Columbus Division, Columbus, OH
TOPIC: "An Integrated Optic Sampler for Transient RF
and Microwave Signals"

DATE: 2-10-87 ATTENDANCE:

SPEAKER: Charles A. Raquet
NASA/Lewis Research Center, Cleveland, OH
TOPIC: "Communication Satellite Antenna Technology"

DATE: 3-10-87 ATTENDANCE: 24

SPEAKER: Prof. Calvin T. Swift, Univ. of Massachusetts
TOPIC: "Advanced Sensors for Microwave Remote Sensing"

DATE: 4-9-87 ATTENDANCE: 39

SPEAKER: Constantine A. Balanis
Arizona State University, Tempe, AZ
TOPIC: "Distortion of Transient Signals in Microstrip"

DATE: 4-14-87 ATTENDANCE: 25

SPEAKER: Stuart Anderson
Australian Defense Science and
Technology Organization
TOPIC: "Frontier of HF Skywave Radar Technology:
An Australian Perspective"

DATE: 4-23-87 ATTENDANCE: 25

SPEAKER: Yueh-Chi Chang
Bell Aerospace, Buffalo, NY
TOPIC: "Dual-Band Dual-Shaped Reflector Antennas"

DALLAS (MTT)

DATE: 10-7-86 ATTENDANCE: 46

SPEAKER: E.C. Niehenke
Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer
TOPIC: "GaAs — Key to Modern Microwave Technology"

DATE: 11-20-86 ATTENDANCE: 60

SPEAKER: Dr. John H. Bryant
Univ. of Michigan, Ann Arbor, MI
1986/1987 Distinguished Microwave Lecturer
TOPIC: "The First Century of Microwaves — 1886-1986"

DATE: 12-4-86 ATTENDANCE: 59

SPEAKER: George L. Matthaei
Univ. of California, Santa Barbara, CA
TOPIC: "Some Novel Dielectric-Waveguide and Microstrip
Techniques for MM-Wave Filters and Couplers"

DATE: 1-22-87 ATTENDANCE: 48

SPEAKER: Tom Cordner
Texas Instruments, Inc., Dallas, TX
TOPIC: "GaAs MMIC Processes/Manufacturing"

DATE: 2-26-87 ATTENDANCE: 68

SPEAKER: Mario A. Maury
Maury Microwave Corp., Cucamonga, CA
TOPIC: "Practical Considerations for Precision Network
Analyzer Measurements"

DATE: 2-27-87 ATTENDANCE: 293

SPEAKER: Dr. Merrill I. Skolnik
Naval Research Laboratory, Washington, DC
TOPIC: "Information from Radar Systems"

DATE: 3-19-87 ATTENDANCE: 124

SPEAKER: Robert E. Munson
Ball Aerospace Corp., Boulder, Colorado
TOPIC: "Conformal Microstrip Phased Arrays — Applications
and Technology Trends"

DATE: 3-26-87 ATTENDANCE: 34

SPEAKER: Al Markwardt, Richardson, Texas
TOPIC: "How to Delineate, Develop, Deliver — Do the Best
with Your Presentation"

DATE: 4-23-87 ATTENDANCE: 48

SPEAKER: Harlan Howe, Jr., M/A-COM, Inc., Burlington, MA
TOPIC: "The Invasion of the Monoliths"

DAYTON (MTT/AP)

DATE: 10-23-86 ATTENDANCE: 41

SPEAKER: Prof. Allen Taflove, Northwestern University
TOPIC: "Advances in Computational Modeling of EM Scattering,
Penetration and Coupling, and Inverse Scattering"

DATE: 11-13-86 ATTENDANCE: 25

SPEAKER: Dr. John H. Bryant
Univ. of Michigan, Ann Arbor, MI
1986/1987 Distinguished Microwave Lecturer
TOPIC: "The First Century of Microwaves — 1886-1986"

DATE: 3-10-87 ATTENDANCE: 27

SPEAKER: Prof. Calvin T. Swift
University of Massachusetts, Amherst, MA
TOPIC: "Advanced Sensors for Microwave Remote Sensing"

DATE: 4-15-87 ATTENDANCE: 28

SPEAKER: Dr. S.J. Anderson
Naval Research Laboratory, Washington, DC
TOPIC: "Frontiers of Skywave Radar Technology"

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MTT-S CHAPTER MEETINGS

(continued from page 33)

FLORIDA WEST COAST (MTT/AP)

DATE: 10-29-86 ATTENDANCE: 13

SPEAKER: Manfred J. Schindler, Raytheon Research Division
TOPIC: "A 15-45 GHz Distributed Amplifier Using 3 FETs of Varying Periphery"

DATE: 11-19-86 ATTENDANCE: 22

SPEAKER: Edward C. Niehenke
Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer
TOPIC: "GaAs — Key to Modern Microwave Technology"

DATE: 1-21-87 ATTENDANCE: 13

SPEAKER: Dr. Naresh Deo
Millitech Corp., So. Deerfield, MA
TOPIC: "Trends and Advances in Millimeter Wave Components and Technology"

DATE: 2-23-87 ATTENDANCE: 20

SPEAKER: Helmut E. Schrank
Westinghouse Electric Corp., Baltimore, MD
TOPIC: "Low Sidelobe Phased Array Antennas"

DATE: 3-1-87 ATTENDANCE: 11

SPEAKER: Prof. Y.T. Lo, Univ. of Illinois, Urbana, IL
TOPIC: "Microstrip Antennas: Theory, Experiments and Applications"

INDIA (MTT/ED)

DATE: 8-4-86, 8-5-86 ATTENDANCE: 16

SPEAKER: Prof. K.C. Gupta
University of Colorado, Boulder, CO
TOPIC: "Computer-Aided Design of Microstrip Circuits — Problems and Current Trends"
"Two-Dimensional Analysis and Planar Components for Microstrip Circuits"
"Multiport Network Approach for Modeling and Analysis for Radiating Microstrip Patterns"
"CAD of Microstrip Patch Antennas — Examples and Mutual Coupling Considerations"

DATE: 9-14-86 ATTENDANCE: 25

SPEAKER: Kenneth L. Carr, M/A-COM, Inc., Burlington, MA
TOPIC: "The Application of Microwave Technology to the Detection and Treatment of Cancer"

MIDDLE AND SOUTH ITALY (MTT/AP)

DATE: 3-23-87 ATTENDANCE: 120

SPEAKER: H.E. Schrank
Westinghouse Electric Corp., Baltimore, MD
TOPIC: "Low Sidelobe Phased Array Antennas"

DATE: 4-9-87 ATTENDANCE: 40

SPEAKER: John H. Bryant
Univ. of Michigan, Ann Arbor, MI
1986/1987 Distinguished Microwave Lecturer
TOPIC: "The First Century of Microwaves — 1886-1986"

DATE: 5-15-87 ATTENDANCE: 15

SPEAKER: Prof. A.K. Fung, Univ. of Texas, Arlington, TX
TOPIC: "Modeling in Microwave Remote Sensing of the Earth Surface"

MILWAUKEE (MTT/ED)

DATE: 10-21-86 ATTENDANCE: 20

SPEAKER: Dr. Devendra K. Misra
Univ. of Wisconsin-Milwaukee, Milwaukee, WI
TOPIC: "Non-Invasive Method for Monitoring the Physiological Movement of the Human Body Using Microwaves"

DATE: 11-12-86 ATTENDANCE: 33

SPEAKER: Dr. T. Ishii
Marquette University, Milwaukee, WI
TOPIC: "Microwave Applications for Industrial Control and Sensing"

DATE: 3-17-87 ATTENDANCE: 104

SPEAKER: Dr. John H. Bryant
Univ. of Michigan, Ann Arbor, MI
1986/1987 Distinguished Microwave Lecturer
TOPIC: "The First Century of Microwaves — 1886-1986"

DATE: 3-17-87 ATTENDANCE: 91

SPEAKER: Edward C. Niehenke
Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer
TOPIC: "GaAs — Key to Modern Microwave Technology"

DATE: 4-22-87 ATTENDANCE: 26

SPEAKER: Dr. J.E. Raue
TRW, Redondo Beach, CA
TOPIC: "Millimeter Waves: Progress and Current Applications"

MONTREAL (MTT/AP/COM)

DATE: 5-1-86 ATTENDANCE:

SPEAKER: Dr. Eleanor H. Hara
Dept. of Communications,
Ontario K1A0C8, Canada
TOPIC: "Fiber Optic Network Designs for Intelligent Buildings — The Fourth Utility Concept"

DATE: 12-10-86 ATTENDANCE:

SPEAKER: Dr. John H. Bryant
Univ. of Michigan, Ann Arbor, MI
1986/1987 Distinguished Microwave Lecturer
TOPIC: "The First Century of Microwaves — 1886-1986"

DATE: 4-1-87 ATTENDANCE:

SPEAKER: Prof. G.W. Farnell
McGill University, Montreal, Canada
TOPIC: "Overview of Acoustic Surface Wave Devices"

NEW JERSEY COAST (MTT/ED/LEO)

DATE: 3-19-87 ATTENDANCE: 24

SPEAKER: Edward C. Niehenke
Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer
TOPIC: "GaAs — Key to Modern Microwave Technology"

DATE: 4-16-87 ATTENDANCE: 42

SPEAKER: Dr. Gareth F. Williams
AT&T Bell Laboratories, Holmdel, NJ
TOPIC: "Inventing for Fun and Profit"

DATE: 4-23-87 ATTENDANCE: 45

SPEAKER: Dr. Stewart D. Personick
Bell Communication Research, Red Bank, NJ
TOPIC: "Photonics (Optical) Switching: Technology and Applications"

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MTT-S CHAPTER MEETINGS

(continued from page 34)

DATE: 5-19-87 ATTENDANCE: 40

SPEAKER: Prof. Y.T. Lo
University of Illinois, Urbana-Champaign
TOPIC: "POLART" — The Magic of EM Waves"

DATE: 6-4-87 ATTENDANCE:

SPEAKER: Dr. Rolf H. Jansen
Industrial Microwave and RF Techniques, Inc.
Ratingen 1, West Germany
1987/1988 Distinguished Microwave Lecturer
TOPIC: "CAD of Hybrid and Monolithic Microwave and
Millimeter-Wave MICs"

NORTH JERSEY (MTT/AP)

DATE: 1-14-85 ATTENDANCE: 57

SPEAKER: Kenneth L. Carr
M/A-COM, Inc., Burlington, MA
TOPIC: "The Application of Microwave Technology to the
Detection and Treatment of Cancer"

DATE: 3-11-85 ATTENDANCE: 21

SPEAKER: Dr. Fred J. Rosenbaum
Central Microwave Co., St. Louis, MO
TOPIC: "Central Microwave Millimeter Wave Solid State
Source"

DATE: 4-24-85 ATTENDANCE: 82

SPEAKER: Dr. Glenn R. Thoren
Raytheon Co., Bedford, MA
TOPIC: "Advanced Millimeter Wave Technology: Solid
State Systems of the Future"

DATE: 4-24-85 ATTENDANCE: 137

SPEAKER: Ted Saad
Sage Laboratories, East Natick, MA
MTT-S Historian
TOPIC: "History of the Radiation Laboratory"

DATE: 3-12-86 ATTENDANCE: 63

SPEAKER: Dr. Richard V. Snyder
RS Microwave Co., Butler, NJ
TOPIC: "Q: How are Microwave Filters like a Fly's Eye?"

DATE: 3-26-86 ATTENDANCE: 61

SPEAKER: Dr. Yuen T. Lo
University of Illinois, Champaign-Urbana, IL
1986/1987 Distinguished Microwave Lecturer
TOPIC: "POLART" — The Magic of EM Waves"

DATE: 3-18-87 ATTENDANCE: 42

SPEAKER: E.C. Niehenke
Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer
TOPIC: "GaAs — Key to Modern Microwave Technology"

DATE: 4-23-87 ATTENDANCE: 32

SPEAKER: Dr. Reinhard Knerr
AT&T Bell Laboratories, Allentown, PA
TOPIC: "Lightwave Communications"

DATE: 5-28-87 ATTENDANCE: 30

SPEAKER: Dr. Gareth F. Williams
AT&T Bell Laboratories, Crawford Hill, NJ
TOPIC: "Inventions for Fun and Profit"

OTTAWA (MTT/AP)

DATE: 10-15-85 ATTENDANCE: 25

SPEAKER: Dr. B. Cornish
Telemus Ltd., Ottawa, Canada
TOPIC: "The Evolution of a New Component — The
Microwave Frequency Halver"

DATE: 12-10-85 ATTENDANCE: 49

SPEAKER: Dr. R. Streater
Bell Northern Research, Ottawa, Canada
TOPIC: "The GaAs Man Cometh"

DATE: 1-28-86 ATTENDANCE: 5

SPEAKER: M. Leitner
Bolriet Technologies, Carleton Place, Canada
TOPIC: "Thin Film on Soft Substrate for Millimeter Wave
Components"

DATE: 4-22-86 ATTENDANCE: 22

SPEAKERS: P.M. Gale and M. Cloutier
Telemus Ltd., Canada
TOPIC: "DRFM (Digital RF Memory) Technology and
Application to EW"

PHILADELPHIA (MTT/AP)

DATE: 9-25-86 ATTENDANCE: 35

SPEAKER: Prof. Bernard D. Steinberg, Univ. of Pennsylvania
TOPIC: "Adaptive Beamforming: What It Is, What It Is
Good For, and How It Is Done"

DATE: 10-23-86 ATTENDANCE: 24

SPEAKER: Dr. Y.T. Lo
University of Illinois, Champaign-Urbana
TOPIC: "Microstrip Antennas: Theory, Experiments and
Applications"

DATE: 11-20-86 ATTENDANCE: 13

SPEAKER: Helmut E. Schrank
Westinghouse Electric Corp., Baltimore, MD
TOPIC: "Low Sidelobe Reflector Antennas"

DATE: 2-26-87 ATTENDANCE: 23

SPEAKER: Herbert J. Wolkstein
RCA Laboratories, Princeton, NJ
TOPIC: "Understanding the Ubiquitous Traveling-Wave
Tube — An Outstanding Amplifier Device"

PHOENIX (MTT/AP/ED/EMC)

DATE: 10-23-86 ATTENDANCE: 28

SPEAKER: Dr. Alan Love
Satellite Systems Division, Rockwell International,
Seal Beach, CA
TOPIC: "Hybrid Mode Horns"

DATE: 11-21-86 ATTENDANCE: 37

SPEAKER: Edward C. Niehenke
Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer
TOPIC: "GaAs — Key to Modern Microwave Technology"

DATE: 1-13-87 ATTENDANCE: 29

SPEAKER: John H. Bryant, Univ. of Michigan, Ann Arbor, MI
1986/1987 Distinguished Microwave Lecturer
TOPIC: "The First Century of Microwaves — 1886-1986"

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MTT-S CHAPTER MEETINGS

(continued from page 35)

DATE: 2-26-87 ATTENDANCE: 34

SPEAKER: Dr. Leon Peters, Jr.

Ohio State University, Columbus, Ohio

TOPIC: "Dominant Scattering Contributions from
'Travelling Wave' Mechanisms"

DATE: 3-19-87 ATTENDANCE: 20

SPEAKER: Dr. Kendall D. Wise

Univ. of Michigan, Ann Arbor, MI

TOPIC: "Integrated Solid State Sensors — Interfacing
Electronics to a Non-Electronic World"

DATE: 4-23-87 ATTENDANCE: 11

SPEAKER: Dr. Anthony P. Trippe, IRT Corp., San Diego, CA

TOPIC: "Nuclear Weapon Effects and the Hardening of
Military Electronics"

PRINCETON (MTT/AP/ED)

DATE: 10-23-86 ATTENDANCE: 12

SPEAKER: Nathan Marcovitz

TOPIC: "Quasiparticle Versus Ray Techniques in Wave
Propagation"

DATE: 1-28-87 ATTENDANCE: 35

SPEAKER: Lawrence West

TOPIC: "Picosecond Integrated Optical Logic Devices
and Nonlinearities"

DATE: 3-19-87 ATTENDANCE: 30

SPEAKER: E.C. Niehenke

Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer

TOPIC: "GaAs — Key to Modern Microwave Technology"

DATE: 6-4-87 ATTENDANCE: 25

SPEAKER: Dr. Rolf Jansen

Industrial Microwave & RF Techniques
West Germany

TOPIC: "CAD of Hybrid and Monolithic Microwave and
Millimeter Wave MICs"

SAN DIEGO (MTT/AP)

DATE: 4-22-87 ATTENDANCE: 19

SPEAKERS: Ruth Hayward, Gus Tricoles

General Dynamics, San Diego, CA

TOPIC: "Wave Fronts: Measurement, Analysis, Reconstruction"

SAN FERNANDO VALLEY (MTT)

DATE: 2-11-87 ATTENDANCE: 38

SPEAKER: Dr. John H. Bryant

Univ. of Michigan, Ann Arbor, MI

1986/1987 Distinguished Microwave Lecturer

TOPIC: "The First Century of Microwaves — 1886-1986"

DATE: 3-19-87 ATTENDANCE: 70

SPEAKER: Bryon Smith, Whittaker-Tasker, Simi Valley, CA

TOPIC: "Digital RF Memories (DRFM)"

DATE: 4-16-87 ATTENDANCE: 34

SPEAKER: Dr. C.K. Chou

Radiation Oncology Division, City of Hope

TOPIC: "Treating Cancer With Heat"

DATE: 5-21-87 ATTENDANCE: 46

SPEAKER: Rob Hartop, Jet Propulsion Laboratory

TOPIC: "The Deep Space Network"

SANTA CLARA VALLEY/SAN FRANCISCO (MTT)

DATE: 9-11-86 ATTENDANCE: 25

SPEAKER: Doug Doherty

Harris Farinon, San Carlos, Ca

TOPIC: "Optical Technology for Communications"

DATE: 10-9-86 ATTENDANCE: 56

SPEAKER: John H. Bryant

Univ. of Michigan, Ann Arbor, MI

1986/1987 Distinguished Microwave Lecturer

TOPIC: "The First Century of Microwaves — 1886-1986"

DATE: 11-13-86 ATTENDANCE: 85

SPEAKER: Larry Lerner, EESOF, Wetlake Village, CA

TOPIC: "Deembedding Techniques for Precision Active
Device Measurement"

DATE: 1-8-87 ATTENDANCE: 87

SPEAKER: Joseph Andrews

Varian Solid State, Santa Clara, CA

TOPIC: "Dielectric Resonator Oscillators"

DATE: 2-12-87 ATTENDANCE: 69

SPEAKER: Edward C. Niehenke

Westinghouse Electric Corp., Baltimore, MD

1986/1987 Distinguished Microwave Lecturer

TOPIC: "GaAs — Key to Modern Microwave Technology"

DATE: 4-9-87 ATTENDANCE: 45

SPEAKER: David Boyd

Eaton Corp., Sunnyvale, CA

TOPIC: "VCO Techniques for EW Systems"

DATE: 5-14-87 ATTENDANCE: 37

SPEAKER: Robert Froelich

Watkins-Johnson, Palo Alto, CA

TOPIC: "Automated Measurement of GaAs FET
Noise Parameters"

SCHENECTADY (MTT)

DATE: 9-25-86 ATTENDANCE: 32

SPEAKER: Zvi Galani

Raytheon Co., Missile Systems Div., Bedford, MA

TOPIC: "The Application of Microwave Signal Sources in
Radar Systems"

DATE: 12-11-86 ATTENDANCE: 34

SPEAKER: Dr. John H. Bryant

Univ. of Michigan, Ann Arbor, MI

1986/1987 Distinguished Microwave Lecturer

TOPIC: "The First Century of Microwaves — 1886-1986"

DATE: 4-9-87 ATTENDANCE: 35

SPEAKER: E.C. Niehenke

Westinghouse Electric Corp., Baltimore, MD

1986/1987 Distinguished Microwave Lecturer

TOPIC: "GaAs — Key to Modern Microwave Technology"

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MTT-S CHAPTER MEETINGS

(continued from page 36)

SEATTLE (MTT/AP)

DATE: 2-17-87 ATTENDANCE: 31

SPEAKER: Edward C. Niehenke
Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer
TOPIC: "GaAs — Key to Modern Microwave Technology"

SOUTH AFRICA (MTT/AP)

DATE: 8-11-86 ATTENDANCE: 40

SPEAKER: Mr. D.A. McNamara
Univ. of Pretoria, Pretoria, South Africa
TOPIC: "Numerical Analysis of Electromagnetic Problems"

SPEAKER: Prof. D.C. Baker
Univ. of Pretoria, Pretoria, South Africa
TOPIC: "MININEC"

SPEAKER: Mr. L. Botha
NIAS, CSIR, P.O. Box 395, Pretoria, S. Africa
TOPIC: "Practical Applications of the Method of Moments"

DATE: 12-5-86 ATTENDANCE: 11
SPEAKER: D.J. Janse van Rensburg
TOPIC: "An Introduction to the Use of Boundary Element Method for Waveguide Problems"

SPEAKER: H.F.V. Boshoff
TOPIC: "An Overview of Design Methods for Antenna Arrays with Non-Uniform Spacing"

SPEAKER: J.C. Olivier
TOPIC: "Design of an Antenna Array with Non-Uniform Element Spacing Using the Source Position Function Method"

