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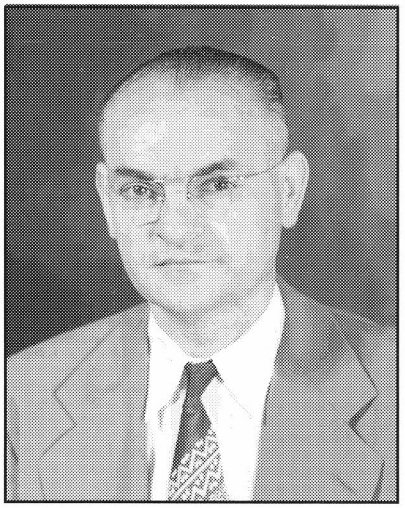
MICROWAVE THEORY
AND TECHNIQUES

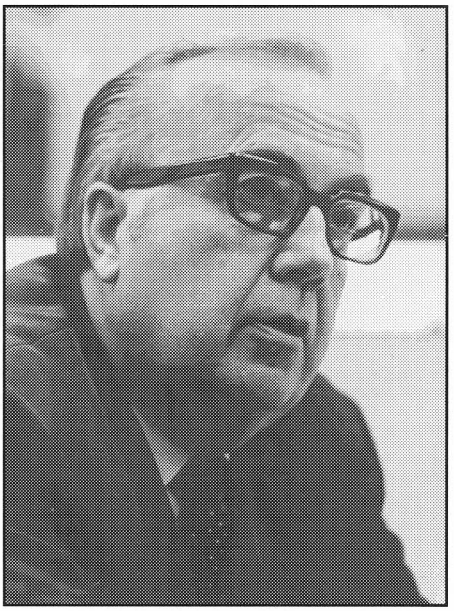
NEWSLETTER

Number 135
Fall 1993

Professor Leonard Lewin
1993 Microwave Career Award



Dr. Claud Cleeton
1993 Pioneer Award



Dr. C. Lester Hogan
1993 Pioneer Award

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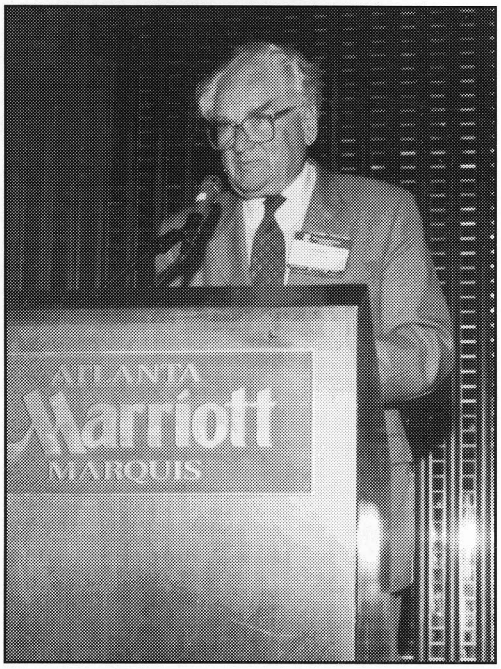
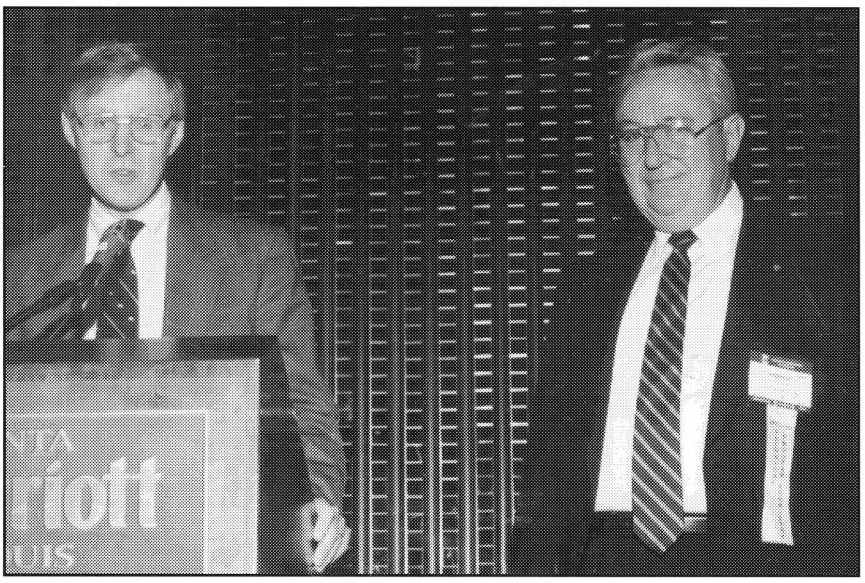


Professor Hubert Döring
1993 Microwave Career Award



Dr. Stephen Adam received the Distinguished Service Award from MTT-S AdCom President Peter Staecker at the 1993 IMS Awards Banquet in Atlanta, Georgia.

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Master Calendar

MTT-S Sponsored Conferences[1]

1993		
• GaAs IC Symposium	October 10-13 San Jose, CA	(CS) (*)
• Microwaves in Medicine	October 11-14 Rome, Italy	(C) (*)
• Asia Pacific Microwave Conference	October 18-21 Hsinchu, Taiwan, China	(C) (*)
• 2nd Topical Meeting on Electrical Performance of Electronic Packaging	October 20-22 Monterey, CA	(S) (*)
• Automatic RF Techniques Group	December 2-3 San Jose, CA	(C) (*)
1994		
• International Conference on Millimeter and Submillimeter Waves and Applications	January 10-14 San Diego, CA	(S) (Tentative)
• Ultra-Wideband Short Pulse Conference	April 7-10 Brooklyn, NY	(C)
• European GaAs Applications Conference	April	(C) (*)
• Topical Meeting on Electrical Performance of Electronic Packaging	April	(S) (*)
• Microwave & Millimeter Wave Monolithic Circuits Symposium	May 23 San Diego, CA	(S) (*)
• MTT-S International Microwave Symposium	May 24-26 San Diego, CA	(S) (*)
• Automatic RF Techniques Group	May 26-27 San Diego, CA	(C) (*)
• National Telesystems Conference	May 26-27 San Diego, CA	(CS)
• Asia-Pacific Microwave Conference	August	(CS) (*)
• IEEE Conference on the Computation of Electromagnetic Fields		(C) (*)
• European Microwave Conference	September	(C) (*)
• IEEE GaAs IC Symposium	October	(CS) (*)
• Automatic RF Techniques Group	December	(C) (*) Affiliated
• National Radio Science Meeting		(C) (*)

[1]Meetings listed are those that have been officially sponsored by MTT-S (i.e., AdCom approved). There are many other microwave related meetings (chapter sponsored, commercial, etc.) that are not listed.

[2]MTT-S conference involvement:

(S) Sponsor, (CS) Co-sponsor, (T) Technical Co-sponsorship, (C) Cooperate, (*) Continuous MTT-S involvement approved by AdCom

NOTICE

In preparation for the 1994 Committee Directory for the IEEE Microwave Theory and Techniques Society, I request that all AdCom officers, past presidents, life members, committee chairpersons and chapter officers send their contact information for listing directly to me at the following address:

John Wassel, Editor
Texas Instruments
P.O. Box 655474, MS 228
Dallas, TX 75265
or Fax (214) 995-3347

Please use only a postcard, letter or fax with legible writing to send me your current address, phone/fax number, and e.mail address. Also, please indicate the office or the commiittee position you hold.

I wish to avoid the inevitable errors that result from gathering this information through the usual sources. Hopefully, I'll be able to transcribe this data correctly from having your inputs first-hand.

Thanks, the Editor

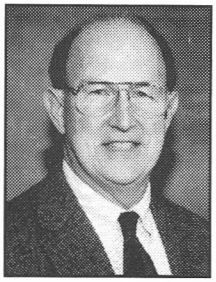
The committee directory will be in the next issue of the IEEE *MTT-S Newsletter*, Issue No. 136, to be mailed in January 1994.

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

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

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

IMS '93 Is History



G. P. Rodrique

C. T. Rucker

The 1993 IEEE-MTT-S International Microwave Symposium and its associated meetings were by all the usual measures quite successful. With bills still coming in it's too early to give a bottom line on finances, but it's clear that the budget, a vital element of the Society's balance sheet, will be met. Attendance at both technical sessions and exhibits was up—almost 6,000 total attendees in spite of the gloomy defense outlook.