SPEAKER: D.J. Janse van Rensburg
TOPIC: "Design of an Antenna Array with Non-Uniform Element Spacing Using Statistical Methods"

DATE: 2-17-87 ATTENDANCE: 38
SPEAKER: Prof. C.W.I. Pistorius
Univ. of Pretoria, Pretoria, South Africa
TOPIC: "New Main Reflector, Subreflector and Dual Chamber Concepts for Compact Range Applications"

DATE: 3-3-87 ATTENDANCE: 21
SPEAKER: Prof. W.J. Louw
Univ. of Pretoria, Pretoria, South Africa
TOPIC: "Aspects of Microwave Mixer Design"

SPEAKER: M. Archer, Univ. of Witwatersrand
TOPIC: "Determination of Search Radar Performance from Flight Trial Data"

SPEAKER: Prof. L.P. Linde
Univ. of Pretoria, Pretoria, South Africa
TOPIC: "An Algorithm for Adaptive Null Steering"

DATE: 4-29-87 ATTENDANCE: 25
SPEAKER: J.R. Nortier, NIAS, CSIR
TOPIC: "Computer-Aided Design of Narrow-Band Etched Band-Stop Filters"

SPEAKER: J.A.G. Malhebe
Univ. of Pretoria, Pretoria, South Africa
TOPIC: "Non-Radiative Dielectric Waveguide: An Overview"

SOUTH BAY HARBOR (LA COUNCIL) (MTT)

DATE: 9-18-86 ATTENDANCE: 48

SPEAKER: Dr. T.B. Ramachandran
M/A-COM Advanced Semiconductor Operations,
Lowell, MA
TOPIC: "State-of-the-Art GaAs Foundry and Devices"

DATE: 11-20-86 ATTENDANCE: 54
SPEAKER: Edward C. Niehenke
Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer
TOPIC: "GaAs — Key to Modern Microwave Technology"

DATE: 1-22-87 ATTENDANCE: 37
SPEAKER: Dr. Ronald C. Rosenfeld
SAWTEK, Inc., Orlando, Florida
TOPIC: "SAW Components and System Applications — An Update"

DATE: 2-10-87 ATTENDANCE: 41
SPEAKER: John H. Bryant
Univ. of Michigan, Ann Arbor, MI
1986/1987 Distinguished Microwave Lecturer
TOPIC: "The First Century of Microwaves — 1886-1986"

DATE: 3-17-87 ATTENDANCE: 65
SPEAKER: Dr. Steve Maas
Aerospace Corp., Los Angeles, CA
TOPIC: "Rethinking the High Performance Mixer"

DATE: 4-21-87 ATTENDANCE: 30
SPEAKER: Dr. Siegfried G. Knorr
Colby Instruments, Santa Monica, CA
TOPIC: "Time-Domain Reflectometry (TDR) Applications"

SOUTHEASTERN MICHIGAN (MTT/AP/ED)

DATE: 10-21-86 ATTENDANCE: 49
SPEAKER: Prof. Robert S. Elliott
University of Southern California, Los Angeles
TOPIC: "The Design of Microwave Arrays"

DATE: 1-20-87 ATTENDANCE: 38
SPEAKER: Prof. Tapan K. Sarkar
Syracuse University, Syracuse, NY
TOPIC: "Application of the Conjugate Gradient Method to Electromagnetics"

DATE: 3-3-87 ATTENDANCE: 35
SPEAKER: Prof. Walter D. Burnside
The Ohio State University, Columbus, Ohio
TOPIC: "Past, Present and Future of Compact Range Measurement Systems"

DATE: 4-7-87 ATTENDANCE: 36
SPEAKER: Edward C. Niehenke
Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer
TOPIC: "GaAs — Key to Modern Microwave Technology"

DATE: 4-21-87 ATTENDANCE: 50
SPEAKER: Prof. Kensall D. Wise
Univ. of Michigan, Ann Arbor, MI
TOPIC: "Integrated Solid State Sensors: Interfacing Electronics to a Non-Electrical World"

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MTT-S CHAPTER MEETINGS

(continued from page 37)

SWEDEN (MTT/AP)

DATE: 2-24-87 ATTENDANCE: 16

SPEAKER: Prof. R. Harrison

Carleton University, Ottawa, Canada

TOPIC: "Design and Application of Microwave Frequency Halvers"

SWITZERLAND (MTT/AP)

DATE: 6-26-86 ATTENDANCE: 13

SPEAKER: Prof. R.S. Elliott, AP-S Distinguished Lecturer

TOPIC: "The Design of Microwave Arrays"

DATE: 9-5-86 ATTENDANCE: 22

SPEAKER: Dr. R. Wohllenben

Max Planck Inst. for Radioastronomy, Bonn, BRD

TOPIC: "Interferometry in Radar"

SPEAKER: Dr. C. Matzler

Univ. of Bern, Bern, Switzerland

TOPIC: "Optimized Sensors for Microwave Remote Sensing"

DATE: 11-3-86 ATTENDANCE: 32

SPEAKER: Edward C. Niehenke

Westinghouse Electric Corp., Baltimore, MD

1986/1987 Distinguished Microwave Lecturer

TOPIC: "GaAs — Key to Modern Microwave Technology"

DATE: 11-19-86 ATTENDANCE: 45

SPEAKER: H.R. Benedickter

Inst. for Field Theory and HF Techniques

Zurich, Switzerland

TOPIC: "Stripline Techniques"

"Measurement Instruments for Microwaves"

SPEAKER: R. Hoffman, Balzers AG, Balzers

TOPIC: "Substrate Materials"

SPEAKER: R. Kunzi, Univ. of Bern, Bern, Switzerland

TOPIC: "MM-Wave Receivers"

SPEAKER: H.G. Mathews, BBC, Baden

TOPIC: "The Gyrotron"

SPEAKER: Prof. Rhodes, Univ. of Leeds, Leeds, UK

TOPIC: "Filters and Multiplexers"

SPEAKERS: A. Brugger and O.J. Kerley

Huber & Suhner AG, Herisan

TOPIC: "Coaxial/Waveguide Filters"

SPEAKER: R. Steffen

Siemens-Albis AG, Zurich, Switzerland

TOPIC: "Pulse Compression"

SYRACUSE (MTT/AP)

DATE: 9-23-86 ATTENDANCE: 49

SPEAKER: Helmut Schrank

Westinghouse Electric Corp., Baltimore, MD

TOPIC: "Low Sidelobe Phased Array Antennas"

DATE: 10-23-86 ATTENDANCE: 25

SPEAKER: Robert S. Elliott

Univ. of California, Los Angeles, CA

TOPIC: "Pattern Synthesis of Linear and Phased Arrays"

DATE: 11-24-86 ATTENDANCE: 15

SPEAKER: Vahe Adamian

Automatic Testing and Networking, Inc.

Lexington, MA

TOPIC: "Automatic Noise Figure and Noise Parameter Measurements of Microwave Components"

TOKYO (MTT)

DATE: 8-8-86 ATTENDANCE: 32

SPEAKER: Prof. Tatsuo Itoh

University of Texas at Austin, Austin, TX

TOPIC: "Application of Electromagnetics to New Millimeter Wave Structures"

DATE: 12-19-86 ATTENDANCE: 33

SPEAKER: Kenneth L. Carr (from videotape)

M/A-COM, Inc., Burlington, MA

1985/1986 Distinguished Microwave Lecturer

TOPIC: "The Application of Microwave Technology to the Detection and Treatment of Cancer"

DATE: 12-19-86 ATTENDANCE: 5

SPEAKER: Prof. Eikichi Yamashita

Univ. of Electro-Communications, Tokyo, Japan

TOPIC: "The Role of MTT Society Tokyo Chapter Officers"

DATE: 4-24-87 ATTENDANCE: 31

SPEAKER: Prof. Tatsuo Itoh

Univ. of Texas at Austin, Austin, TX

TOPIC: "Recent Advances in Quasi-Optical Microwave and Millimeter Wave Integrated Circuits"

SPEAKER: Prof. Roberto Sorrentino

University of Rome, Rome, Italy

TOPIC: "Image Parameter Method for Planar Circuit Filters"

TUCSON (MTT/AP/COM/EMC)

DATE: 4-24-86 ATTENDANCE: 33

SPEAKER: Bud Eldon, Past President of the IEEE

TOPIC: "What the IEEE Can Do For You"

DATE: 5-28-86 ATTENDANCE: 32

SPEAKER: Dr. Allen Mense, Chief Scientist

TOPIC: "Strategic Defense Initiative (SDI)"

DATE: 11-25-86 ATTENDANCE: 26

SPEAKER: Howard Kohlbacher

Tucson Pace Chairman

TOPIC: "Education — The Key to America's Future"

DATE: 12-12-86 ATTENDANCE: 50

SPEAKER: Clint James, Sr. Engineer, Kit Peak

TOPIC: "Multiple Mirror Telescopes"

TWIN CITIES (MTT)

DATE: 9-17-86 ATTENDANCE: 22

SPEAKER: E.C. Niehenke

Westinghouse Electric Corp., Baltimore, MD

1986/1987 Distinguished Microwave Lecturer

TOPIC: "GaAs — Key to Modern Microwave Technology"

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MTT-S CHAPTER MEETINGS

(continued from page 38)

DATE: 10-30-86 ATTENDANCE: 30
SPEAKER: Dr. John H. Bryant, Univ. of Michigan, Ann Arbor, MI
1986/1987 Distinguished Microwave Lecturer
TOPIC: "The First Century of Microwaves — 1886-1986"

DATE: 11-20-86 ATTENDANCE: 45
SPEAKER: Dr. R. Artz, Sperry Computer Systems
TOPIC: "Next Generation Weather Radar System — NEXRAD"

DATE: 2-19-87 ATTENDANCE: 28
SPEAKER: Dr. G. O'Clock, Mankato State Univ., Mankato, MN
TOPIC: "Satellite Microwave Systems"

DATE: 3-19-87 ATTENDANCE: 35
SPEAKER: George Gill, Millitech Corporation
TOPIC: "Monopulse Antenna Techniques"

DATE: 4-23-87 ATTENDANCE: 22
SPEAKER: Joel Larson, Hewlett-Packard
TOPIC: "Measurement Techniques Using the HP 8510
Network Analyzer"

SPEAKER: Dr. Eugene Kutz, Kutz Graduate School
TOPIC: "Engineering Management is the Future"

DATE: 5-21-87 ATTENDANCE: 26
SPEAKER: David Fryklund, M/A-COM, Inc.
TOPIC: "MIMIC Components Design and Applications"

WASHINGTON/NORTHERN VIRGINIA (MTT)

DATE: 10-14-86 ATTENDANCE: 100
SPEAKER: Dr. D. Curtis Schleher, Eaton Corp., Deer Park, NY
TOPIC: "Electronic Warfare (EW) — Principles and Overview"

DATE: 11-5-86 ATTENDANCE: 44
Joint Meeting with Baltimore Chapter
SPEAKER: Dr. John H. Bryant, Univ. of Michigan, Ann Arbor, MI
1986/1987 Distinguished Microwave Lecturer
TOPIC: "The First Century of Microwaves — 1886-1986"

DATE: 11-11-86 ATTENDANCE: 85
SPEAKER: Allan Baron, Litton Amecon, College Park, MD
TOPIC: "Electronic Support Measures (ESM) Receivers"

DATE: 12-9-86 ATTENDANCE: 65
SPEAKER: William E. Sears
Georgia Tech Research Institute, Atlanta, GA
TOPIC: "Electronic Countermeasures (ECM)"

DATE: 1-13-87 ATTENDANCE: 125
SPEAKER: Dr. Merrill I. Skolnik
Naval Research Labs, Washington, DC
TOPIC: "Electronic Counter-Counter Measures (ECCM)"

DATE: 2-10-87 ATTENDANCE: 48
SPEAKER: George Nicholas
George Nicholas Enterprises, Arlington, VA
TOPIC: "Command, Control & Communication Systems"

DATE: 3-10-87 ATTENDANCE: 60
SPEAKER: Edwin M. Drogin
Eaton Corp., AIL Div., Deer Park, NY
TOPIC: "EW Signal Processing"

DATE: 4-7-87 ATTENDANCE: 59
SPEAKER: Dr. John Montgomery, Naval Research Laboratory
TOPIC: "EW Technology and Future Trends"

MTT-S SPECIAL MEETINGS, COURSES, SYMPOSIA WORKSHOPS, CLINICS & SOCIAL EVENTS (1986/1987)

ALBUQUERQUE (MTT/AP/EMC)

DATE: 12-31-86 ATTENDANCE:
TYPE OF FUNCTION: New Year's Eve Party at the home of
Bob & Linda Gardner, Sandia Heights, NM.

BALTIMORE (MTT/AP)

DATE: 11-22-86 ATTENDANCE: 69
TYPE OF MEETING: One day short course
SUBJECT: "Modern Radar Systems: Fundamentals and
Future Trends"

SPEAKERS:

(all from Westinghouse Electric Corp., Baltimore, MD)
J. Kane, "Radar Overview"
F. Falkowski, "Radar Receivers"
C. Keagle, "Digital Signal Processing"
S. Caldwell, "Microwave Signal Generation"
W. Fedarko, "System Overview"
W. Hapwood, "Wideband Radar"

CENTRAL NEW ENGLAND/BOSTON (MTT)

DATE: 9-18-86 ATTENDANCE:
TYPE OF MEETING: A Panel Discussion
TOPIC: "GaAs Foundry Services"

PANEL MEMBERS:

Dr. Yalcin Ayasli, Hittite Microwave Corp.
Dr. Richard Gold, Adams-Russell Company
Thomas Leonard, M/A-COM Advanced
Semiconductor Operations
Dr. James Oakes, Raytheon SMDO
Lt. John Schoenberg, Rome Air Development Center
Dr. Donald Temme, MIT Lincoln Laboratory

DATE: 3-19-87 ATTENDANCE: 57
TYPE OF MEETING: Panel Discussion
TOPIC: "Microwave Computer-Aided Design"

SPEAKERS: O. Pitzalis
R. Pucel
S. Powell
T. Spohrmann

DALLAS (MTT)

DATE: 9-26-86 ATTENDANCE: 178
TYPE OF MEETING: Mini-Seminar
TOPIC: "Electronic Warfare Receivers"
SPEAKERS: C. Frey, "Introduction to Advanced Receivers"
L. Blacketter, "The Channelized Receiver"
Bill Daniels, "SAW Device Technology to Support
Advanced Receivers"
Hal Camp, "Processing of Receiver Output"

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MTT-S SPECIAL MEETINGS

(continued from page 39)

DATE: 10-23-86 ATTENDANCE (Technical Meeting): 82
137 Guests, 155 Manufacturers Representatives
TYPE OF MEETING: 3rd Annual Industry Event — Microwave
Products Exhibits

SPEAKER: Alexander E. Braun
Microwave Systems News and Communication
Technology
TOPIC: "Strategic Defense Initiative — The Scientific Hurdles"

DATE: 4-9-87 ATTENDANCE: 72
TOPIC: "High Electron Mobility Transistor (HEMT) Tutorial"
SPEAKERS:

Dr. Umberto Ravaioli, Univ. of Illinois
"Simulation of the HEMT"
Dr. K. Nakano, TRW, Redondo Beach, CA
"High Performance Quarter Micron Gate MODFETs"
Dr. John Herb, Gould, Inc., San Jose, CA
"HEMTs: The Transition to Production"
Dr. H.D. Shih, Texas Instruments, Inc., Dallas, TX
"Preparation and Properties of Epitaxial Structures of
HEMTs"

DATE: 5-28-87 ATTENDANCE: 45
TOPIC: Preview of Technical Papers to be Presented at
the 1987 International Microwave Symposium
SPEAKERS: Local Authors

INDIA (MTT/ED)

DATE: 8-1-86, 8-2-86 ATTENDANCE: 40
TYPE OF MEETING: Annual Workshop
TOPIC: Bioelectromagnetics

SPEAKERS:
Prof. O.P. Gandhi
Univ. of Utah, Salt Lake City, Utah, USA
"Recent Advances in the Dosimetry of Radio Frequency
and Microwave Radiation"
"Calculation of Three Dimensional Pattern for RF
Hyperthermia"
"Current Induced in a Human Being for Plane Wave Ex-
posure Conditions 0-50 MHz and for RF Sealers"
"The ANSI RF Safety Guidelines — Its Rationale and Some
of Its Problems"

Prof. S. Saha
"The Effect of Electromagnetic Simulation on Bone Growth
and Repair"
"Electrical Properties of the Bone"

Prof. S.K. Guha, I.I.T., New Delhi, India
"Medical Application of Electromagnetic Fields (Parts 1 & 2)"

Dr. J. Behari
Jawaharlal Nehru Univ., New Delhi, India
"Dielectric Dispersion and Mechanism of Microwave Interac-
tion in Biological Media"

ISRAEL (MTT/AP)

DATE: 10-27-86 ATTENDANCE: 80
TYPE OF MEETING: Microwave Symposium
SPEAKER: Edward C. Niehenke

Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer

TOPIC: "GaAs — Key to Modern Microwave Technology"
OTHER PRESENTATIONS: Eight presentations by Israeli re-
searchers on various topics such as nonlinear network analysis,
dielectric resonator oscillators, FET amplifiers, antennas, swit-
ching arrays, power amplifiers, filters and MESFET devices.

DATE: 3-17-87 ATTENDANCE: 70
TYPE OF MEETING: Eighth One-Day Symposium
GUEST LECTURER: Helmut E. Schrank
Westinghouse Electric Corp., Baltimore,
MD

TOPIC: "Low Sidelobe Antennas"
TOTAL NUMBER OF PRESENTATIONS: 6

DATE: 8-7-87, 8-8-87 ATTENDANCE:
TYPE OF MEETING: Fifteenth Convention of Electrical
Engineers in Israel. This was a section activity. It included two
microwave sessions. Total number of presentations in
microwave sessions: 14. Estimated attendance in microwave
sessions: 50.

SPEAKER: John H. Bryant
Univ. of Michigan, Ann Arbor, MI
"The First Century of Microwaves — 1886-1986"

NORTH JERSEY (MTT/AP)

DATE: 10-29-86 ATTENDANCE: 500 +
TYPE OF MEETING: Symposium and Mini Show
SPEAKERS:

Dr. Reinhard Knerr
AT&T Bell Laboratories, Allentown, PA
"Lightwave Local Area Networks"
Attendance: Approx. 100

Dr. John Bryant
Univ. of Michigan, Ann Arbor, MI
1986/1987 Distinguished Microwave Lecturer
"The First Century of Microwaves — 1886-1986"
Attendance: Approx. 110

PHILADELPHIA (MTT/AP)

DATE: 3-21-87 ATTENDANCE: 133
TYPE OF MEETING: Ben Franklin Symposium on Advances in
Antenna and Microwave Technology
21 SPEAKERS

SANTA CLARA VALLEY/SAN FRANCISCO (MTT)

DATE: 3-21-87 ATTENDANCE:
TYPE OF MEETING: One-Day Short Course
TOPIC: "High Volume Microwave Applications"
9 SPEAKERS

SOUTH AFRICA (MTT/AP)

DATE: 10-15-86 ATTENDANCE: 22
TYPE OF MEETING: Presentation of Papers Presented by Local
Chapter Members at Recent Overseas Symposia
SPEAKERS:

J.C. Olivier and J.A.G. Malherbe
Univ. of Pretoria, Pretoria, South Africa
"A Bandstop Filter Constructed in Non-Radiative Dielectric
Waveguide"

D.J. Janse van Rensburg, J.A.G. Malherbe, D.A.
McNamara, University of Pretoria
"Electromagnetic Scattering from a Dielectric Body Using
Physical Optics"

D.A. McNamara, University of Pretoria
"The Exact Synthesis of Exact Difference Patterns for
Discrete Analysis"

L. Botha, CSIR & D.A. McNamara, Univ. of Pretoria
"Theoretical Prediction of Bearing Errors of Vehicle
Mounted DF Systems"

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MTT-S SPECIAL MEETINGS

(continued from page 40)

K. Cloete and J.A.G. Malherbe, Univ. of Pretoria
"Accuracy of a Physical Optics Approximation to the Backscatter of a Complex Structure"

J.H. Cloete and C.F. du Toit, Univ. of Stellenbosch
"Dielectric Loading of a Small Ridged Cavity Backed Slot Antenna"

J.A.G. Malherbe, University of Pretoria
"A Compact Horn Antenna with Low Return Loss"

D.C. Baker, D.A. McNamara, G.W. Reed
University of Pretoria
L. Botha, CSIR

"Results of Numerical and Physical Modeling of Airborne Adcock Arrays for VHF DF Arrays"

D.E. Baker and C.A. van der Neut, CSIR
"Evaluation of Localized Inhomogeneities in the Reflectivity of Planar Absorbing Panels"

D.E. Baker and L. Botha, CSIR
"Pattern Prediction of Broadband Monopole Antennas on Finite Ground Planes Using the BOR Moment Method"

DATE: 3-24-87 ATTENDANCE: 16
TYPE OF MEETING: MTT-S and AP-S Workshop
SPEAKERS:

V. v d Riet
"Computed and Measured Responses of a Resonant Quadrifilar Helix"

L. Botha
"Comparison of Results Obtained NEC, THWIRE and Measurements"

T. Reuss
"Comparison of NEC Predicted Results with Logperiodic and Yagi Antenna Measurements"

D. Davidson
"Experience with the Body of Revolution Method"

A. Fourie
"NEC 2 Simulation of Broadband HF Antennas"

A. Kahn
"An Interactive Preprocessor for NEC"

D.J. v Rensburg
"An Interactive Pre- and Postprocessor for the Piecewise Sinusoid Thinwire Method of Moments Code"

SWEDEN (MTT/AP)

DATE: 11-6-86 ATTENDANCE: 26
TYPE OF MEETING: Seminar on GaAs Devices, Circuits and MMIC

SPEAKERS:

Edward C. Niehenke
Westinghouse Electric Corp., Baltimore, MD
1986/1987 Distinguished Microwave Lecturer
"GaAs — Key to Modern Microwave Technology"

Dr. Staffan Rudner
National Defense Research Institute (FOA), Linköping
"Microwave Devices and Circuits Developed at FOA 3"

Dr. Florian Sellberg
Microwave Institute Foundation, Stockholm
"The Nordic GaAs Programme (NOGAP) and Development of MMIC CAD Tools at IM"

Prof. Erik Kollberg
Ericsson Radio Systems, Molndal, Chalmers University of Technology
"Activities Concerning GaAs Devices in Gothenburg"

TOKYO (MTT)

DATE: 5-8-86 ATTENDANCE: 16
TYPE OF MEETING: The Rehearsal of 1986 MTT-S Symposium Speakers

SPEAKERS: Hideki Asao and six other speakers and B. Martel, Mitsubishi Electric Corp, Kamakura, Japan

DATE: 7-25-86 ATTENDANCE: 8
TYPE OF MEETING: Meeting of the MTT-S Tokyo Chapter Delegation of the European Microwave Conference
SPEAKERS: Eikichi Yamashita and seven other members Univ. of Electro-Communications, Tokyo, Japan

DATE: 7-25-86 ATTENDANCE: 43
TYPE OF MEETING: Report of the 1985 International Conference on Infrared and Millimeter Waves
SPEAKER: Kouji Mizuno
Tohoku Univ., 2-1-1, Katahira, Sendai, Japan

DATE: 9-22-86 ATTENDANCE: 28
TYPE OF MEETING: Workshop on Dielectric Resonators
SPEAKERS:

Prof. Yoshio Kabayashi
Saitama Univ., 255 Shimoohkubo, Urawa-shi, Japan
"Optimum Design Method"

Dr. Kikuo Wakino
Murata Mfg. Co., Nagapakyo-shi, Kyoto, Japan
"Material Design"

DATE: 10-24-86 ATTENDANCE: 22
TYPE OF MEETING: Report on 1986 MTT-S International Microwave Symposium
SPEAKERS: Hiroshi Shigesawa and six other speakers
Doshisha Univ., Kamigyo-ku, Kyoto, Japan

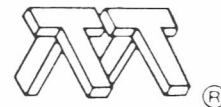
DATE: 12-19-86 ATTENDANCE: 33
TYPE OF MEETING: Report on 1986 European Microwave Conference

SPEAKERS: Prof. Tsukasa Yoneyama
Tohoku Univ., Sendai, 980 Japan

Dr. Yoichiro Takayama
NEC Corp., Miyamae-ku, Kawasaki, Kanagawa, Japan

DATE: 5-25-87 ATTENDANCE: 13
TYPE OF MEETING: The Rehearsal of 1987 MTT-S Symposium Speakers

SPEAKERS: T. Noguchi and nine other speakers and R. Magallanes (presentation specialist)
NTT Yokosuka Research Center
Yokosuka-shi, Japan



THE FIRST CENTURY OF MICROWAVES 1886 to 1986

A Historical Perspective of Microwave Devices and Their Uses



by John H. Bryant

DISTINGUISHED MICROWAVE LECTURER (1986/1987)

I have given 48 lectures on "The First Century of Microwaves, 1886-1986," from July 1986 through June 1987. The average attendance was 42, ranging from 12 to 151. Of the 48 lectures, 38 were given in the U.S., four in Canada, and six overseas. More than 2,000 IEEE members and colleagues turned out for this historical approach to the topic.

To sum up my year, I can say that an MTT-S Lectureship is labor-intensive. The amount of communication involved was astonishing, averaging eight or more phone calls or letters per lecture, all of which required planning and follow-up. I never missed an appointment, or failed to have a slide projector for use. I made every effort to arrive early for each visit, and I learned that there are plenty of very early morning airline flights scheduled. My trip planning was not very optimal from a weather and seasonal point of view. I followed the policy that the first request got the requested schedule. As one result, for example, I gave four lectures in one week in Florida in September while between December 8th and January 8th I gave four lectures in Canada, plus one each in Schenectady and Buffalo.

The scheduling and detailed arrangements for travel: where to stay, where to be and when for get-togethers during the day, and for the lecture, had to be made with individuals who are themselves very busy. These arrangements, plus the actual travel and follow-up, make this nearly a full-time job for the 8 or 9 months during which meetings are generally held. It was stimulating for me, nevertheless, and I trust the MTT-S and the more than 2,000 members and colleagues who attended the lectures during 86-87 also gained something from them.

Needless to say, I learned a great deal. I perceive that my lectures and the resulting discussions have stimulated increased interest in the history of our field and increased the awareness of the need to document key work and collect artifacts while the players and artifacts are still available. In several instances historical work is now in progress as a result of my efforts.

The lectureship has been personally rewarding, and I want to take this opportunity to thank the numerous people who became involved for their hospitality and cooperation in making the visits successful.

TECHNOLOGY TRENDS IN MICROWAVE RADAR



by David Barton
ANRO Engineering Consultants
5 Militia Drive
Lexington, MA 02173
Phone (617) 862-3000

DISTINGUISHED MICROWAVE LECTURER (1987/1988)

Abstract

The capabilities of microwave devices used in today's radars are compared with requirements for future systems. Areas in which system requirements may drive technological advances are identified, along with those in which technology may open up new system approaches. An example of the former is the requirement for ultra-stable microwave sources to drive doppler radar systems operating with high power near the ground surface. To date, the only satisfactory source is a cavity-stabilized klystron oscillator operating in the final RF band. An example of the second is the modular, solid-state T/R module for small tactical radar applications. Modular arrays have, in the past, been limited primarily to large systems in the lower-frequency bands, but the prospect of greater efficiency in the microwave bands makes it possible to consider the modular approach to mobile and airborne radars.

The relationships among modular phased arrays, solid-state microwave sources and conventional antennas and transmitters are explored. There have been predictions for the past twenty-five years that reflector antenna systems would be phased out of the inventory, to be replaced first by passive arrays and then by active modular arrays. The slow rate at which these predictions have been realized is only partly explained by the high cost of phase shifters and the high cost and limited power capability of microwave T/R modules. Some of the system considerations in applying the new technology are reviewed, and areas in which applications may be most practical are identified.

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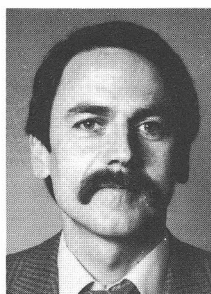
**DISTINGUISHED MICROWAVE LECTURER —
David Barton** (continued from page 42)

BIOGRAPHY

David K. Barton joined the staff of ANRO Engineering Consultants in 1984 after serving 21 years with the Raytheon Company. Prior to that, he was with RCA at Moorestown, NJ and with the Signal Corps Engineering Labs at Ft. Monmouth, NJ and White Sands Missile Range. He is a Fellow of the IEEE and has been active in that organization's Aerospace and Electronic Systems Society, having served on the Board of Governors, as Associate Editor for Radar of the AES Transactions, and as Chairman of the Radar Systems Panel.

Barton has specialized in radar since his graduation from Harvard College in 1949 with an AB in Physics. He has authored 75 papers and books on radar engineering subjects. He is the author of *Radar System Analysis*, and coauthor of the *Handbook of Radar Measurement*, both published by Artech House. David Barton is also the series editor of the Artech Radar Library, which includes a seven-volume set on *Radars*. He is a lecturer on radar in The George Washington University's program on Continuing Engineering Education, and has served on a number of advisory committees to the Department of Defense. In 1958 he received RCA's David W. Sarnoff Award for outstanding achievement in engineering, in 1961 the IEEE PGMIL M. Barry Carlton Award, and in 1984 the IEEE Centennial Medal.

CAD OF HYBRID AND MONOLITHIC MICROWAVE AND MILLIMETER-WAVE MICs



by *Rolf H. Jansen*
*Industrial Microwave and RF
Techniques, Inc.*
*Neanderstrasse 5
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West Germany
Phone 49-2102-83095*

**DISTINGUISHED MICROWAVE LECTURER
(1987/1988)**

Abstract

With the availability of transistors having useful gain in the MM-wave range and the advanced development of GaAs monolithic MICs in the last five years, demand for accurate and reliable CAD up to highest frequen-

cies is growing. The economic design of MMICs without CAD is simply impossible. Yet the development of sophisticated computer-aided design tools is far behind the pace of technology and the needs arising thereof, similarly as in the early days of silicon ICs. With today's advanced technologies having complex metallization schemes, multilayer dielectrics and submicron devices, it is necessary to employ improved component modules and CAD strategies to ensure first design iteration success as far as possible. In view of this, engineering workstations are under development which will finally close the gap between standard technology processes and CAD as well as eventually merge silicon and GaAs design techniques.

The electrical phenomena which complicate the design of MICs into the MM-wave range will be discussed in relation to technological and economic requirements. Also, an overview on existing CAD packages and their specific features will be given. This includes the first commercial solutions representing essentially extensions from the electronic circuit domain as well as a variety of less-known dedicated microwave packages with particular stress put on developments made in Europe. The discussion addresses linear and non-linear CAD and the advantages and shortcomings of frequency-domain and time-domain analysis. Out of more than 10 years of professional experience in the computer-aided design and realization of MICs, a judgement of the existing solutions and concepts will be attempted. A process-independent design and layout engineering workstation system as it is presently configured in one of Europe's most progressive GaAs MIC companies will be described. The lecture will be concluded by a demonstration of various MMIC designs and the latest techniques used to simulate the respective circuits and verify new modeling approaches and CAD strategies.

BIOGRAPHY

Rolf H. Jansen received his MS (1972) and Ph.D. (1975) degrees, both in electrical engineering, from the University of Aachen (RWTH). In his thesis he treated large-signal bipolar transistor modeling and the hybrid-mode analysis of arbitrarily-shaped microstrip structures, respectively. He continued his research work at the RWTH Aachen microwave laboratory as a Senior Research Engineer (1976-1979) where he was mainly engaged in the characterization of MIC components and the CAD of microwave circuits. He was also in charge of the thin-film technology of the microwave lab and, since 1977, worked as a research associate for radio communication at Standard Elektrik Lorenz AG (SEL) in Pforzheim, West Germany.

In 1979, he became Professor of Electrical Engineering at the University of Duisburg near Dusseldorf/Cologne and did teaching and research on such topics as electromagnetic theory, microwave techniques and CAD, measurement techniques and modeling. His university career was supplemented by a one year's leave 1981/1982 as a full-time scientist with SEL

continued on page 44

DISTINGUISHED MICROWAVE LECTURER —

Rolf H. Jansen (continued from page 43)

Pforzheim, and of a variety of software and hardware projects for the communication industry since 1976. He developed, introduced and tested the first layout-oriented general purpose microwave CAD package in a West Germany production-oriented industry environment. He is author of 55 technical papers in the field of microwave CAD and related topics and recipient of the outstanding publications award in 1979 of the German Society of Radio Engineers.

Presently, with a preparatory phase since the end of 1984, he is engaged in the development of a novel engineering CAD workstation for GaAs MMICs with Plessey Research Caswell, GB, following completely new design concepts. He is co-founder of MCAD Software and Design Corp. in Aachen and owner of another small microwave company. He is a Senior Member of the IEEE, member of the editorial board of the Transactions on MTT and of two MTT Technical committees. He is serving as the West Germany MTT Chapter Chairman for the period 6/85 to 5/87.

LIGHTWAVE COMMUNICATIONS



by Reinhard H. Knerr
AT&T Bell Laboratories
555 Union Boulevard
Allentown, PA 18103
Phone (215) 439-7505

DISTINGUISHED MICROWAVE LECTURER (1988/1989)

Abstract

Lightwave communications technology has now reached a fairly sophisticated level of maturity. Applications range from multi-mode short wavelength LED systems, which can transmit at kilobits per second and are used primarily for short range applications, to long-haul single-mode laser systems, which can transmit at the rate of gigabits per second.

This talk will touch on the full range of lightwave communications applications. A short introduction to basic fiber technology will be given. Applications to optical data links and interfaces for point to point data networks, will be discussed as well as the extension of such technologies to lightwave local area networks (LANs). Different network architectures for lightwave LANs will be discussed, including the fiber distributed

data interface (FDDI), and the manufacturing automatic protocol (MAP). Long haul digital systems will be mentioned, with special emphasis on the microwave aspects of gigabit systems, such as stripline and low noise GaAs preamplifier technology.

Coherent lightwave systems will be reviewed with emphasis on the equivalence between such systems and the older microwave technology. We will detail problems which have been addressed in microwave systems and which are now being encountered in coherent lightwave systems and being solved by analogy to the older microwave technology. These include techniques such as isolation, internal and external modulation schemes, low noise amplification and phase lock techniques. Emphasis will be placed on heterodyne rather than homodyne systems.

Because of the wide range of topics covered, the talk will be more in the nature of a review than an in-depth presentation of any given topic. Some theoretical discussion will be included, but hardware will be emphasized. We will conclude with a short look into the future, and a discussion of the fundamental problems that have yet to be solved in order to make certain exploratory systems practical.

BIOGRAPHY

Reinhard H. Knerr is a native of Pirmasens, Germany. He received a PhD and an MS in EE from Lehigh University, Bethlehem, PA and Dipl. Ing. degree from the Ecole Nationale Supérieure d'Electrotechnique et d'Hydraulique in Toulouse, France and a BS degree from the Technical University of Aachen, Germany.

He joined AT&T Bell Laboratories as a Member of the Technical Staff in 1968. He was involved in R&D on circulators, IMPATT power amplifiers, low noise and power GaAs FET amplifiers and satellite receivers. He has published extensively in the field and holds six patents.

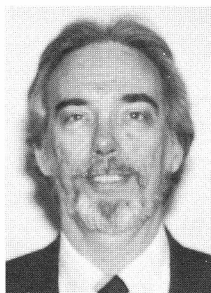
Knerr has supervised work in lightwave passive components, integrated optics, lightwave local area networks and lightwave data interfaces.

He is a Fellow of the IEEE and was editor of the Transactions on MTT from 1980 to 1982. He served as president of the MTT Society in 1986.

A long, hot shower can be dangerous. The water commonly releases two toxic chemicals, trichlorethylene and chloroform, which are then inhaled in high concentrations. *Safer:* Take the quickest and coolest shower you can stand. Set your shower head for the coarsest spray. Ventilate your bathroom by opening a window or using a fan. Or take a bath...the chemical concentration is only half as high.

Research by Julian Andelman, Ph.D., University of Pittsburgh's School of Public Health, cited in *Mademoiselle*, 304 E. 45 St., New York, NY 10117, monthly, \$12/year.

MEMBERSHIP DEVELOPMENT



by Alton L. Estes
Membership Development

1987 Progress Report

Growth Rate Continues Above Ten Percent

The Society Membership has continued to increase steadily this year through June when compares on a month-by-month basis to the 1986 Membership results. The MTT-S membership growth rate compared to the other 32 IEEE Societies has varied between second and third place for the first six months of 1987. At the end of June, the MTT-S was the 2nd fastest growing IEEE Society with a 10.6% Membership growth over June, 1986 MTT-S Membership results. This growth rate compares favorably to the Institute Society Membership growth rate of 2.9% for the same period. In addition, MTT-S is currently the 7th largest Society with 9,229 active Members. The MTT-S was the 9th largest Society at the end of 1986 with 9,445 active members. The MTT-S Membership growth rate for the rest of 1987 is expected to average 10%, which indicates the MTT-S Membership will end 1987 at our goal of 10,390 active Members.

Membership Booth Enrolled 167 Members

Due to the efforts of many active MTT-S Members the IEEE/MTT-S membership booth set up at the 1987 IEEE MTT-S was a tremendous success. Thanks to all who participated in making this year's booth a success. A total of 167 new Members enrolled with the Society. Of this total, 129 Members joined the IEEE in addition to the MTT-S, and 38 current IEEE Members took advantage of the free Membership offer by our Society. Also, adding to the booth success was the receiving and servicing of many inquiries concerning current IEEE or MTT-S Members. In addition, three MTT-S Members paid their dues which were in arrears.

The booth was a success because of four reasons. First, over sixty MTT-S members volunteered one or more hours of their time to staff the booth. The volunteers included elected AdCom members, Chapter Chairmen, Chapter Vice-Chairmen, Symposium speakers, workshop speaker or coordinators, and other very active MTT-S members. Second, Steve March and the 1987 IEEE MTT-S International Microwave Steering Committee allowed some of the Symposium non-member fees to be applied to reducing the costs of joining the IEEE at the booth. Third, advertisement of the

reduced fees seemed to increase enrollment. Fourth, the application allowed enrollment fees to be charged. Of the 129 enrolling IEEE Members; 91 charged their dues, 15 paid by check and 23 paid cash.

Other Activities

Many other Membership Development activities have occurred this year and a summary of this activity would be too lengthy for this newsletter. However, most of this activity is described within the minutes of the recent AdCom meetings. Ask your Chapter Chairman to let you look at his or her copy of the minutes if you are interested in more details about Membership statistics (such as retainment, Chapter Membership, arrears, reinstatements, etc.) or other Membership Development activities and tasks.

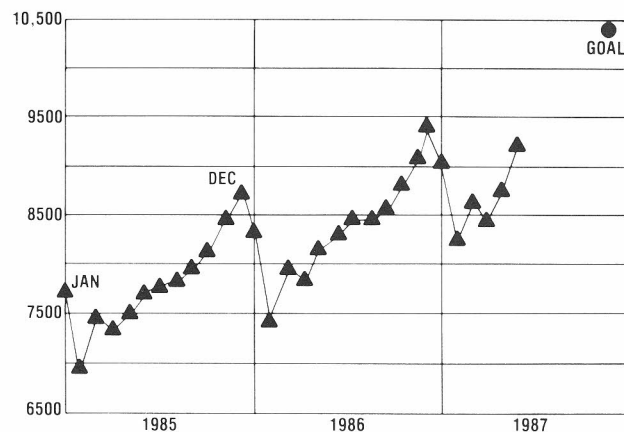
Extended Membership for New MTT-S Members

New members joining MTT-S will receive free MTT-S membership to the end of 1988. These new members may be IEEE members who do not currently belong to the MTT-S or they must join the IEEE and the MTT-S concurrently. This free membership offer should stimulate your colleagues and friends to join MTT and benefit from the educational opportunities that the Society has to offer. Please refer to the Newsletter article concerning the Membership drive for further details.

Membership Growth Curve Explanation

Two periodic negative-going spikes in the MTT-S growth curve occur as can be observed in the following plot of MTT-S growth for the past 2½ years. As promised in the Spring 1987 Newsletter, an explanation of this effect follows. In addition, the periodicity of the growth curve will be explained. The plot of IEEE MTT-S Membership growth and the accompanying table of total active Members by month for the past 5½ years is included for reference as part of this explanation.

IEEE MTT-S MEMBERSHIP
ACTIVE MEMBERS VERSUS MONTH(END)/YEAR



continued on page 46

MEMBERSHIP DEVELOPMENT

(continued from page 45)

Total Active Members

Month	1982	1983	1984	1985	1986	1987	Change		Society Growth Rank
							Total	%	
Jan.	6256	6711	7085	7751	8370	9033	663	7.9	3
Feb.	5651	6085	6407	6971	7437	8234	797	10.7	2
Mar.	5947	6468	6847	7465	7959	8627	668	8.4	3
Apr.	5751	6336	6698	7356	7948	8490	542	6.8	2
May	5914	6465	6899	7512	8211	8755	544	6.6	2
June	6067	6577	7076	7728	8346	9229	883	10.6	2
July	6152	6649	7134	7770	8443				
Aug.	6227	6707	7152	7827	8454				
Sept.	6298	6811	7297	7943	8530				
Oct.	6466	6972	7500	8150	8825				
Nov.	6684	7145	7786	8475	9097				
Dec.	6968	7435	8064	8715	9445				

IEEE Billing/Arrears Influence

To explain the periodicity of the growth curve, an explanation of the billing/arrears procedures of the IEEE is necessary. First, the invoices for the IEEE Member's dues are mailed in early November. Second, all Regions 1-6 IEEE Members in arrears on February 28 are dropped from the rolls of the IEEE (hence the dip that occurs at the end of February). Third, all Regions 7-10 IEEE Members in arrears on April 30 are dropped from the rolls of the IEEE (hence the dip that occurs at the end of April). Fourth, an arrears statement/invoice is mailed in June to all IEEE Members in arrears. This action by the IEEE tends to spur IEEE members (who are still in arrears) to pay their dues during the last six months of the year. This response to the IEEE arrears statement/invoice influences the growth curve in the positive direction after August.