About 1000 people attended the Plenary Session where John Day and Dick Snelling gave insight on and vision of the future of our industry. The (sometimes five) parallel technical sessions provided opportunities to hear more than 350 papers. The number of hotel rooms booked and used as reported by the local convention bureau increased by almost 15 percent over Albuquerque in '92 and 60 percent over Boston in 1991. The symposium program and the exhibition appeared to flow smoothly. The Georgia World Congress Center is a big hall and could easily accommodate the crowd. (A really big show for the GWCC has 90,000+ attendees.) There were a few "lost" attendees for the Monday morning workshops, but by 9:00 a.m. everyone seemed to have found their way. The annual awards ceremony was handled with taste and timeliness by Reinhard Knerr and Peter Staecker. Almost 500 attended this Awards Banquet, and a few photos from that event appear in this *Newsletter*.

As we expected, Mother Nature turned up the heat and humidity, but the AC met the challenge. Those attending Tuesday evening's outdoor events at the Laser Show and the Atlanta/Fulton County Stadium showed no ill effects from the heat . . . and the Braves beat the Mets! Working with the Atlanta Steering Committee was one of our greater pleasures of the Symposium. Approximately thirty volunteers worked together as an effective team not only to carry out their assigned responsibilities, but also to fill in and improvise when the need arose. The amount of personal time expended by the Steering Committee is hard to estimate with any precision, but it is certainly measured in kilomanhours. While a totally professionally managed symposium might be more efficiently done, it would lack some of the personality (and unpredictability) of the current volunteer based format . . . and the management fees would be much higher. Our symposium did use the

(Continued on page 29)

Microwave Career Award

The Microwave Career Award is the highest honor bestowed by the IEEE Microwave Theory and Techniques Society. The awards are made in recognition of a lifetime of meritorious service and technical excellence in the microwave field. The 1993 honorees are Professor Hubert Döring of the Technical University of Aachen, Germany, and Professor Leonard Lewin of the University of Colorado, USA. Both of these individuals have had very distinguished teaching careers and are now retired. They have established themselves as world renowned researchers.

Their Microwave Career citations read **"for a career of meritorious achievement and outstanding contributions to the field of microwave theory and techniques.**

Pioneer Award

The Pioneer Award recognizes contributions that have had major impact on the field and have stood the test of time. The basis for the nomination is an archival paper in the field of interest of MTT-S, published at least 20 years prior to the year of the award; that is, it recognizes important technical contributions that have had a continuing effect on the practice of microwave engineering for a period exceeding two decades. The 1993 recipients are Dr. Claud Cleeton, retired Associate Director of the Naval Research Laboratory, and Dr. C. Lester Hogan, retired President and Chief Executive Officer of Fairchild Camera and Instrument.

Dr. Cleeton is cited **"for pioneering contributions to microwave spectroscopy."** Dr. Cleeton's notebook is now in the Smithsonian National Museum of American History, Washington, DC, Accession 1984.0408. Some of the fundamental work was published in a paper entitled "Electromagnetic Waves of 1.1 cm Wavelength and Absorption Spectrum of Ammonia," *Phys. Rev.*, Vol. 45, pp. 234-237, Feb. 15, 1934.

Dr. Hogan is cited **"for pioneering the application of ferrites to microwave devices."** His paper, "The Ferromagnetic Faraday Effect at Microwave Frequencies and its Applications," *Bell System Technical Journal,* Vol. 31, pp. 1-31, January 1952, is the seminal paper publication on microwave ferrite devices.

Distinguished Service Award

The Distinguished Service Award is presented to honor an individual who has given outstanding service over a period of years for the benefit and advancement of MTT-S. This year Dr. Stephen F. Adam, who served MTT-S and IEEE in various functions including President of the Society, was honored at the IMS Awards Banquet.

The citation for the Distinguished Service Award reads: **"for his outstanding and dedicated service to the society."**

June 1993 AdCom Meeting Highlights

by Jim Crescenzi and Fred Schindler

The Symposium AdCom meeting has a reputation for being the most active interchange of ideas and initiatives of the year, and this one continued the tradition. The con-vergence of many of our members for the Symposium is undoubtedly the stimulus—there was a strong representation of members, chapter chairmen, committee activists, and approximately twenty past presidents! This meeting had more than its fair share of new initiatives and controversial subjects. The following list highlights several topics and individuals to contact if the reader wishes to follow up on particular issues.