The plateau that tends to occur in June, July and August is due to fading of the response to the original IEEE billing in November. The abnormally large increase in June 1987 compared to other years is due to the response to two actions taken by Membership Development. First, an arrears letter was mailed in May to IEEE Members who dropped their 1987 MTT-S membership. Second, a promotion of free MTT-S membership was mailed in May to those IEEE members not currently MTT-S members but having expressed a first priority interest in Microwave Theory or Techniques in their IEEE Technical Interest Profile.

The decrease in MTT-S membership in January is due to past-year MTT-S members paying their IEEE dues billed them in November but not paying their MTT-S fees (dropping their MTT-S Membership).

MTT-S New Members/Dropouts Influence

While all the above is occurring many new members are joining. For instance, 1952 new MTT-S members were added to the Society rolls in 1986. But, 1304 MTT-S members were in arrears at the end of 1986 and tended to offset a large part of the membership gain. The response to the "arrears questionnaire" mailed in

May will be described in the Winter Newsletter and should provide some insight as to why members drop their Society Membership.

MEMBERSHIP DRIVE

by Alton L. Estes, Membership Development

Free Membership for New MTT-S Members

New members joining MTT-S will receive free MTT-S membership to the end of 1987. These new members may be IEEE members who do not currently belong to the MTT-S or they can join the IEEE and the MTT-S concurrently. This free membership offer should stimulate your colleagues and friends to join MTT and benefit from the educational opportunities that the Society has to offer.

Why Add Members?

The purpose for adding members is to expand a skilled and enthusiastic Membership so as to enhance the value, the technical scope, and the effectiveness of the Institute and the Society in achieving the Constitutional Object of the Institute and the Society. One of the most important objectives of MTT-S is to serve the professional interests and needs of those engaged in the use of microwave theory or using techniques that employ microwave field theory.

A major objective of the MTT-S as outlined in the MTT-S Bylaws (Section III, 9.(b)[2] Membership Drive Subcommittee...) is... "promoting the increased membership for the purpose of improved **welfare** of the Society and the IEEE." "**Welfare**" is the key word and reason for adding members.

The MTT-S Constitution, Section 2, has something to state concerning the Society objectives that relate to "**welfare**": "Its object shall be scientific, literary and educational in character. The Society shall strive for the advancement of the theory and practice of electronics...with special attention to such aims within the field of interest of the Society..." **Note:** adding members also adds to the numbers of potential papers, articles or tutorials that will be written that assist in meeting the Object of the Society. Doing anything (such as increasing membership) that assists the Society in achieving its Object should be taken as improving the "**welfare**" of the Society.

Why Should New IEEE Members Join MTT-S?

A new MTT Society membership brings with it publications and an awareness of technical conferences, tutorials and workshops targeted toward the new members' primary technical interests. Adding an MTT Society membership provides an opportunity to interact with professionals of similar interests and to participate in some of the most meaningful and rewarding activities of the IEEE and the Society.

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**DON'T MISS THIS OPPORTUNITY
JOIN THE IEEE MICROWAVE THEORY AND TECHNIQUES SOCIETY
TODAY - FREE OF CHARGE**

If you are an IEEE member, you may join the IEEE Microwave Theory and Techniques Society (MTT) as a new member, **FREE** of charge. If you are not an IEEE member, join IEEE at the 1987 annual dues rate and you will also receive MTT Society Membership free of charge through December 1988. (Applications received by August 15, 1987 begin membership as of Sept. 1987. Later applicants allow one to two months for member services to begin.)

**1987/88 MEMBERSHIP APPLICATION 1987/88
IEEE MICROWAVE THEORY AND TECHNIQUES SOCIETY**

I am applying for the following as indicated:

FREE I am an active 1987 IEEE member. Please enroll me in the Microwave Theory and Techniques Society **FREE** of charge. Send all issues I'm entitled to receive. (Current MTT Members not eligible for **FREE** MTT offer). Current IEEE members must renew 1988 membership by 12/31/87 to receive MTT Free for 1988.

OR IEEE MEMBER NUMBER

<p>EXTRA PUBLICATION ISSUES!</p> <p><input type="checkbox"/> I am not an IEEE member. Enroll me in IEEE at the annual dues rate and in the MTT Society FREE of charge. Send all issues I'm entitled to receive. (Applications received by August 15 begin 1988 membership Sept. 1987. Later applicants allow one to two month for member services to begin.) Enclosed is my IEEE membership dues/payment. Membership is through Dec. 31, 1988.</p> <p>MTT Membership includes one of the following <u>Free</u>.</p> <table border="0"> <tr> <td><input type="checkbox"/> Trans. on MTT</td> <td><input type="checkbox"/> <u>Printed</u> FREE</td> <td>OR</td> <td><input type="checkbox"/> <u>Microfiche</u> FREE</td> </tr> <tr> <td><input type="checkbox"/> Journal of Solid State Circuits</td> <td><input type="checkbox"/> FREE</td> <td></td> <td><input type="checkbox"/> FREE</td> </tr> <tr> <td align="center" colspan="4"><u>OPTIONAL PUBLICATIONS</u></td> </tr> <tr> <td><input type="checkbox"/> Trans. MTT and JSSC</td> <td><input type="checkbox"/> \$ 8.00</td> <td></td> <td><input type="checkbox"/> \$ 8.00</td> </tr> <tr> <td><input type="checkbox"/> Journal of Lightwave Technology</td> <td><input type="checkbox"/> \$18.00</td> <td></td> <td><input type="checkbox"/> \$18.00</td> </tr> <tr> <td><input type="checkbox"/> Trans. on Power Electronics</td> <td><input type="checkbox"/> \$10.00</td> <td></td> <td><input type="checkbox"/> \$10.00</td> </tr> </table>	<input type="checkbox"/> Trans. on MTT	<input type="checkbox"/> <u>Printed</u> FREE	OR	<input type="checkbox"/> <u>Microfiche</u> FREE	<input type="checkbox"/> Journal of Solid State Circuits	<input type="checkbox"/> FREE		<input type="checkbox"/> FREE	<u>OPTIONAL PUBLICATIONS</u>				<input type="checkbox"/> Trans. MTT and JSSC	<input type="checkbox"/> \$ 8.00		<input type="checkbox"/> \$ 8.00	<input type="checkbox"/> Journal of Lightwave Technology	<input type="checkbox"/> \$18.00		<input type="checkbox"/> \$18.00	<input type="checkbox"/> Trans. on Power Electronics	<input type="checkbox"/> \$10.00		<input type="checkbox"/> \$10.00	<p align="center">IEEE PAYMENT SCHEDULE (Valid only if received at IEEE by 21/31/87)</p> <p><input type="checkbox"/> U.S. \$67.00 <input type="checkbox"/> Canada \$62.00</p> <p><input type="checkbox"/> Europe, Africa, Mid East \$59.00</p> <p><input type="checkbox"/> Latin America \$52.00 <input type="checkbox"/> Asia & Pacific \$53.00</p> <p><input type="checkbox"/> Check Enclosed. Make payable to IEEE. (U.S. funds only drawn on a U.S. Bank please)</p> <p><input type="checkbox"/> NON U.S.A. applicants only may pay by Credit Card Unless Applying at a <input type="checkbox"/> Conference, <input type="checkbox"/> Symposia or Convention. <input type="checkbox"/> Eurocard</p> <p><input type="checkbox"/> Visa <input type="checkbox"/> Master Card Total Payment \$ _____</p> <p><input type="checkbox"/> Diners Club <input type="checkbox"/> Amex</p> <p>\$10.00 Minimum Charge Only Sign application at bottom</p> <p>Credit Card # _____ Exp. date _____</p>
	<input type="checkbox"/> Trans. on MTT	<input type="checkbox"/> <u>Printed</u> FREE	OR	<input type="checkbox"/> <u>Microfiche</u> FREE																					
<input type="checkbox"/> Journal of Solid State Circuits	<input type="checkbox"/> FREE		<input type="checkbox"/> FREE																						
<u>OPTIONAL PUBLICATIONS</u>																									
<input type="checkbox"/> Trans. MTT and JSSC	<input type="checkbox"/> \$ 8.00		<input type="checkbox"/> \$ 8.00																						
<input type="checkbox"/> Journal of Lightwave Technology	<input type="checkbox"/> \$18.00		<input type="checkbox"/> \$18.00																						
<input type="checkbox"/> Trans. on Power Electronics	<input type="checkbox"/> \$10.00		<input type="checkbox"/> \$10.00																						

Full Name (Print)	Given Name	Middle Initial	Family or Surname
Street Address			
City	State/Country	Postal Code	

APPLICANTS FOR IEEE MEMBERSHIP COMPLETE THE FOLLOWING INFORMATION

Date of Birth _____ Male Female Years in Profession _____
Mo. Day Yr.

EDUCATION

Degree Received	Date	Major
Institution		City/State
Degree Received	Date	Major
Institution		City/State

ENDORSEMENT (Signature of one IEEE Member who knows you professionally)
IEEE Membership includes SPECTRUM and the INSTITUTE monthly
I hereby make application for IEEE Membership and if elected will be governed by IEEE's Constitution, Bylaws, Statements of Policy and Procedures.

MAIL TO: IEEE Service Center
Membership Development
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855-1331 U.S.A.

Full Signature of Applicant _____ Date _____

O M T T 1 7 8 8
MTT Account #9170876

Who Should Work to Add Members?

All MTT-S members should actively recruit new members. Adding more members who are enthusiastic and skilled to a Chapter will inherently strengthen the technical programs that the Chapter sponsors. Adding more active members reduces the work for those who assist putting on the technical programs that do so much toward serving the new members' technical interests. Adding more members assists in achieving the Object of the Society.

Need Membership Applications?

Membership applications were mailed in mid-July by Bill Hunter to all Chapter Chairmen. These applications reflect the current IEEE membership fees for 1988 (which may be changed this Fall by IEEE) and the free MTT-S membership. **The current 1988 IEEE membership fees printed on the application will be valid for applications received at IEEE by December 31, 1987.** Please use these applications since they have a tracking code that will allow the IEEE to give the Society a five dollar rebate for each new IEEE member added. If you need more applications, you may photocopy the mailed applications or the facsimile located on the previous page.

Who to Contact

For assistance in adding members, use your 1987 MTT-S Committee Directory to find the address and phone number of your Chapter Chairman, the AdCom Liaison assigned to your Chapter, or the Membership Development Officer, Al Estes. In addition, contact Bill Hunter, IEEE Membership Development Support Coordinator (address and telephone number below), for membership development supplies, brochures, Information Centers, and suggestions that will be a valuable aid in promoting membership.

Mr. William Hunter, Coordinator
IEEE Membership Development
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855-1331
U.S.A.
(201) 981-0060, X301

Tippling ("toking") a blackjack dealer can improve your chances if done strategically. *Reason:* A sympathetic dealer will defer a shuffle when the remaining cards in the deck favor the player. *Protocol:* Take at least 10% of your bet *before* a deal. Place the token on top of your own bet, letting the dealer know it's being wagered for him. If you win the bet, you can opt to let the token "ride" for another bet.

Gambling Times, 1018 N. Cole Ave., Hollywood, CA 90038, monthly, \$36/year.

TECHNICAL COMMITTEES



by Reynold S. Kagiwada

The Technical Committees serve as the technical expertise for various disciplines germane to the MTT-S membership. This is an extremely important function for the MTT Society. In order to better understand the role of the various committees and their activities, a series of articles will be published describing the activities of each of the committees.

The material below presents the first of these articles.

MTT-3: LIGHTWAVE TECHNOLOGY



by Chi H. Lee
Dept. of Electrical Engineering
University of Maryland
College Park, MD 20742
(301) 454-6852

MTT-3 was reorganized in 1986. It changed its name from "Fiber and Integrated Optics" to "Lightwave Technology." With this new name the scope of MTT-3 is broadened to cover all aspects of technology interface between optics and microwaves. The committee consists of Chi H. Lee (University of Maryland) as chairman and the following members: K.K. Agarwal, Norm Dietrich (AT&T Bell Lab.), Tatsuo Itoh (University of Texas), Arye Rosen (David Sarnoff Research Center, SRI), Henry Taylor (Texas A&M University) and H.W. Yen (Hughes). This committee is formed to serve the membership of MTT-S. Please feel free to contact any member of the committee. If you have any comments and suggestions with regard to this committee, please write or call Chi H. Lee at the above address.

In the past year MTT-3 has organized two major activities: (1) focussed sessions on "Optical Techniques for Microwave Applications" at the 1987 IEEE MTT-S International Microwave Symposium, and (2) Workshop

continued on page 49

MTT-3: LIGHTWAVE TECHNOLOGY

(continued from page 48)

on "Optical-Microwave Interactions" in conjunction with the Symposium.

The workshop was intended as a forum for the exchange of ideas among those who are interested in using optical technology to solve microwave/millimeter problems as well as the microwave and millimeter-wave aspects of light wave technology. It was jointly organized by Lightwave Technology and Digital Signal Processing Committees.

MTT-3 again plans to organize focussed sessions and workshops in the future. For 1988, we plan to work with microwave systems group to organize focussed sessions and/or workshops in the area of fiber optic links and transmission systems. J.B. Horton and H.W. Yen will be the organizers.

MTT-6: MICROWAVE AND MILLIMETER-WAVE ICs



by *Edward C. Niehenke*

The MTT-6 Technical Committee, Microwave and Millimeter-Wave Integrated Circuits, promotes discussion, special transaction issues, and focused sessions on the technology of hybrid and monolithic integrated circuits from microwave to millimeter-wave frequencies. Our committee of 12 is quite active and generally sponsors two workshops and two panel sessions at the annual Microwave Symposium. Recent all-day workshops and panel sessions that we either sponsored or co-sponsored over the last three years include:

Workshops:

- Modern Microwave Oscillator Design Techniques
- Quasi-Planar Millimeter-Wave Components and Subsystems
- Dielectric Resonators in Microwave Oscillators
- Planning and Packaging for the Next Generation of Integrated Circuits
- Non-Linear CAD and Associated Modeling

Panel Sessions:

- Millimeter Wave Integrated Circuits
- MIC Assemblies for Performance, Reliability, and Profit
- Millimeter Wave Integrated Circuit Sources

- Microwave GaAs FET and MMIC Reliability
- GaAs Microwave Monolithic Integrated Circuits (MMIC)
- Applications of HEMT Devices and Circuits

The committee members and their affiliations are:

Member	Affiliation	Telephone
Erwin F. Belohoubek	SRI International Princeton, NJ	(609) 734-2629
Gailon Brehm	Texas Instruments Dallas, TX	(214) 995-5571
Charles Buntschuh	NARDA Microwave Corp Hauppauge, NY	(516) 231-1700
Richard Gold	Adams Russell Burlington, MA	(617) 273-3333
Rudolph Henning	Univ. of S. Florida Tampa, FL	(813) 974-2581
Derry Hornbuckle	Hewlett-Packard Co. Santa Rosa, CA	(707) 577-3658
Douglas Maki	Tachonics Plainsboro, NJ	(609) 275-2510
Edward Niehenke	Westinghouse Electric Baltimore, MD	(301) 765-4573
W. Horton Prather	Electromagnetic Sciences, Norcross, GA	(404) 448-5770
Barry Spielman	Naval Research Lab Washington, DC	(202) 767-3312
Frank Sullivan	Raytheon Company Bedford, MA	(617) 274-4414
James C. Wiltse	Georgia Tech. Research Institute Atlanta, GA	(404) 894-3494

We meet twice a year, first at the Microwave Symposium Technical Program Committee meeting in the winter and again at the Microwave Symposium in the spring. The chairman serves for two years and the members serve on the committee as long as they are active. New members are selected by the committee. I am the chairman for 1987-1988 and will select my successor from the committee. Many members present lectures in their areas of expertise at local meetings of MTT-S chapters. When appropriate, we will also organize a special issue of the MTT-S Transactions. We are co-sponsors with MTT-15 of a special MTT-S Transaction issue on quasiplanar millimeter-wave components.

Our committee is presently preparing workshops and panel sessions for consideration at the 1988 New York Microwave Symposium. Horton Prather, Dilek Darles, and Frank Sullivan are preparing a workshop "Designing MMICs Through Foundries." Gailon Brehm will be working with MTT-1 on the "CAD Modeling of Discontinuities" workshop. Erwin Belohoubek and Derry Hornbuckle are working with MTT-8 on a panel session exploring the use of high-temperature superconductors for microwave integrated circuits and are also recommending this topic as a focused session. Finally, Frank Sullivan is organizing a panel session, "Heterojunction Bipolar Transistor Circuits." Interested participants should contact these people. Feel free to contact me if you have inputs for our committee or if we can assist you.

MTT-15: MICROWAVE FIELD THEORY



by Tatsuo Itoh

The Microwave Field Theory Committee is concerned with electromagnetic field theory, guided waves and other wave-related technologies which are fundamental to microwave, millimeter-wave and optical engineering. This committee is concerned with the very basic materials both theoretical and experimental. However, the committee is constantly looking for new directions and horizons in which field theory can play a key role in development of new technology. By its nature, the committee activities are closely related to other committees such as CAD (MTT-1), Lightwave Technology (MTT-3) and Microwave and Millimeter-Wave Integrated Circuits (MTT-6). Over the last several years this committee has sponsored a number of workshops at the annual MTT Symposium and several Transactions Special Issues.

On the occasion of the 1986 MTT Symposium in Baltimore, MTT-15 sponsored a workshop on Trends in Microwave CAD jointly with MTT-1. The workshop was organized by Dr. K.C. Gupta of the University of Colorado. Both active and passive devices were treated in the workshop by a number of speakers both from industry and universities. In recognition of the growing sensitivity of the microwave engineers to the fact that CAD is an indispensable tool for the microwave community, the attendance exceeded the predicted number by a large margin. As an outgrowth of this workshop, a Special Transaction Issue on Computer Aided Design is being compiled under joint sponsorship of MTT-1, MTT-6 and MTT-15. The Guest Co-Editors are K.C. Gupta of the University of Colorado and T. Itoh of the University of Texas. The deadline for submission of papers was April 15, 1987 and the issue will be published in February 1988. Currently, the review process is being carried out by a number of dedicated reviewers.

At the 1987 MTT Symposium in Las Vegas, MTT-15 sponsored a workshop on, "Numerical Techniques for Microwave Field Problems and Their Implementation on Personal Computers," and sponsored jointly with MTT-6 another workshop on, "Quasi-Planar Millimeter-Wave Components and Subsystems." The PC workshop was organized by W.J.R. Hoefler of the University of Ottawa and Y.C. Shih, Consultant. This workshop was in response to the ever-increasing availability of personal computers whose performance equals that found in a main frame machine a few years ago. The workshop was tutorial in nature and

demonstrated how typical algorithms can be formulated and implemented on digital computers, in particular on personal computers. The workshop was an overwhelming success with audiences larger than room capacity. Copies of hand-outs went quickly. Professor Hoefler is contemplating a Special Transaction Issue as an outgrowth of this workshop. If this materializes, a proposal will be sent to the AdCom for consideration via the Regular Transactions Editor, Dr. R. Levy.

Another special issue is planned by MTT-15 and MTT-6 on Quasi-Planar Millimeter-Wave Components and Subsystems. The paper deadline is January 1988 and the issue will be published in October 1988. The Guest Co-Editors are A.K. Sharma, presently with TRW, and J.C. Wiltse, Georgia Institute of Technology. Obviously, this issue has been motivated by the workshop held in conjunction with the 1987 MTT Symposium in Las Vegas. The Call for Papers has already gone out.

The MTT-15 wants to keep this high level of activity for the years to come. If you have any suggestions, please write or call me.

Cardiovascular Cleanup

One powerful motivation for giving up cigarettes is that a couple of nicotine-free years can put you back in the non-smokers' category as far as most health risks are concerned. But the case for lowering blood cholesterol has never been as clear. If you follow a "heart-healthy" diet, you can certainly keep more plaque from building up in your coronary arteries, but what about the plaque already there? Can you actually *reduce* blockage? People at high risk for heart disease and their physicians have long yearned for an answer to this question. And, of course, it's of interest to health people, too.

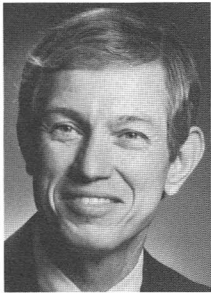
Limiting fats and cholesterol is indeed hard. It takes willpower as well as an intellectual effort. So knowing just how far dietary modifications can actually take us would certainly help. But while blood cholesterol levels are comparatively easy to measure, alterations in arterial plaque are difficult to gauge in a living human being.

Now, however, doctors at the University of Southern California School of Medicine have completed a two-year study showing that arterial plaque can be reduced. Men who had undergone coronary bypass surgery modified their diets and received cholesterol-reducing drugs. Their coronary plaque was monitored with X-rays. At the end of the study 16% showed perceptible improvement, compared with only 2% of the control group.

This is excellent news for healthy people as well as for those who already have heart disease. If you lower your blood cholesterol, you may not only halt arterial damage but start to unclog your arteries as well.

University of California, Berkeley Wellness Letter, Box 10922, Des Moines, IA 50340, monthly, \$20/year.

MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM SITE SELECTION



by N. Walter Cox

At the June 1987 AdCom meeting, Atlanta, Georgia, was selected as the site for the 1993 International Microwave Symposium in a close competition with Orlando, Florida. The meeting will be held June 14-18, 1993, at the Georgia World Congress Center which is the site for the 1988 Democratic National Convention.

The MTT-S Administrative Committee will select the site for the 1994 Symposium at the January 1988 AdCom meeting in New York. Chapters interested in hosting the 1994 or other future symposia should contact Walter Cox, Chairman of the Meetings and Symposia Committee, at (404) 894-2928. Based on the normal procedure of alternating between the East and West Coasts for the symposium, with an occasional stop in the middle, the 1994 symposium would logically be held in the central or western part of the U.S. Chapters wishing to compete for the 1994 Symposium should indicate their interest immediately to allow adequate time for preparation of a brief letter proposal by December 1987.

Sites selected for future International Microwave Symposia are listed below along with the Symposia chairmen.

1988	New York City	C. Buntschuh
1989	Long Beach	C.W. Swift
1990	Dallas	J.W. Wassel
1991	Boston	P.W. Staecker
1992	Albuquerque	J. Hausner
1993	Atlanta	N.W. Cox

Save 5%-32% on purchases made in Europe. Just remember to get your Value-Added Tax (VAT) refund. Request a VAT refund form from the store when you make a purchase, ask Customs to validate the form when you leave the country, and mail the form back to the store. You should receive your refund in six to eight weeks. *Exceptions:* Austria, Finland and Norway. They give refunds on the spot.

John Flynn, Senior Vice President, Deak-Perera/U.S., Inc., quoted in *Self*, 350 Madison Ave., New York, NY 10017, monthly, \$15/year.

1991 IEEE MTT-S INTERNATIONAL SYMPOSIUM



by Peter W. Staecker

The Central New England/Boston Chapter of the MTT is proud to host the 1991 Symposium, and has begun preparations to maintain the standard of excellence set by previous engagements here in 1967 and 1983.

The geographical center of activity will be nearly identical to that of 1983; the new Hynes Convention Center, scheduled to open in early 1988 has reserved the second and third levels for our exhibit and technical program. Three hotels, the Sheraton, Marriott Copley Place, and Westin, all within a short walking distance to the Hynes, have blocked a total of 2500 rooms for our peak use during the week of June 9-14. Peripheral properties, also within the Copley Place area, can provide nearly 1000 more rooms. Negotiations are under way to secure these room blocks also.

Historically, the focus of the 1991 Symposium will be the celebration of the 50th anniversary of the MIT Radiation Laboratory, an organization to which nearly all current microwave practice can trace its beginnings. The buildings still exist at MIT where the first military radar sets were produced nearly 50 years ago. Many of the engineering staff even today live surprisingly close to MIT; we hope you will join us in celebrating their achievements in 1991. Ted Saad has begun organization efforts with the Rad Lab community to solicit participation in planning celebration events. The first of these informal meetings, described by Ted in this issue, was a resounding success.

With this auspicious beginning, we solicit your suggestions and participation in making the Rad Lab celebration and the 1991 Symposium significant events.

Clipping coupons saved American shoppers \$2.2 billion in supermarket bills last year. But only 3.6% of all coupons available were redeemed.

Runzheimer International, Runzheimer Park, Rochester, WI 53167.

Fish skin is high in cholesterol and just as unhealthful as chicken skin. *Bottom line:* Skip the skin.

Glamour, 350 Madison Ave., New York 10017, monthly, \$15/year.

SPECIAL ARTICLES FOR THE MTT NEWSLETTER



by Zvi Galani

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 Symposium and in the Transactions.

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

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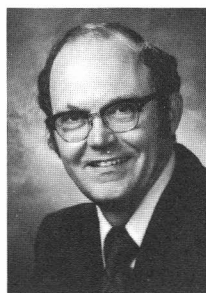
Happier Days

Upside-down breathing makes you feel calmer and more in control. *How to do it:* Instead of breathing normal (actively drawing air into your lungs, then passively letting it out), reverse the procedure. Actively *push* the air out of your lungs, then passively let it back in.

Why this works: We subconsciously associate normal breathing (working to suck in air) with desperate, anxiety-ridden situations. Reversing the pattern breaks the anxiety trigger.

The Breath Play Approach to Whole Life Fitness by Ian Jackson, Doubleday & Co., Garden City, NY 11530, \$14.95.

PCs FOR MTT



by E.K. Miller
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This article reviews the evolution of mainframe electronic computers over the four plus decades of their existence. The material presented here is excerpted from an article, "Some Aspects of the Present Status and Future Directions of Computational Electromagnetics" prepared by Fred Deadrick of LLNL and me for the JINA '86 Meeting held in Nice, France, November 1986.

Mainframe Computer Development

During the past 20+ years, computer applications in electromagnetics have grown from initial implementations on the first widely available mainframes such as the Univac-1, and IBM 701 and 7094, to present day "super number crunchers" like the Cray 2 and the Cray X/MP. The growth in mainframe capability has inexorably expanded the horizons of what is computable in electromagnetics, evolving from problems involving a few 10's of unknowns to the present day simulations incorporating thousands (integral-equation models) to millions (differential-equation models) of unknowns, depending on the kind of model being used. This growth in computational capability has occurred across a broad spectrum which ranges from super mainframes to minicomputers to PCs.

It is interesting to recall that the electronic computer was preceded by earlier, mechanical versions. Although Charles Babbage's Analytical Engine in the mid-19th century represents the first attempt to develop a computational power significantly beyond what could be done by hand, its mechanical design required a fabrication precision beyond the capabilities that then existed. In spite of its failure to achieve its design goals, Babbage's work did provide a foretaste of things to come, among which were the mechanical tabulating machines that were first used in the early 20th century by the United States government for handling census statistics. It was somewhat later that a company, eventually to become International Business Machines or IBM, acquired a large part of the business associated with the building and servicing of electro-mechanical tabulating machines for which an expanded scope of applications were being discovered.

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ENIAC

But electro-mechanical systems were limited in speed and flexibility. It thus happened in the years just preceding and during World War II that the first electronic computers made their appearance. In the United States, perhaps the first shot in the "computer revolution" was fired literally in connection with the need to more quickly and accurately develop firing tables for the growing variety of guns used by the military. Thus it was that ENIAC (for Electronic Numerical Integrator and Computer) was proposed to the Aberdeen Proving Grounds by Atanasoff, Eckert and Brainerd of the Moore School of Electrical Engineering, University of Pennsylvania¹. ENIAC was envisioned to operate at the then unheard of speed of 100,000 "pulses" (cycles) per second. For comparison, an earlier electro-mechanical calculator designed in 1935 by Atanasoff to solve simultaneous equations by Gaussian elimination operated at 60 pulses. ENIAC was estimated to be potentially 10 times faster than an earlier differential analyzer at the Moore School and 100 times faster than a human with a desk calculator.

That ENIAC was actually built and worked as anticipated was due certainly to the persistence and dedication of its designers and builders, for it would contain 18,000 vacuum tubes, or more than 180 times the number of the largest tube-based system that preceded it. But there was also the impetus provided by military needs, certainly not the first, nor the last, example of such synergism.

UNIVAC

ENIAC was followed by a number of other "ACs" including EDVAC (Electronic Discrete Variable Arithmetic Computer), ORDVAC, ILLIAC, SWAC and UNIVAC-1. The latter achieved perhaps the greatest fame (in the United States) of these early computers by being used to predict the results (correctly) of the 1952 Presidential elections. For that and other reasons, it has provided a benchmark by which to measure subsequent improvements in computer technology. The UNIVAC-1 provided a peak rate of about 1,000 floating-point operations per second (FLOPS), about 1/40,000th the speed of CRAY-XMP, at a clock speed of 2.5 MHz. It contained 10,000 vacuum tubes and employed mercury delay lines as memory elements, giving it a central memory of 1,000 91-bit words. It lacked even an assembler, requiring the programmer to work at the lowest level of machine language.

FLOPS vs. Time

Since the UNIVAC-1 was an integer-hardware machine with the floating-point operations done in software, it is somewhat inconsistent to use the term FLOPS to describe such a machine. However, the principle value of knowing the performance capability of

a given computer referred to some standard process like a floating-point operation is that a user can at least infer something about the likely relative performance that can be expected of various computers for numerically similar applications.

Since introduction of the UNIVAC-1, mainframe computer power has continued to grow at an approximately exponential rate. As illustrated in Figure 1, where the peak operating speed of a number of computers since UNIVAC-1 is plotted in terms of their year of introduction, there has occurred a nearly six order-of-magnitude improvement. Such data only provides one indication of computer power. Benchmarks of various kinds are also used for comparing computers, where it should be noted however that depending on the computer design, the benchmark being used as the test, and the degree of code optimizing that has been done, the results obtained might vary by a factor of three or more. In any case, the throughput achieved for an actual problem can be expected to be only some fraction of the peak FLOP rate. For example, a CDC-7600 has a peak rate of ~5 MFLOPS, yet when solving a linear system by factorization achieves about a 1 MFLOP throughput.

After smoothing the raw data points shown in this graph, we obtain a performance curve from which a smoothed rate of change can be derived as also shown in Figure 1. We observe that during the mid-50's, the improvement rate in computer speed was about a factor of 100% per year. A nearly monotonic decline took place until a low point of only 25% per year improvement was reached in the mid-70's, at which time a turn-around appears to have occurred. This conclusion should not be given too much weight since it involves only the one data point of a Cray 2 beyond the Cray 1.

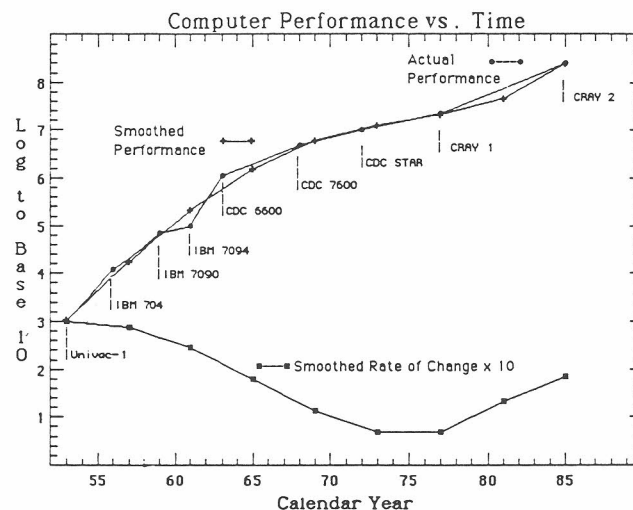


Figure 1. Performance improvement over time of mainframe computers in terms of peak FLOP rate since introduction of the UNIVAC-1 computer. Shown are the actual data points for a number of computers, a smoothed curve based on these points and a smoothed rate-of-change of performance.

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¹ Metropolis, N., J. Howlett and Gian-Carlo Rota (editors) (1980), "A History of Computing in the Twentieth Century." Academic Press, Inc., New York, NY

PCs FOR MTT (continued from page 53)

The peak-FLOP rate is only one of the various ways by which computing power might be characterized. Also important are the word length and high-speed memory size, the rate at which hard-copy output can be produced, the cost of memory, etc. We summarize in Figure 2 some of these characteristics over the same time span as for Figure 1. For simplicity, and since the intermediate data is not always available, we have chosen to show only the end-point values. Somewhat surprisingly, the rate of improvement of these various aspects of computing power over more than 30 years are quite comparable on a log-linear scale.

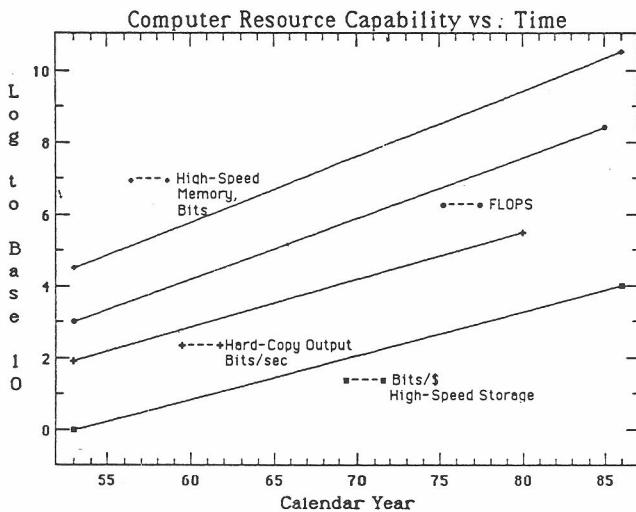


Figure 2. Performance improvement of various computer resources since introduction of the UNIVAC-1 computer. Only end points are shown for clarity.

Mainframes and PCs Compared

One of the more intriguing aspects of the computer revolution is the increasing computational productivity that has occurred during the short existence of the electronic computer. And where there was only the mainframe number cruncher during the first two or so decades of the computer era, there has developed since about the mid-70's an extended spectrum of computational tools. These range from the hand-held, programmable calculator to micro-computers typified by the PCs just discussed to mini-computers such as the VAX. The result has been to provide the computer user with a continuously expanding variety of options from which to choose.

Another Measure of Performance

In order to establish quantitative measures for computer performance that go beyond raw speed, it is informative to compare modeling performance in an EM context. We note that for moment-method, frequency-domain, integral-equation (FDIE) computer models, the total computer time required to process a problem

involving N unknowns is well approximated by:

$$T \sim A_{\text{fill}} N^2 + B_{\text{solve}} N^3 \quad (1)$$

where A_{fill} and B_{solve} are computer- and algorithm-dependent coefficients associated with filling the impedance matrix and solving it by factorization or inversion (iterative techniques are not considered here). Because the N^3 term dominates the overall time as N increases beyond some threshold, a few hundred or so (and matrix solutions are encountered in many other kinds of computer modeling, those based on finite differences and finite elements, for example) subsequent discussion here considers only matrix-solve time in comparing computer performance. Note also that we do not consider special cases such as symmetry or banded techniques that can be used for near-neighbor approximations in integral-equation modeling or routinely in differential-equation based modeling.

Now consider the three classes of computers represented by the Apple Macintosh "Fat Mac," DEC VAX 11/785 and the Cray 1, for which the B_{solve} coefficient is given approximately by 3×10^{-4} sec, 4×10^{-6} sec and 2×10^{-7} sec respectively for compiled FORTRAN code. These numbers indicate that the three computers respectively could handle dense or full systems of equations having 229, 966 and 2621 unknowns if I/O associated with accessing external memory is ignored.

Computational Cost

Next consider the capital cost of these systems which are approximately 2.0, 200 and 15,000 kilo-dollars (the original article used 1.0 k\$ for the Mac which is probably too low). Further note that the terms of the information generated by the moment-method, FDIE model, there are N^2 mutual admittances provided by the solution matrix. The number of admittances generated per dollar of system cost for these one-hour problems then becomes approximately 26.0, 4.7 and 0.46 admittances/\$. We note that these somewhat surprising results are affected by the fact that solving the impedance matrix involves $N^3/3$ complex operations to obtain N^2 complex items of information, so that the computational effort required per admittance increases in proportion to the value of N . For subsequent comparison, we therefore use the 1 hour, 229 unknown, Mac problem.

As another comparison, we might compute the number of admittances provided per dollar of system cost per millisecond, i.e., the production rate normalized by cost, of all three computers for the 229-unknown matrix that uses one hour of Macintosh time. On this basis, the corresponding results become 7.5, 5.5 and 1.5 admittances/\$/millisec for the Macintosh, VAX and Cray computers, where as before, the higher the value of this measure the better.

Finally, because these results may not appear to be particularly relevant to how most users might pay for

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PCs FOR MTT (continued from page 50)

time on a mini or mainframe computer, we repeat the preceding calculation using representative CPU charges for the VAX and Cray computers. For our purposes, these are taken to be \$100 and \$2000 per hour respectively. If the acquisition cost of the Macintosh is spread out over a two-year period of four hours per day, five days per week, and 50 weeks per year of use, there results an hourly cost of \$1 per hour. On this basis, the normalized production rate for the 229-unknown problem then becomes 15, 11 and 11 admittances/\$/sec for the Macintosh, VAX and Cray computers. (In the original article, these numbers were given in units of admittance/\$/hr., although the hour unit was not stated explicitly.) As can be seen, this normalized measure provides the closest outcome of the three kinds of measures evaluated here, as summarized in Table 1. Whichever measure is used, one of those discussed here, or others that might be explored as alternatives, it is interesting to find that the normalized cost of using moment-method, FDIE EM models is not very sensitive to the kind of class of computer employed.

TABLE 1. Matrix-Solution Costs for PC, Mini and Mainframe Computers

Measure	PC (MAC)	Mini (VAX 11/785)	Mainframe (Cray 1)
Size of matrix solvable in one hour of time	229	966	2621
No. of solution-matrix coefficient/\$ of system cost for one hour problem	26	4.7	0.46
No. of coeffs/\$ of system cost/millisecond for 229 unknowns	7.5	5.5	1.5
No. of coeffs/\$ of CPU charge/sec for 229 unknowns	15	11	11

Computational Requirements

In order to more fully appreciate the implications of Equation (1) it is important to relate N to the kind of model being solved. For wires, it can be concluded that N_{wire} is proportional to L/λ where λ is the wavelength and L is the total wire length, with the relationship $N_{wire} \approx 2\pi L/\lambda$ providing a good estimate. It can be similarly shown that to model a surface object of area A, N_{surf} is proportional to A/λ^2 where the $N_{surf} \approx 2 \times 2\pi A/\lambda^2$, the factor of two arising from the need to model two vector components of the surface current. Not surprisingly, a volumetric object required correspondingly a number of unknowns given approximately by $N_{vol} \approx 3 \times 2\pi V/\lambda^3$.

It is relevant to comment that since many applications require information to be obtained over some

band of frequencies, the associated computer times required for their modeling is proportional to f^3 , f^6 and f^9 respectively for wire, surface and volume objects for each frequency sample. This fact must be kept in mind when appraising the impact that growing computer power has had on computational electromagnetics. Considering for example, that present-day "super" computers have about 10^6 times the speed of the UNIVAC-1, this increase in throughput translates to increases in problem size by factors of about 10^2 , 10 and $10^{2/3}$ for wires, surfaces and volumes respectively. This point is made more graphically in Figure 3. If future growth in computing power continues at the same general rate, this means another 15+ years would pass before FDIE models for volumes would have grown by a factor of only 10 relative to the UNIVAC-1 computer!

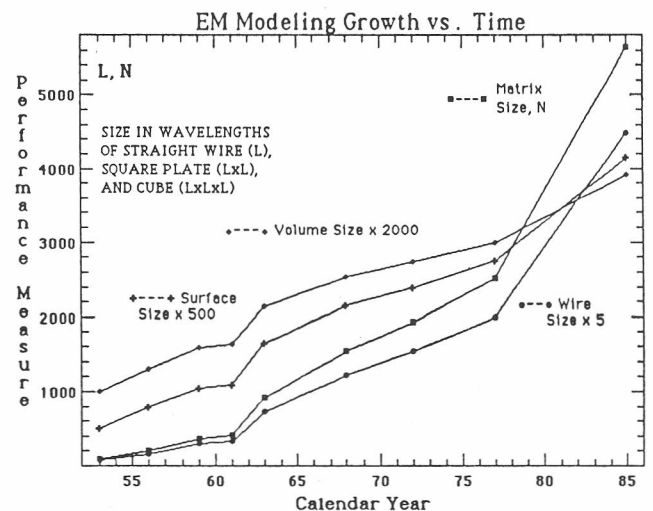


Figure 3. Growth in EM-problem-solving capability in time using frequency-domain integral equations. The various curves respectively show the size of complex matrix that can be solved using factorization in one hour of computer time upon introduction of each new mainframe. The corresponding size in wavelengths of a straight wire of length L, a square plate of size LxL, and a cube of size LxLxL that this solution capability makes possible.

Women who marry smarter men become smarter as they grow older, and women who marry less intelligent men lose some of their own intelligence over time. But husbands are less often affected by the intelligence of their wives. *Possible reason:* Men are still primary breadwinners...and a smart man makes more money, giving his wife opportunities to better herself.

A 30-year study of 175 couples by K. Warner Schaie, begun at the University of Washington in Seattle.

WRITING AND EDITING — THE TWO HALVES OF LANGUAGE



by Cheryl Reimold
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Cheryl Reimold is president of PERC Communications, a communications firm that conducts in-house courses on effective writing and speaking for businesses and other associations. For information, please contact her at the address listed above.

PART II. EDITING — THE SHAPING OF A MANUSCRIPT*

Most of us don't like to edit our work. We quake at the scourge of red pencil that slashes through our manuscript, changing hard-sought expressions, questioning others, even amputating whole sentences or sections. If *only* our original outpouring could satisfy our colleagues, our readers, our editors — ourselves. Alas, it rarely does.

But — the new way of writing offers an alternative. You simply don't edit anymore. Rather, you *shape* the free-flown words into an orderly, attractive piece of communication. And it feels entirely different.

Shaping is a positive, creative act. It is what a sculptor does to a hunk of marble, a prize confectioner to a lump of dough. Shaping makes the critical difference between an unfathomable sea of thoughts and a well-charted channel between writer and reader. The red pencil becomes an instrument of creation, not amputation.

Find the Unifying Force

A piece of technical writing usually has a few points to make about a single topic — the subject of a memo, the event or plant described in a trip report, the experiments detailed in a technical report. In a *unified* piece, these points are connected by a single unifying force or impulse.

The *subject* of Gettysburg Address is a memorial to the soldiers who died at the battle of Gettysburg. The *unifying force*, the impulse behind the words that draws them all powerfully together, is Lincoln's desire to preserve the Union. The short address covers a great deal — the birth of the United States, its early principle, the Civil War, the battlefield, the heroic death of the men who fought there, the charge now given to the living. Yet throughout, the words seem to throb with the

energy of that single impulse: this nation must survive.

Our regular writing tasks seldom grow from a force so powerful and urgent as this. But we always write to say something. If we have nothing important to say, we'd better put down the pencil.

Read through your first unedited (I hope!) draft. Then close your eyes and try to formulate a one-sentence answer to the question: What do I want to convey? It may help to begin your answer with the words, "I want..." For example:

- I want you to continue supporting these experiments.
- I want our company to consider buying the copiers I examined at the XYZ plant.
- I want better service.
- I want you to understand exactly how this machine works.

Very often, the unifying force is discernible only after you've written the first draft. You have to write down all your thoughts and discoveries on a subject to find out or clarify what, essentially, you want to say about it. That is why it is much better to write first and shape later. You can be more confident of having something real to shape instead of fabricating something flimsy around a chosen focus that may be neither appropriate nor relevant.

Build Your Words Around the Unifying Force

When you've found the unifying force in your writing, you will be able to extract the points you've made in its service. Underline every sentence that:

- makes a relevant point (one line)
- illustrates or explains a point already made (two lines)
- connects one point or thought to another (three lines)

Check *every* sentence; if you find one that doesn't fulfill one of these conditions, it probably should go.

Now pick out your three major points. If there are more, see if any of them can be subsumed into one of the three. If not, omit them. More than three points with illustrations and explanations simply cannot be absorbed at one sitting. If your work contains a number of chapters or sections, apply this rule to each.

Make Your Writing Good to Read

Now that your work has its structure and form, you can give it the final aesthetic shaping. Make it good to read. For the final phase of shaping, you can use a checklist.

Trim away:

- **Cliches.** Expressions such as "last but not least," "in the final analysis," "in actual fact," "back to square one" are unoriginal phrases that have lost their precision through overuse and now serve to cover up the writer's personality — precisely because everybody uses them. Avoid them.

continued on page 57

WRITING AND EDITING (continued from page 56)

- **Irrelevant detail** that draws attention away from the unifying force.
- **Excessive explanation of the obvious.** Watch out for sentences beginning with "That is to say..." or "In other words,..." If you've said it clearly, you don't need to repeat it in other words.
- **Unnecessary modifiers**, such as "a *loud* explosion," "a *high* peak," "an *empty* vacuum," or "the *final* conclusion."

Check for:

- **Correct subject/verb agreement:** Freeze drying of the sample and recommencement of the entire process three hours later *were* (not *was*) found to produce...
- **Correct punctuation**, particularly commas that may change meaning: Next, we prepared the wood lying in the freezer...*not* Next, we prepared the wood, lying in the freezer. (Unless you prefer to work in subzero temperatures.)
- **Variety** in words, expression and the structure and length of sentences.
- **Relationships.** Are your ideas connected? Could you make the relationship clearer by using conjunctions (e.g., *because, since, yet*) rather than placing one sentence after another.
- **Completeness.** Have you covered all you promised in your opening paragraphs?
- **Coherence.** Does your work have a beginning, a middle and an end? Are they connected?

Shaping *is* fun. It gives form to your thoughts and makes them pleasantly accessible to others.

But as half the writing process, it requires half the writing time. Are you willing to give it the time it needs? The reward is clear. You will be read. With pleasure.

*Part 1 of *Writing and Editing — the Two Halves of Language*, appeared in MTT Newsletter, Spring 1987, p. 24.

EDUCATIONAL AWARDS COMMITTEE



by Jorg E. Raue

Two types of educational MTT-S awards were announced and publicized in 1986. The following awards were made in June 1987:

Microwave Graduate Fellowship Awards to:

- R. Steven Brozovich, Washington University, to develop power circuits in GaAs MMICs
- T. Scott Martin, Texas A&M, to analyze ring resonators and their application to microwave and optical applications

\$10,000 Grant-in-Aid Award to:

- Dr. Clifford B. Cloonan and California Polytechnic State University, San Luis Obispo, to update eight undergraduate microwave laboratory work stations

For both of the above awards, a schedule is in place for 1988:

- Requests for information by October 15, 1987
- Closing date for Fellowship applications: October 30, 1987
- Closing date for Grant-in-Aid applications: November 13, 1987
- Evaluation: November/December 1987
- Recommendation to AdCom: January 1988 meeting
- IEEE approval of AdCom recommendation: Spring 1988
- Awards made at the MTT Symposium Banquet: June 1988

At the January 1987 meeting, AdCom approved a new education MTT-S award: the VISITING FELLOW award. Since then, approval for this award was received from IEEE headquarters. The plan is to initiate this award for 1989, with publicity planned in early 1988 and applications submitted in Fall 1988. **The purpose of this award program is to facilitate the exchange of engineers and scientists among university, industry and government.** It would recognize and support outstanding microwave oriented engineering faculty, engineers in industry or government labs and provide support for the furtherance of their professional growth in the field of microwaves.

I am soliciting your help. After all, it is your money that is being spent. Your ideas will provide my committee with a useful data base on this subject as well as the needed guidance as to how MTT-S may best serve the needs of its members in this area.

I have prepared a brief questionnaire that I would like you to take just a few minutes to complete (by hand, if you like, for your convenience). It is generally self-explanatory. The support MTT is considering is to **supplement** what the individual would be receiving from his home and/or host organization. The award would be issued directly to the applicant, the final amount determined by AdCom based on need, justification and budgetary considerations.

**IEEE MICROWAVE
THEORY & TECHNIQUES
SOCIETY
1988-1989
SCHOLARSHIPS,
FELLOWSHIPS AND
GRANTS-IN-AID**

TWO MERIT SCHOLARSHIPS — for children of MTT-S members at undergraduate level (not limited to engineering), \$1,000-\$2,500 each, renewable for 4 years, given to meritorious students based on PSAT/SAT test scores, academic record, GPA, class rank, leadership, career goals, significant extracurricular and community activity, etc.

GRADUATE FELLOWSHIPS — several \$5,000 fellowship awards each year for graduate research studies in microwave engineering on a full-time basis. Applicants must have attained high academic level in engineering or physics. Faculty Research Supervisor must be MTT-S member.

EDUCATIONAL GRANTS-IN-AID — for individual members of MTT-S and for non-profit institutions, number and amount to be based on proposals submitted, proposed activity and financial justification. Applicant must be MTT-S member of 5 years standing.

For further information on the Merit Scholarships, contact:

Dr. Krishna K. Agarwal
Chairman, MTT-S Education Committee
3928 Wilshire Drive
Plano, TX 75023
(214) 867-3947

For further information on the Fellowships and Grants-in-Aid, contact:

Dr. Jorg E. Raue
Chairman, MTT-S Educational Awards Committee
TRW ESG, 03-2673
One Space Park
Redondo Beach, CA 90278
(213) 535-7409

Requests for information must be made no later than October 15, 1987.

PACE REPORT



by Robert A. Moore

Technology Transfer

Many of you will recall a few years back when Merrill Skolnik and Robert T. Hill were chastised by Vice-Admiral Richard A. Miller, then Vice-Chief of Naval Material Command, for giving radar seminars in non-DoD forums. Merrill Skolnik ignored the Admiral, but Bob Hill ceased giving the seminars. This is just one example reported, among other places, on page 1 of the September, 1984, **The Institute**, of suppressing the release of nonclassified, nonsensitive material through pressure from DoD. In the opinion of many, including Leo Young, past MTT-S and IEEE president, this form of data restriction is a misguided policy.

Few, if any, in the microwave industry question the need for classifying information relative to sensitive aspects of application systems. Our employers may impose release restrictions and delays for proprietary reasons. With these restrictions strongly endorsed, there are many ways to argue the value not only to us professionally but to the industry and to the defense effort of the relative freedom to release for good reason (for example, to publish in IEEE symposia and journals) nonclassified data of appropriate merit.

As used by the IEEE and, perhaps many others, "technology transfer" refers to 1) release of information (when paper is presented and/or published) and 2) transfer of hardware embodying critical technology (when exporting to other countries). Restricting the distribution of unclassified data reduces research and development efficiency. Restriction of hardware exports removes direct markets from our industry and reduces the offshore potential for equipment containing our products.

In recent years of the present administration, DoD has mounted a significant challenge to our traditional relative freedom to transfer technology. Many of us welcome the increased emphasis on defense; however, it is possible to restrict data flow to the point of actually harming our defense effort.

With the passage of the Military Appropriations Act of 1984, DoD was given approval authority over technology export. Using this authority in April 1985, DoD notified the Society of Photo-Optical Instrumentation Engineers (SPIE) that 43 of the 219 papers scheduled to be presented at a conference could not be given in open session. Through intense negotiations, the number of papers to be removed was reduced.

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PACE REPORT (continued from page 58)

Other examples can be cited. The Frequency Control Symposium received a call from DoD one year concerning broad categories of papers. This time the symposium management took no direct action, but rather notified all authors of the DoD request. Though in most cases DoD has been forced to reduce the scope of such restrictive requests, such actions both create disruption to the conferences and raise questions as to the nature of the next such action DoD might take. Several MTT members have told me of increased difficulties in obtaining paper approval. The security officer of one large systems house has told me of the much greater pressure he feels to restrict release of papers as a result of recent DoD actions.

The basis for proprietary restrictions on release of nonclassified data is reasonably straightforward. If work is for companies who have financed the effort, they have an ownership interest in the results. In the defense industry, much technical data has relatively short-lived proprietary value. Thus, the marketing strategy argues for early release of much material in the defense sector.

Though from a security standpoint the boundaries may not be as clearly identifiable, there is a similar tradeoff between the values of release and restriction. In favor of early release is the value of such material to the industry as a whole and reduction in cost of related projects. The possible value of such material to Eastern Bloc countries argues against release.

There are many issues relative to release of unclassified data that have a bearing on the balance between usefulness to U.S. defense industry vs. potential value to the Eastern Bloc. One issue often not noted, may be one of the most significant: the relative efficiency with which the two sides can assimilate such released information. In the West, organizations such as the IEEE provide very efficient information distribution networks. In the Eastern Bloc countries, however, material is parcelled out through central agencies which become choke points to its distribution. Edward Teller, for example, has argued that all that is needed to keep U.S. science ahead of the Eastern Bloc is to control the opportunity of Soviet scientists and engineers to work side by side with U.S. scientists. Any other method of technology transfer — scientific conferences, academic papers — Teller has said, is of little value to countries playing catch-up. Whether or not Teller's argument is an exaggeration, many feel that the natural proprietary instincts of private industry normally are sufficient to prevent release of unclassified data of value to Eastern Bloc countries. According to this argument, by withholding unclassified information from IEEE meetings and publications we are withholding it from ourselves more than from Eastern Bloc countries. The outstanding success we have had in computer advances is, perhaps, some evidence of this. Because primarily it is a product of the commercial sector, information release, as opposed to hardware export, has been under the least government control of almost any "high technology" areas related to IEEE activity. Yet this is the area for which many feel we are most ad-

vanced relative to the Eastern Bloc.

Is DoD moving toward greater restriction to release of nonclassified data? Or with the election of a new administration in 1988 will this trend be relieved or reversed? One cannot tell. However, as long as DoD has authority over export of nonclassified technical data, there is a clear danger that those with security responsibility will seek greater restriction on release. It is an area that bears watching.

Legislative Update

SCIENCE AND TECHNOLOGY

A tidal wave of "competitiveness" proposals may engulf the Congress. Because of the attraction of slogans, many bills dropped in the hopper in recent sessions suggest that U.S. competitiveness in the world will be enhanced by adopting each of the "competitiveness" bills. In both House and Senate, committees are considering legislation to improve competitiveness by reorganizing government activities in the trade and technology areas. These bills involve major alterations of the Department of Commerce, with the goal of transforming it into a new entity — a Department of Science and Technology. IEEE President-Elect Russell C. Drew gave limited endorsement on behalf of the IEEE USAB when he testified April 30 before the House Science, Research and Technology Subcommittee, addressing the national Policy and Technology Foundation bill and the Department of Science and Technology Act. "The two bills being considered...are a valuable first step toward the definition of new measures to mobilize our scientific and engineering resources and direct these resources more effectively toward the solution of our current problems," Dr. Drew said. "We support them in principal and strongly endorse further discussion and refinement over the coming months." Copies of Dr. Drew's testimony are available from the IEEE Washington Office.

EMPLOYMENT GUIDES

Both the **Employment Guide for Engineers and Scientists**, Second Edition, and the **Employment Guide for Engineers and Scientists**, Student Edition, have been reprinted by USAB's Employment Assistance Committee, in order to meet the continued high demand. Employed engineers may purchase the Second Edition from the IEEE Service Center (201-981-1393) for \$7.50 (member) or \$15.00 (non-member). Please specify IEEE catalog number UH0157-8. Unemployed members may request a complimentary copy of the second edition by writing to the Washington Office and including their IEEE membership number. The Student Edition is \$8.95 (member) and \$11.95 (nonmember) for which IEEE catalog number UH0174-3 should be specified. All sales are subject to tax billing and/or shipment charges. The Student Edition also should be purchased from the service center.

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1987 IEEE SALARY SURVEY SHOWS that the mean income of non-student U.S. members of the IEEE is \$53,889 as of January, 1987. The survey was published May 11 by the Institute's USAB. It notes that IEEE members in Atlantic City, NJ and West Palm Beach, FL, receive the highest average salaries with means of \$68,400 and \$67,400, respectively. The 1987 survey, the eighth conducted since 1972, was based on responses of some 13,000 randomly-selected non-student U.S. members. All figures mentioned in this paragraph exclude supplementary income, overtime income and retirement benefits. The **IEEE U.S. Membership Salary & Fringe Benefit Survey**, publication no. UH0175-0 can be ordered for \$55.95 (IEEE members) or \$69.95 (nonmembers) plus a handling charge of \$5.00 per single copy order. Prepaid orders should be directed to the IEEE Service Center, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331 or by credit card by phone (201) 981-1393. Review copies of the survey are available on request to IEEE Public Information in Washington, (202) 785-0017, Ext. 309.

INTERIM STORAGE OF NUCLEAR WASTE

Efforts have begun in Congress to solve the problem of storing nuclear wastes in temporary repositories while they cool down enough to permit permanent storage. The formula outlined in pending bills is for construction of four regional Monitored Retrievable Storage (MRS) facilities across the country. Senator Daniel Evans (R-WA), sponsor of S. 1266, believes MRS facilities "can provide safe, cost-effective storage for nuclear waste, while giving us necessary time to ensure that our final disposal option is safe, responsible and technically sound."



Bert Aaron (L) receives the Long Island Section Award from Don Grieco, Chairman, "For his unstinting support over the past 25 years of New York Metropolitan area MTT activities and, in particular, for the vital role he played in the 1984 to 1987 Long Island MTT Symposia."

REPORT ON THE EUROPEAN QUASI-OPTICAL WORKSHOP IN BONN

by Nigel Keen

Chairman, Millimeter- and Submillimeter-Wave Working Group, W. German MTT Chapter

The European Quasi-Optical Workshop, organized by the Millimeter- and Submillimeter-Wave Working Group of the German MTT Chapter was held at the Max-Planck-Institut für Radioastronomie, Bonn on May 12-13, 1987. More than 60 participants attended, and to judge from the response, the workshop was just as successful as the two previous workshops organized by the chapter.

The first session was devoted to four invited papers, and in the afternoon twenty-two short contributions were presented — covering subjects ranging from antenna efficiency to quasi-optical diplexers, from very overmoded waveguide to antenna-arrays. The second day was entirely dedicated to impromptu discussions, questions to papers from the previous day and suggestions for future work. Some definitions were critically examined (e.g., "beam efficiency," "effective receiver noise" and "non-overlap loss").

Although all participants contributed to this event, the role of Derek Martin (Queen Mary College) deserves special mention. Starting with his keynote address and continuing throughout the workshop, his comments and explanations were a catalyst and a stimulus for all participants. It was a privilege to experience one of the innovators and founders of quasi-optics in action.

Proceedings of the workshop contain all papers in various forms, and can be obtained by sending DM 30 (thirty German marks) to the chairman, Professor Peter Russer, Institut für Hoch-Frequenz-Technik, TU München, Arcisstr. 21, D-8000 München 2, West Germany.

Finally, we should draw the attention of MTT members to the second workshop of our working group, entitled "Solid-State Sources at Millimeter- and Submillimeter-Wavelengths," to be held at AEG Ulm, West Germany, on September 29-30, 1987. Application forms may be obtained from Jorg Schroth, AEG AG, Sedanstr. 10, A1 E144, D-7900 Ulm, West Germany.

When phoning a hotel guest, it's helpful to leave a message with the hotel operator *before* you ask to be connected with the room. If you get through to your party, just tell him to ignore the message. If there's no answer, you're spared a possible long wait until the operator picks up your call again.

Travel Sense, by Dr. Barbara A. Pletcher, Ace Books, 200 Madison Ave., New York, NY 10016, \$5.95.

BALTIMORE MTT/AP CHAPTER HOLDS MEMBERSHIP DRIVE PICNIC

by Ed Niehenke

The Baltimore MTT/AP Chapter held its annual membership drive picnic on June 20, 1987. Anyone joining MTT or AP at the picnic was entitled to attend the event free. This is one technique the Baltimore Chapter uses to encourage people to join MTT and AP. The menu included hot steamed crabs, corn on the cob, hamburgers, sausage, hot dogs, beer, wine, and soda. In addition to the fine Maryland food, we swam, played volleyball, and enjoyed each other's company all day at a private home overlooking the Chesapeake Bay. This is an annual event that all the members and their families look forward to and enjoy.



Baltimore MTT/AP members get together at the June picnic.

At the picnic, John Gipprich, the outgoing Baltimore MTT Chapter Chairman, showed us the plaque and the \$200 check he received from MTT-S at the MTT Chapter Chairmans dinner in Las Vegas as recognition for the outstanding increase in membership during 1986. Our membership grew 58 percent to 186 members. John Gipprich attributes much of the growth to the Baltimore Chapter's hosting of the 1986 International Microwave Symposium. This event spurred much activity and there was a lot of opportunity to obtain new members. All the officers and members pitched in last year to help with the symposium. It was a very rewarding, exciting, and enjoyable experience for all involved. MTT Chapters should contact Walter Cox at (404) 894-2928 to propose having the Microwave Symposium in their city.

Baltimore had a very successful program for their September 1986 to June 1987 year. This program with seven events included lecturers from John Bryant, the

MTT Distinguished Microwave Lecturer; two AP Distinguished Lecturers; a fiber optics talk; a microwave CAD talk; the June picnic; and a one-day short course, "Modern Radar Systems — Fundamentals and Future Trends" with six speakers. The last event was well received with 69 in attendance.

The new officers, introduced to everyone at the picnic by John Gipprich, are Chairman David Saul, Vice-Chairman Dale Garrett, Secretary/Treasurer Paul Esker. The Facilities Chairman is under selection. Ed Niehenke, the MTT-S AdCom Liason for this chapter, presented all the officers with a personal gift for their hard work. The Baltimore members and their families gave all chapter officers a round of applause and look forward to coming to the events starting this September.

MICROWAVE EDUCATION MEETING

Santa Clara University

April 11, 1987

by George D. Vendelin

Santa Clara Valley, Chapter Chairman

This was a one day workshop attended by 35 people from educational institutions (including six universities) and industry in the Bay Area.

The activities of the IEEE MTT AdCom Educational Committee were presented by Dr. Jorg Raue of TRW. These included:

- 1) TV Broadcast in Nov/Dec '86 "Frontiers of High Technology"
- 2) Individual Learning Tapes priced at \$200.
- 3) About 30 Continuing Education Courses via satellite at \$3500 per site
- 4) Scholarship and grants-in-aid
- 5) Student paper contest in microwaves at both local and national level
- 6) Visiting Fellows Program

The industrial viewpoint was presented by Dick Clark of Avantek, who emphasized the need for a solid math and physics background and an understanding of the experimental technique. Can the student set up an experiment, obtain the answer, and evaluate the accuracy of the answer? Some of the attributes which are sought include:

- 1) broad range of interests
- 2) common thread of the courses
- 3) filter theory
- 4) ability to communicate
- 5) basic computer skills (program in basic)
- 6) courses in EM theory, Smith chart and S-parameters
- 7) fundamental understanding of Q
- 8) DC biasing a simple circuit

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MICROWAVE EDUCATION MEETING

(continued from page 61)

The areas of concern include:

- 1) problem set mentality
- 2) excessive use of computers
- 3) failure to question models
- 4) lack of EM theory
- 5) too much emphasis on equipment

Most people agreed there was very little need for an HP8510 at the University level, but some low frequency exposure to S-parameters in the laboratory would be very useful. When the student is hired, he will be given a project and asked to:

- 1) Design the circuit
- 2) Draw and cut the master artwork
- 3) Have the circuit built
- 4) Test the circuit
- 5) Write a report and evaluate the results

Students who can complete these tasks will usually make good microwave engineers.

Representatives from the universities explained each microwave education program in some detail. Some approximate numbers of students follow:

Bay Area Engineering Students at Universities

School	No. of Undergraduate Students	No. of Graduate Students	No. of Microwave Students Graduated Per Year
U. Cal. Berkeley	1800/1000 EE	600/300 EE	120
San Jose State	1500/470 EE	200/60 EE	30
Stanford	650/200 EE	2300/700 EE	100
Cal. Poly	3700/900 EE	100/20 EE	40
Univ. of Santa Clara	700/400 EE	1500/600 EE	70
U.C. Davis	1200/600 EE	300/100 EE	20
TOTALS			380

Several other Bay Area schools also reported including Microwave Training Institute, College of San Mateo, University of California Extension, Ed Tech and Besser Associates.

Some ideas for attracting more students into microwave include:

- 1) Contact High Schools and invite the top 15-20 science students to a plant tour.
- 2) At college level, bring in more summer students.
- 3) Use the acronym "MMIC," it helps.
- 4) Advertise much more new microwaves:
Computers with higher speed
Fiber Optics
MMIC
- 5) Use a Coop program more.
- 6) Improve college recruiting, which seems to be over by Fall (Spring is too late).

Some suggestions for further MTT involvement are:

- 1) Provide a list of qualified summer students. Industry has no time for this, but hiring summer

- students significantly lowers the "mishires."
- 2) Write to Engineering Faculty Heads and request more microwave faculty.

The general conclusion of this meeting was education is doing an excellent job increasing the pool of microwave graduates in the Bay Area. An even higher number would exist if more high school students can be attracted, which requires industry and/or MTT involvement. Everyone was both pleased and surprised by the wide range of activities in Bay Area microwave education. This meeting should probably be repeated about every other year.

MICROWAVE DAY AND MICROWAVE SEMINAR SERIES AT THE CITY COLLEGE OF NEW YORK

by Mohammed N. Afsar

The City College of New York had its first full day Microwave Symposium (The Microwave Day) on November 13, 1986. This was part of the Microwave Seminar Series also introduced in 1986 at the City College of New York. The City College Student Branch Chapter of the IEEE/MTT-S was formally opened by Dr. Reinhard Knerr, President of the IEEE/MTT-S on October 2, 1986. Dr. Knerr talked and explained to students about the importance of joining a professional society.

On October 9, 1986, Mr. Theodore S. Saad of Sage Laboratories talked about the MIT Radiation Laboratory. The third event of the series was the Microwave Day (November 13, 1986). Mr. Jim Borja of Compact Software gave a seminar and demonstration on Modern Computer-Aided Microwave Circuit Design on November 20, 1986. The last seminar of the 1986/87 academic year was on Multiple Beam-Forming Antenna Systems for Radar, which was presented by Mr. Daniel Davis of the Westinghouse Corporation on April 2, 1987. Over 200 students and engineers from nearby microwave companies attended each seminar. Electrical Engineering students of the City College had their first chance to interact with engineers, working in nearby companies.

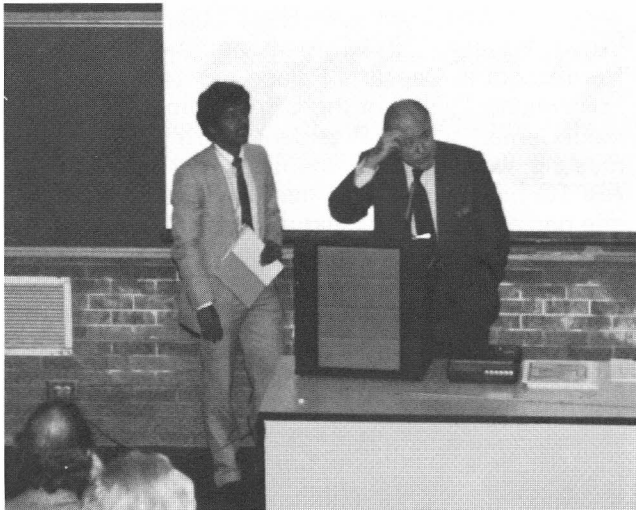
The Microwave Day

Professor Mohammed N. Afsar (Chairman, Organizing Committee) organized the one full day Microwave Symposium together with the City College Student Branch Chapter of the IEEE Microwave Theory and Techniques Society, the IEEE Student Branch of the City College, the City College Student Branch Chapter of the IEEE Communications Society and the Eta

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MICROWAVE DAY (continued from page 62)

Kappa Nu, Beta Pi Chapter of the City College. The IEEE/MTT-S sponsored the Microwave Day.



Dr. Bruno Weinschel, President of the IEEE with Professor Afsar.

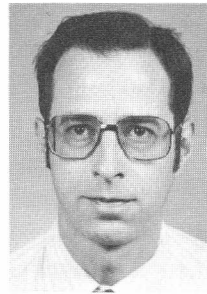
The part of the North Academic Center (NAC) building was decorated with balloons and ribbons. Light breakfast, lunch, afternoon snack, coffee and soft drinks were available to the participants. After the welcoming remarks by Professor Afsar, Dr. Bruno Weinschel, President of the IEEE presented the opening tutorial talk on "Microwave Attenuation Measurement and the Standard." Ten leading microwave companies opened the exhibit at noon time in the right foyer of the NAC building. The second tutorial talk was a spectacular one on "Radio Astronomy — A Challenge to the Microwave Engineer," which was given by Dr. Sander Weinreb of the National Radio Astronomy Observatory, Virginia.

After the lunch break Dr. Arthur Ballato of the Army Electronics Technology and Devices Lab., Fort Monmouth, New Jersey presented the very interesting and amusing talk on "Sources of Frequency and Time — Past, Present and Future." The last tutorial talk was given by Dr. Albie Williams of the COMSAT Laboratories on "Microwave Satellite Communications."

Tutorial talks were followed by two short contributed papers presented by City College Ph.d students. One was on "Microwave Six-Port Measurement" and the other was on "Millimeter-Wave Dielectric Measurements." Technical sessions ended around 4:45 p.m. The exhibit continued until 5:30 p.m.

Over 200 student members of the IEEE and about 50 engineers from Long Island and Northern New Jersey area and City College faculty members attended the technical sessions and the exhibit.

ARFTG HIGHLIGHTS



by Raymond W. Tucker, Jr.

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

An Introduction

With this article, I take over the role of ARFTG MTT-S Coordinator from the most able and innovative hands of my predecessor, Mario A. Maury, Jr. I am an electrical engineer employed at the Rome Air Development Center, Griffiss AFB, NY, which is the communications, command, control and intelligence research and development laboratory for the USAF. As past President of ARFTG I will continue to inform the microwave community on the activities of ARFTG.

30th ARFTG Conference Announcement

The Fall 1987 ARFTG Conference will be held at the Holiday Inn Crowne Plaza in Dallas, Texas on December 3 and 4, 1987. The Symposium Chairman will be Ken Bradley, Texas Instruments. The ARFTG Awards Banquet will be held on Thursday evening, December 3.

The main topic selected for this Conference will be AUTOMATED MMIC TECHNIQUES. Appropriate papers for presentation would focus on computer-aided analysis, design and measurement of MMICs. As considerable activity exists in this area, primary consideration will be given to papers on the main topic, however, papers on other areas of computer-aided RF and microwave design or measurement will also be considered. Technical presentations shall be twenty-five minute talks using viewgraphs and/or 35mm slides. Deadline for submission of Abstract and Summary will be October 1, 1987. Authors wishing to submit papers are requested to obtain an "ARFTG Instructions to Authors Kit" by contacting the Technical Program Chairman:

Dwayne Ragel
Texas Instruments
P.O. Box 655474, MS 404
Dallas, TX 75265
214-995-2465

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ARFTG HIGHLIGHTS (continued from page 63)

Manufacturers are encouraged to exhibit and present technical information related to new products applicable to these areas. Submit technical papers to the above address. Manufacturers interested in exhibiting their products, contact the Exhibits Chairman:

Gary Simpson
Maury Microwave Corporation
8610 Helms Avenue
Cucamonga, CA 91730
714-987-4715

For further information or to obtain registration material if you are not an ARFTG member, contact the Conference Chairman:

Ken Bradley
Texas Instruments
P.O. Box 660246, MS 255
Dallas, TX 75266
214-995-6158

30th ARFTG Conference Schedule

Wednesday, December 2, 1987

5:00 pm — 10:00 pm Registration and Reception
3:00 pm — 10:00 pm EXECOM Meeting & Dinner

Thursday, December 3, 1987

7:30 am — 5:00 pm Registration
7:30 am — 8:15 am Speaker's Breakfast
7:30 am — 8:15 am Continental Breakfast
7:30 am — 5:00 pm Manufacturer's Exhibits
8:30 am — 12 noon Morning Technical Session
12 noon — 1:15 pm Lunch
1:15 pm — 5:00 pm Afternoon Technical Session
6:00 pm — 7:00 pm Cocktail Party (Cash Bar)
7:00 pm — 10:00 pm ARFTG Awards Banquet

Friday, December 4, 1987

7:30 am — 1:00 pm Registration
7:30 am — 8:15 am Continental Breakfast
7:30 am — 2:00 pm Manufacturer's Exhibits
8:30 am — 12 noon Morning Technical Session
12 noon — 1:15 pm Lunch
1:15 pm — 5:00 pm Afternoon Technical Session
5:00 pm — 10:00 pm EXECOM Meeting & Dinner

30th ARFTG Conference General Information

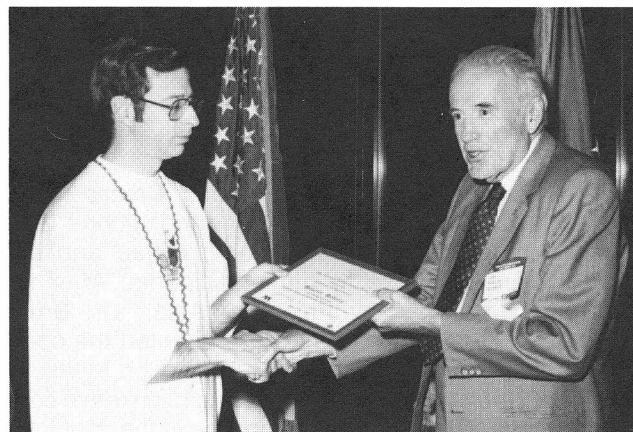
The Conference fee includes the ARFTG Awards Banquet on Thursday, and continental breakfast and lunch on Thursday and Friday. Spouses of ARFTG registrants are invited to the ARFTG Banquet at no additional cost. A post Conference Digest is also included in the fee. The digest is mailed approximately 90 days after the Conference.

This ARFTG Conference promises to be outstanding, with an excellent Technical Program, Exhibits and Awards Banquet — plan to attend!

29th ARFTG Conference Highlights

The Spring Automatic RF Techniques Group Conference was held in conjunction with the 1987 IEEE MTT-S International Microwave Symposium. The Technical Sessions were held on Friday and Saturday, June 12 and 13, 1987 at the Bally's Grand Hotel in Las Vegas, Nevada. The Awards Banquet was held in the Nero Room at Caesar's Palace.

Raymond Tucker of the USAF Rome Air Development Center, and the President of ARFTG opened the meeting, welcomed the attendees and introduced the ARFTG Executive Committee. After assuring that no one had as yet lost his shirt at the gaming tables, Ray introduced Peter Lacy of Wiltron Company, the Conference Chairman. Peter asked the attendees to introduce themselves, and thanked Maurice Moberg of Avantek, the Technical Program Chairman, and the authors for the excellent technical program.



ARFTG Conference Chairman, Dr. Peter Lacy, receives award from toga-clad ARFTG President, Raymond Tucker, during ARFTG Banquet, held at Caesars Palace (naturally).



Roger Pollard, Ken Bradley and Harold Stinehelfer, Sr. at the ARFTG Banquet Reception.

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ARFTG HIGHLIGHTS (continued from page 64)

The main topic for this conference was "Noise Parameter Characterization." Twenty-four technical papers were presented at this Conference. The following is a list of the papers presented:

"Bandwidth Effects in Noise Figure Measurements," William Pastori, Eaton.

"Automated Measurements of the BIT Error Rate as a Function of S/N Ratio for Microwave Communications Systems," Robert J. Kerczewski, Lewis Research Center.

"Full Band Millimeter Test Fixture with Integrated Biasing Network for Noise Measurements," Jamal Izadian, Avantek.

"A New Automated Noise and Gain Parameter Measurement System," Vince A. Hirsh and T.H. Miers, Ball Aerospace.

"Automated Noise Parameter Measurement Using a New De-embedding Algorithm," R.N. Schwartz, Avantek.

"Data Acquisition and Baseband Analysis Techniques of the HP3048A Phase Noise Measurement System," N. Nalder, Hewlett-Packard.

"ATE Implementation," Gary Simpson and Roger Pollard, Maury Microwave.

"A New Phasor Network Analyzer to 40 GHz in Coax," Edward Daw, Wiltron.

"Development and Accuracy Enhancements for Network Analysis," John Barr and Michael Pervere, Hewlett-Packard.

"Using Modularity to Improve Microwave Instrumentation," Mark Roos, EIP Microwave.

"Assurance Verification of ANA Calibration," William Oldfield, Wiltron.

"A Network Calibration Technique Employing Short Lengths of Precision Transmission Line," Roger Pollard, University of Leeds.

"Questions and Answers Concerning Air Lines as Impedance Standards," Cletus Hoer, National Bureau of Standards.

"Automated RF/DC Testing of Microwave Device Wafers," Bernard Ziegner, M/A-COM.

"Calibration Tuner for Chip Characterization Above 18 GHz," B. Bates and Ronald Harris, National Radio Astronomy Observatory.

"Improving CAD Accuracy with Planar Analysis Models of Junctions & Discontinuities," Henry A. Burger and R.F. Windell, Loral Systems Group.

"A Lumped Coplanar to Microstrip Transition Model for De-embedding S-Parameters Measured on GaAs Wafers," Don Harvey, Boeing Electronics.

"The Design and Modeling of Automated Broadband Slide-Screw Tuners," Mark Pierpoint, Roger Pollard and J. Richardson, University of Leeds.

"Arbitrary Time Domain Stimulus Analysis with S-Parameter Network Analyzers," Phil Bartley, Innovative Measurement Solutions.

"Implantation Process for Removing a Reflection Inside a Circuit," Harold E. Stinehelfer, Sr., Raytheon Bedford Labs and Made-It Associates.

"Time Delay Caused by Impedance Mismatch," Donald Lanzinger, Goodyear.

"An Analytical Model for Low Barrier Schottky Diode Detector Used for the Measurement of Noisy Signals," Ralph H. Britton and Bret A. Herscher, Wavetek Microwave.

"Application of Phase Discriminator Error Mode to Pulsed RF Measurement System Calibration," Gerald H. Bright, Robert E. Macior and H.K. Schuman, Atlantic Research.

"Characterization of Resonators with S-Parameter Network Analyzers," T. Semones, Innovative Measurement Solutions.

In addition to the Technical Program, Gary Simpson of Maury Microwave, and the ARFTG Exhibit Chairman, assembled 12 vendors for the ARFTG Exhibits.

At the ARFTG Awards Banquet, Ray Tucker of the Rome Air Development Center, Rome, NY, the ARFTG President, arrived in a Roman toga, to preside over the Roman (and other) citizens present for the Roman feast, amidst the Roman decor of Caesar's Palace. Remember that when in Rome...

ARFTG presented its Service Award to Barry Perlman of the David Sarnoff Research Center, for his service to the group as Treasurer; ARFTG presented its Automated Measurement Technology Award to Erich W. Strid of Cascade Microtech for his work in Microwave Device Wafer Probing; and ARFTG presented its Automatic Measurement Career Award to Les Besser of Besser Associates for a career of meritorious achievement and outstanding technical contribution to the field of computer-aided measurement and design for his efforts in microwave continuing education. ARFTG was honored by the presence of Robert W. Beatty, the 1983 ARFTG Automated Measurement Career Award recipient and this year's MTT-S Microwave Career Award recipient.

John Bryant, 1986 Distinguished Microwave Lecturer presented his lecture on the "First Century of Microwaves," which recognizes the pioneering work of Hertz a century ago. The evening concluded with the Comic Magic of Dick Ryan and an unplanned magicians challenge from Harold Stinehelfer, ARFTG's resident magician. Honor, Fellowship and Fun were had by all.

continued on page 66

ARFTG HIGHLIGHTS (continued from page 65)

Join ARFTG

ARFTG brings you the latest techniques in RF, Microwave and Millimeter-Wave Analysis, Design and Measurements. State-of-the-art papers are presented twice a year. If you are involved in automated techniques, come and join your peers and keep current with our ever-evolving technology. For more information on ARFTG, write: ARFTG, Sly Hill Road, Ava, NY 13303.

12th ANNUAL IEEE INTERNATIONAL CONFERENCE ON INFRARED AND MILLIMETER WAVES



by Kenneth J. Button

Conference Preview

The annual conference on Infrared and Millimeter Waves, formerly referred to as the "submillimeter" conference, appears to have graduated into the big time. This year the December 14-18 meeting at the Grosvenor Resort in Lake Buena Vista, Florida will have over 100 contributed millimeter wave papers (20 minutes) and more than a dozen invited keynote papers (40 minutes). This will provide two parallel sessions Monday through Friday noon. This portion of the program has been organized by James C. Wiltse.

A third parallel session will be required to accommodate more than 50 papers on millimeter wave gyrotrons and free electron lasers. This portion of the program has been organized by Richard J. Temkin.

The fourth parallel session will have to accommodate about 20 to 25 papers on millimeter wave materials properties and methods of millimeter wave measurement of materials properties. This special seminar has been organized by M.N. Afsar, George J. Simonis and Ulrich Strom.

Another special seminar has been organized on "microwave-optical interactions" by Tatsuo Itoh and Chi H. Lee.

Back to the Future?

This annual millimeter wave conference now resembles the IEEE International Microwave

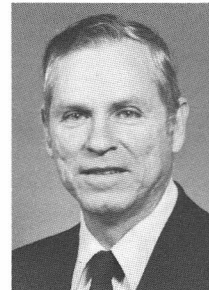
Symposium over ten years ago before we had a professionally-organized trade show. Thanks to those who helped Howard Ellowitz get started with our great exhibit, the Microwave Symposium now attracts several times the attendance of yesteryear, but the technical program is about the same size, thus permitting a higher level of quality.

We have similar hopes for the Millimeter Wave Conference. This year we are organizing our first commercial exhibit. We are starting off our exhibit organization modestly, offering only draped table-tops, 8' x 30" although there is ample space within the same divided ballroom that accommodates the technical sessions. The exhibit will be held for only two days, December 15th and 16th. It is supervised by M.N. Afsar.

Those who wish to contribute technical papers or to join the commercial exhibit should write to Kenneth J. Button, Box 72, MIT Branch, Cambridge, MA 02139-0901 or call (617) 489-4353. The preliminary program is available.

This Annual Millimeter Wave Symposium is sponsored by the IEEE Microwave Theory and Techniques Society.

INTERNATIONAL ACTIVITIES



by Richard A. Sparks

A major part of the MTT Society's growth in the last few years has been in membership outside the United States. This growth is reflected in the number of new chapters that have been formed with a total of three in Region 7 (Canada), nine in Region 8 (Europe, USSR and Africa), two in Region 9 (Central and South America) and three in Region 10 (Far East and Australia). These comprise nearly a third of the Society's chapters, indicating the truly international character of the IEEE.

Rio de Janeiro

This summer, following the IEEE/MTT-S International Microwave Symposium in Las Vegas, there are two regional microwave conferences that the MTT Society is cooperatively sponsoring. The first of these is the SBMO International Microwave Symposium in Brazil during the week July 27-30. The Sociedade Brasileira de Microondas, following its establishment in 1982, has organized its second meeting with invitations extended to the international microwave community, and will

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INTERNATIONAL ACTIVITIES

(continued from page 66)

focus on topics that include microwaves, antennas, propagation and optics. 180 papers have been organized into 31 technical sessions plus five panel discussions during the four-day meeting and a fifth day has been reserved for a mini-course on "CAD of Microstrip Circuits and Antennas." The symposium site is the Rio Palace Hotel facing Copacabana beach in Rio de Janeiro.

Rome

The second meeting of note is the 17th European Microwave Conference and Exhibition that will be held in Rome, Italy this year during the week of September 7-11. The symposium has been organized into 20 oral sessions and five poster sessions that include 151 presentations over four days. On Friday, September 11 a workshop is scheduled on "Present and Future Terrestrial and Satellite Microwave Communications for Fixed and Mobile Services." The four-day exhibition that accompanies the conference biennially will feature 250 microwave organizations from around the globe displaying their products and services. Venue for the Conference and Workshop is the Ergife Palace Hotel in the western Via Aurelia section of Rome.

MEETINGS OF INTEREST

GENERAL INTEREST

MIDCON '87 — Sept. 15-17. O'Hare Exposition Center, Rosemont, IL. Contact: Ms. Alexes Razevich, Electronic Conventions Mgmt., 8110 Airport Blvd., Los Angeles, CA 90045, (213) 772-2965, (800) 421-6816.

NORTHCON '87 — Sept. 22-24. Portland Memorial Coliseum, Portland, OR. Contact: Ms. Alexes Razevich, Electronic Conventions Mgmt., 8110 Airport Blvd., Los Angeles, CA 90045, (213) 772-2965, (800) 421-6816.

Electrical and Electronics Conference and Exposition — Sept. 28-30. Metro Toronto Convention Centre, Toronto, Ontario, Canada. Contact: IEEE Canadian Region Office, 7061 Yonge St., Thornhill, Ont. L3T 2A6, Canada, (416) 881-1930.

International Professional Communication Conference — IPCC '87 — Oct. 14-16. Sheraton Hotel Winnipeg, Winnipeg, Manitoba, Canada. Contact: Ron S. Blicq, General Chairman, The Roning Group, Box 8110, Postal Station C, Winnipeg MB Canada R3M 3S7, (204) 632-2292.

Western Electric Show & Convention (WESCON '87) — Nov. 17-19. Moscone Center and Brooks Hall, San Francisco, CA. Contact: Ms. Alexes Razevich, Electronic Conventions Mgmt., 8110 Airport Blvd., Los Angeles, CA 90045, (213) 772-2965, (800) 421-6816.

AEROSPACE/MILITARY

Aerospace Applications of Artificial Intelligence Conference — Oct. 5-9. Dayton, Ohio. Contact: Michael Johnson, BDM Corp., 1900 Founders Dr., Kettering, Ohio 45420, (513) 259-4434.

IEEE Military Communications Conference (MILCOM 87) — Oct. 19-22. McLean Hilton, McLean, VA. Contact: Mr. Alan J. Roberts, The Mitre Corporation, M/S W300, 1820 Dolley Madison Blvd., McLean, VA 22102-3481, (703) 883-5691.

ANTENNAS/PROPAGATION

9th Annual Meeting and Symposium, Antenna Measurement Techniques Association — Sept. 29-Oct. 1, The Stouffer Madison Hotel, Seattle, WA. Contact: James R. Otley, 1987 AMTA Symposium, 6682 South 191st Place, Suite E-105, Kent, WA 980223, (206) 655-7780.

1988 International Antennas and Propagation Society Symposium and URSI National Radio Science Meeting (AP) — June 6-10, Sheraton University Inn and Conference Center, Syracuse, NY. Contact: Arlon T. Adams, Dept. of Electrical Engineering and Computer Science, Syracuse University, 111 Link Hall, Syracuse, NY 13210, (315) 423-4397.

COMMUNICATIONS

10th Data Communications Symposium Datacomm '87 — Oct. 5-8. Embassy Suites, Napa Valley, CA. Contact: Bart Stuck, Teltron, Inc., Suite 300, 120 Wood Ave. S., Iselin, NJ 08830, (201) 906-0666.

GLOBECOM '87 — Nov. 15-18. Keio Plaza International Hotel, Tokyo, Japan. Contact: Noriyoshi Kuroyanagi/NTT ECL, Musashino, Tokyo 180, Phone: +81-422-59-2539, Telex: 02822620 NTT ECLJ or Takuro Muranti, General Affairs Chairman, R&D Labs., KDD<, Nakameguro, Tokyo 153, Phone: +81-3-713-0111, Telex: J 22500 KDD TOK In N.Y. (212) 705-7857.

International Conference on Communications — June 12-15, 1988. Philadelphia, PA. Contact: IEEE Office, Moore School of EE, Room 209, University of Pennsylvania, Philadelphia, PA 19104, (215) 898-8106.

COMPUTERS

1987 Conference on Software Maintenance — Sept. 21-23. Washington, DC. Contact: Software Maintenance, 1730 Massachusetts Ave., NW, Washington, DC 20036-1903, (202) 371-0101. TWX: 7108250437 IEEECOMPSON.

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MEETINGS OF INTEREST (continued from page 67)

1987 Second International Conference on Architectural Support for Programming Languages and Operating Systems (COMP) — Oct. 5-8. Hyatt Riskey Hotel, Palo Alto, CA. Contact: Martin Freeman, 4189 Donald Drive, Palo Alto, CA 94306, (408) 991-3591.

Annual IEEE International Conference on Computer Design (ICCD '87) — Oct. 5-8. Rye Town Hilton, Port Chester, NY. Contact: Prathima Agrawal. AT&T Bell Laboratories, Room 3-D-480, 600 Mountain Ave., Murray Hill, NJ 07974, (201) 582-6943.

COMPSAC '87 (COMP) — Oct. 5-9. Tokyo, Japan, IEEE Computer Society, 1730 Massachusetts Ave., NW, Washington, DC 20036, (202) 371-0101.

IEEE Computer Society International Conference on Computer Languages — Oct. 27-30. Konover Hotel, Miami Beach, FL. Contact: IEEE Computer Society, 1730 Massachusetts Avenue, NW, Washington, DC 20036-1903, (202) 371-0101, TWX: 7108250437 IEEECOMPISO.

IEEE International Conference on Computer Aided Design (ICCAD '87) — Nov. 9-12. Santa Clara Convention Center, Santa Clara, CA. Contact: Dr. Basant Chawla, AT&T Bell Laboratories, 1247 S. Cedar Crest Blvd., Allentown, PA 18103, (216) 770-3485.

INSTRUMENTATION

Conference and Exhibit on Instrumentation and Control Systems (ISA '87) — Oct. 5-8. Anaheim, CA. Contact: Paul Albert, Director, Conference and Exhibits, Instrument Society of America, 67 Alexander Dr., Research Triangle Park, NC 27709m, (919) 549-8411.

IEEE Instrumentation/Masurement Technology Conf. — April 19-22, 1988. San Diego, CA. Contact: Robert Myers, 1700 Westwood Blvd., Suite 101, Los Angeles, CA 90024, (213) 475-4571.

MICROWAVES

12th Annual IEEE International Conference on Infrared and Millimeter Waves — Dec. 14-18. Americana Dutch Resort Hotel, Orlando, FL. Contact: Kenneth J. Button, Conf. Chairman (Temporary), Box 72, MIT Branch, Cambridge, MA 02139-0901, (617) 253-5561, (617) 489-4353, Telex: 92-1473.

1988 IEEE MTT-S International Microwave Symposium (MTT) — May 25-27, Marriott Marquis/New York Convention Center, New York, NY. Contact: Charles Buntschuh, Narda Microwave Corporation, 435 Moreland Road, Hauppauge, NY 11788, (516) 231-1700.

POWER

1987 Engineering, Safety, Maintenance, Operation of Lines-ESMOL '87 (PE) — Sept. 22-24. Convention Center, Albuquerque, NM. Contact: K.E. Lindsey, Lindsey Manufacturing Co., 760 N. Georgia Ave., Azusa, CA 91702, (818) 969-3471.

1987 Joint Power Generation Conference (PE) — Oct 4-8. Omni Marriott Hotel, Miami, FL. Contact: M.W. Migliaro, Ebasco Services, Inc., 2 World Trade Center, New York, NY 10048, (212) 839-2245.

RELIABILITY

Conference and Exhibition on Instruments, Equipment and Supplies for Industrial Test and Measurement in Quality Control — Sept. 22-24. Cobo Hall, Detroit, MI. Contact: Joseph Maurer, Tower Conference Management Co., 331, W. Wesley St., Wheaton, IL 60187, (312) 668-8100.

1987 Quality in Electronics Conference — Nov. 12-13. Viscount Hotel, Los Angeles Airport, AVVV Electronic Systems, Inc. 2233 E. Grand Ave., El Segundo, CA 90245, (213) 334-4636.

SOLID STATE

17th European Solid-State Device Research Conference — Sept. 14-17. Bologna, Italy. Contact: Rita Mambelli, Dipartimento Elettronica Informatica Sistemistica, Facolta di Ingegneria, Universita di Bologna, Viale Risorgimento 2, 40136 Bologna, Italy, (39 + 51) 587454.

13th European Solid State Circuits Conference (SSC, REGION 8, et. al) — Sept. 23-25. Bad Soden, West Germany. Contact: G. Albert Darmstadt, Institut fuer Halbleitertechnik, Schlossgartenstrasse 8, D-6100 Darmstadt, West Germany, (49 + 6151) 16 39 33.

14th International Symposium on Gallium Arsenide and Related Compounds — Sept. 28-Oct. 2. Capsis Hotel-Research Center of Crete, Heraklio, Crete, Greece. Contact: A. Christou, Naval Research Laboratory, Code 6815. Washington, DC 20375, (202) 545-6700.

1987 IEEE GaAs IC Symposium — Oct. 13-16. Contact: Richard Y. Koyama, Technical Program Chairman, 1987 IEEE GaAs IC Symposium, Triquint Semiconductor, Tektronix Industrial Park, Group 600, P.O. Box 4935, Beaverton, OR 97076, (503) 627-6773.

1987 IEEE International Electron Devices Meeting (IEDM '87) — Dec. 6-9. Washington Hilton, Washington, DC. Contact: Ms. Melissa Widekehr, c/o Courtesy Associates, Inc., 665 15th Street, NW, Suite 3000, Washington, DC 20005, (202) 347-5900.



PHILLIP H. SMITH
(A'30, SM'46, F'52, LF'70)
1905-1987

Mr. Phillip H. Smith, who had suffered from Parkinson's disease for the last 10 years, passed away on August 29, 1987.

He was a vital contributor to the microwave and antenna fields. A brief description of his accomplishments and background follows.

In 1975, the Microwave Society for the IEEE presented to Phillip H. Smith a Special Microwave Application Award for his invention and application of the Smith Chart. The Smith Chart is perhaps the most widely used design tool in the microwave field. Although the Smith Chart has been called by a number of different names, such as Reflection Chart, Circle Diagram, Emittance Chart, etc., Phil Smith, a very modest man, chose the name Smith Chart, because "none of the other names were in themselves sufficiently definitive to be used unambiguously when compared with similar charts."

The idea for the chart began probably in 1931, when he developed a rectangular chart which was used to assist in the solution of transmission line problems. The rectangular plot was a graphical plot of a modified form of J.A. Fleming's 1911 telephone equation, which expressed the impedance characteristics of high frequency transmission lines in terms of measureable effects of electro-magnetic waves propagating thereon. For example, the standing wave amplitude and the wave position. However, because the rectangular chart had certain limitations, specifically the limited range of normalized impedance values and standing wave amplitude ratios, Smith was stimulated to transform the curves into a more useful arrangement, which ultimately resulted in the first circular Smith Chart, in 1936. In January 1939, there appeared in *Electronics* the famous article that described the Smith Chart, much as we know it today. A second article, which was published in 1944, incorporated further improvements, including the fact that it could be used both as an impedance chart and as an admittance chart.

From the beginning of World War II until the time of the introduction of the microprocessor and digital techniques, the Smith Chart was the dominant tool for microwave engineers. When Phil Smith retired from Bell Labs in 1970, he organized a small company — Analog Instruments Company of New Providence, NJ, which initially merchandised simple navigational instruments for light aircraft, but later began supplying his charts and a dozen or more chart-related items. At that time, his charts were selling to nearly every civilized country on earth. He had sold through 1975 about 9 million copies, and as he pointed out, microwave engineers all over the world who did not have the access to digital test equipment were ordering the chart in large quantities and were using it on a day-to-day basis.

But, while one is aware of the Smith Chart, they may not be aware of Phillip H. Smith, the engineer who designed it. He received his BSEE from Tufts College in 1928 and upon graduation he joined the technical staff of Bell Telephone Laboratories, where he remained until he retired. He was involved in the early development of transmission lines and directional antennas for the Bell Systems Shortwave Overseas Radio Telephone Circuits, and it was during that period that he developed the early forms of the chart. During the war, his experience was utilized in the design and development of radar antennas, where his numerous contributions placed him on the Reserved List of War Manpower Commission's Committee of Scientific and Research Personnel. Following the war, he turned his attention to commercial FM radio broadcasting antenna design and subsequently invented the Cloverleaf Antenna. Later, he became heavily involved in military weapons systems studies and design and supervised groups responsible for the electrical design of the Dual Line, Sage System, Nike Zeus and Nike X Radar Systems.

One of the programs that Phil Smith worked on that can help to illustrate his creativity in antenna design was a phased array radar system on the island of Kwajalein. This was an experimental system in the early days of the Safeguard program. The design of the antenna involved using a Lunenburg lens technique. The classical Lunenburg lens is a spherical lens that has the property that when the lens intercepts a plane wave, the focal point of the wave will always appear at a point on the opposite surface of the sphere, regardless of the direction from which the plane wave approaches the lens.

The technique that was used at Kwajalein was to build one half of the sphere — that is a hemispherical Lunenburg lens — with a ground plane significantly larger than the diameter of the sphere itself. The lens was made up of a series of polyfoam cubes about 2'x2'x2' loaded with aluminum slivers, so that the polyfoam block had a uniform dielectric constant throughout. By varying the amount of aluminum slivers one could vary the dielectric constant of the block. The required values of dielectric constant were then determined to achieve the Lunenburg lens performance. It turned out for their system they needed about 10 to 12 different values of dielectric constant and perhaps dozens of each value. There was a separate transmitter located nearby. When a signal was received, by virtue of the location of the receivers and the action of the Lunenburg lens, one could determine the azimuth and elevation of the target.

The system worked as predicted by theory, but it had a blind area below 10° azimuth, due to the limits of the ground plane.

The operation of the antenna relied on the ability to build the homogeneous aluminum-loaded polyfoam blocks of varying dielectric properties. The idea for the blocks came from Phil Smith.

Mr. Smith has 20 U.S. patents in the field, including basic patents on the optimum ratio coaxial transmission line and transmission line matching stubs. He published over 35 technical papers on antennas and transmission lines and he was responsible for a book entitled "Electronic Applications of the Smith Chart," which describes in great detail the many applications of his invention.

Theodore Saad

ENGINEERING RESEARCH INITIATION GRANTS

Sponsored by THE ENGINEERING FOUNDATION

with the cooperation of its Founder Societies

American Society of Civil Engineers
American Institute of Mining, Metallurgical and
Petroleum Engineers
American Society of Mechanical Engineers
Institute of Electrical and Electronics Engineers
American Institute of Chemical Engineers

General

The Engineering Foundation announces the availability of Engineering Research Initiation Grants during 1988-1989 in fields represented by its Founder Societies.

The program is directed toward assisting the start of research of new full time engineering faculty members who are without research support. Those with industrial-type experience but who are beginning an academic career are particularly encouraged to apply.

Up to two grants of \$20,000 each may be awarded on a competitive basis to members of each Founder Society for proposed research projects in fields of mutual interest to the Founder Society and to the Engineering Foundation. The Foundation will also cost-share up to three additional grants, one grant per Founder Society, in the amount of \$10,000 per grant subject to the Society's contributing or obtaining the remaining \$10,000 to fully fund the additional award. Should more than three Societies express willingness to cosponsor a grant, the allocation of additional awards will be determined by the order in which their official notification of intent is received by the Executive Secretary of the Foundation. Awards made with matching funds will be designated as joint Engineering Foundation-Founder Society awards, and will be selected and administered by the same procedures applicable to all Engineering Foundation Research Initiation Grants.

It is expected that investigators will devote at least one-fourth time during one academic year as part of their normal academic assignment and full time (2-3 months) during the summer following the academic year to the proposed research on the campus of their institution.

Eligibility

One proposal may be submitted per department on behalf of an individual who:

1. a). holds a full-time regular academic appointment on the engineering teaching faculty of an accredited institution of higher education.
- b). is without research support during the proposed project period.
- c). is a member of the society to which the proposal is submitted.

and either

2. a). was awarded the Doctor's degree not longer than three academic years prior to the submission of the proposal.

or

- b). has gained several years of industrial-type or post-doctoral experience and is within his or her first three years as a full time member of the faculty.

Statement by Department Head

The proposal must contain a signed statement by the Department Head indicating: investigator's eligibility, and where applicable, the name of the institution that conferred the Doctor's degree, date and title of the dissertation; the normal full time teaching load of the applicant during the current year at the present institution and that anticipated during the grant duration; and an endorsement by the Department Head.

Statement of Engineering Relevance

The proposal must contain a short specific statement of the relevance of the proposed research to engineering.

Interdisciplinary projects directed toward innovative engineering approaches to the solution of major problems or toward the development of new engineering principles, applications and techniques are encouraged.

Evaluation and Selection of Proposals

Proposals are to be sent directly to the appropriate professional society. A panel organized by the professional society will evaluate and select meritorious proposals. Not less than five of these will be submitted (in rank order) to the Projects Committee of the Engineering Foundation which will make the selection of proposals in the technical field of each of the Founder Societies for submission to the Board of the Engineering Foundation for final approval.

Deadline

All proposals being submitted to the Founder Societies must be received by November 15, 1987. Twenty-five copies are required.

The rank-ordered proposals selected by the Founder Societies must be received by the Projects Committee of the Engineering Foundation by February 15, 1988. Sixteen copies of each proposal are required. Proposals received after that date will not be considered.

Announcement of Grants

Grantees will be notified by a grant letter from the Executive Secretary of the Engineering Foundation on or about June 1, 1988. Grants will be effective as of September 1, 1988. Applicants not selected will be notified by the Founder Societies.

continued on page 71

Reports and Publications

Each grantee will submit to the Engineering Foundation in duplicate a semi-annual progress report, due March 1, 1988 and a final report, due September 1, 1989.

It is the policy of the Engineering Foundation that results of all investigations shall be available to the engineering profession and to the public. If the results of an Engineering Foundation supported project are not otherwise published, the Engineering Foundation reserves the right to publish the material giving due credit to those who conducted the work.

Engineering Foundation policy requires assignments of rights to patents, royalties, inventions, copyrights, etc. to the Engineering Foundation or to the public domain, unless otherwise agreed at the time the project is funded by Engineering Foundation.

Appropriate recognition of the Engineering Foundation and the cooperating FOUNDER SOCIETY must be prominently displayed on the title page of any publications resulting from projects supported by the Engineering Foundation.

Payments

Payment of supporting funds to the grantee's institution will be made in installments as determined by the Executive Secretary of the Foundation, contingent upon timely submission of the required reports and satisfactory progress as thereby evidenced. The final installment will be paid upon receipt of the investigator's final report, its approval by a Foundation-designated monitor, and Foundation acceptance of a final financial report from the institution comparing approved budget categories and actual expenditures.

Grant Renewal

There are no provisions for automatic grant renewal, although the Foundation may invite submission of additional research proposals at its discretion.

Mail proposals to:

Dr. Irving Engelson
Staff Director, Technical Activities,
Institute of Electrical and Electronics Engineers
345 East 47th Street
New York, NY 10017.

INSTRUCTIONS FOR PREPARING A PROPOSAL

The formal proposal shall include the following information.

Number of Copies

Twenty-five copies are needed.

Maximum Length

Proposals may be no longer than 25 double spaced pages including cover, statements, abstract, budget, biography, description and dissertation abstract (if applicable). Copies of publications, bibliographies and other such material should not be included, either as

part of the proposal or as attachments. Proposals longer than 25 pages in total length will be returned to the investigator.

The Cover Sheet

The first page of the proposal shall include the title of the project; name of the principal investigator, social security number (desired but optional); title, institution and location; and name of person financially responsible for administering project funds.

Statements

The Department Head's statement should be on page 2. The engineering relevance statement should be on page 3.

Abstract of Proposed Research

The fourth page of the proposal should contain an abstract of the proposed research. It should be limited to approximately 250 words and be of a style suitable for direct insertion into a technical journal.

Proposed Budget

The proposed budget should be on page 5. The funds provided may be used to defray such costs as support of the investigator's salary, expendable supplies, some travel, publication costs, and computer time. The Engineering Foundation reserves the right to make adjustments in budget categories.

Budgets will be prepared on the above basis and may not exceed \$20,000. Indirect costs, overhead and capital equipment will not be covered by the grant.

Biographical Sketch

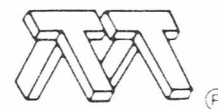
Following the proposed budget, a biographical sketch of the principal investigator should be presented including a listing of publications.

Description of Proposed Research

The next section should contain the research proposal in sufficient detail to allow evaluation of its engineering merit, including statement of the problem, its significance, relevance to engineering, interdisciplinary aspects, approach to execution of the project and timing of project work. Names of two or three recognized authorities in the field should be provided.

Dissertation Abstract (where applicable)

As the last page, the proposal should contain an abstract of the investigator's doctoral dissertation.



YEARLY TRANSACTIONS INDEX QUESTIONNAIRE

Presently, the December issue of the MTT-S Transactions includes an index of papers from the following sources:

1. MTT-S Transactions
2. MTT-S Symposium
3. Microwave and Millimeter-Wave Monolithic Circuits Symposium

The cost per member to provide this service is roughly twenty-five cents. Suggestions have been made to expand the coverage to other journals and symposia. Since the service is for the benefit of MTT-S members, your inputs are solicited. Please indicate your preference for journals and/or conferences you wish to see included in this index issue:

- International Conference on Infrared and Millimeter Waves
- Conference on High-Speed Semiconductor Devices and Circuits (Cornell)
- Gallium Arsenide Integrated Circuit Symposium
- European Microwave Conference
- International Symposium on Circuits and Systems
- Others
-
-
-

Return your choices and any comments to: Peter Staecker
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