- Encouragement by President Peter Staecker of the rapid expansion of MTT-S use of *email*, especially by AdCom members, committee members, and chapter officers. *Contact: Roger Pollard, roger@ee.eeds.ac.uk, or more conventionally at: 011-44-532-332080.*
- The "unbundling" of MTT-S publications, and itemization of dues. There was a vigorous debate regarding the possible consequences of a motion to unbundle publications, which was passed by the AdCom. *Contact: Jim Crescenzi, j.crescenzi@ieee.org, or (415) 813-2506.*
- Increased emphasis on surveys to determine membership interests, preferences, and professional priorities. *Contact: Derry Hornbuckle, derry_hornbuckle@hp5300. desk.hp.com, or (707) 577-3658.*
- Selection by AdCom of Boston as the IMS site for the year 2000, after consideration of proposals from Philadelphia, Atlantic City, and Boston. There was additional discussion regarding the methodology of site selection by AdCom, of screening criteria used to downselect to final candidate sites, and of the utility of professional Convention Bureau presentations at the AdCom meetings. *Contact: Eliot Cohen, ecohen@arpa.mil or (703) 696-2214; or George Oltman (818) 348-1697.*
- AdCom voted to co-sponsor the National Telesystems Conference in San Diego in 1994 (thus setting a precedent for making the NTS an ongoing participant in the Microwave Week). It also recently voted (mail ballot in August) to co-sponsor the Second International Conference on Ultra-Wideband, Short-Pulse Electromagnetics. Increased emphasis is being placed on "co-sponsorship" of meetings, as opposed to "cooperative- sponsorship", which more typically involves endorsement and support. Co-sponsorship includes active participation and sharing of financial responsibility. *Contact: John Horton: (310) 813-1156 on the National Telesystems Conf., and Ed Rezek, edward_rezek@qmail4.nba.trw.com or (310) 814-1860, on the Conf. onUltra-Wideband, Short Pulse Electromagnetics.*
- Continuing debate and discussion of the most appropriate means of supporting, organizing, and participating in microwave meetings and conferences held outside of North America. *Contact Rolf Jansen, fax: (203) 379-3498; or Eikichi Yamashita, fax: 81-424-80-3801.*
- A discussion of the role of "short courses" in MTT-S sponsored events. A distinction of "short courses" versus "workshops" is the possible deviation from the long standing policy of not compensating volunteer speakers and organizers. Short course lecturers of "tutorial" material might be an exception and receive compensation. *Contact: Roger Sudbury, (617) 981-7024.*
- Discussion regarding the advisability of establishing an MTT-S consulting network of microwave engineers. An AdCom "straw poll" established support of the general concept, and Steve Maas was assigned the follow-up action of recommending a specific policy. *Contact Steve Maas, smaas@aol.com, or (310) 426-1639.*

Leading the MTT-S AdCom meeting in Atlanta, GA, prior to the 1993 IEEE MTT-S International Microwave Symposium are (l-r) Fred Schindler (Secretary), Peter Staecker (1993 President), and Jim Crescenzi (Vice-President).

The 1994 budget was presented by Treasurer Skip Bryan, and adopted by the AdCom. The adopted budget anticipates a modest deficit, based on very conservative projections. This is due in part to the need to increase the Transactions page budget (1994 only) to deplete a large backlog of papers ready for publication,

thereby reducing the delay from submission to delivery to our members. Of various measures being undertaken to increase publications revenue, a priority activity is to increase library subscriptions to the *Microwave & Guided-Wave Letters* (which is less well known to librarians than our *Transactions*).

Unbundling of publications in 1994 will present the members with the following choices: membership (including the *Newsletter*): $8, *M&GW Letters*: $7, and *Transactions on Microwave Theory & Techniques*: $12. Although less of a bargain than in 1992 and 1993, these rates still make our technical publications available to members at a fraction of the incremental cost of publication. Unbundling gives the choice to the member as which technical publications (if any) to receive. This eliminates the costly practice of sending publications to members who might not wish to receive them, and it will provide direct feedback as to the preferences of our members. The policy was adopted by AdCom on a split vote (Y:18, N:13, A:1), and considerable concern was expressed about changing the historic policy of one membership fee for all publications. The projected favorable budgetary impact of unbundling was probably the deciding factor in the vote.

The major agenda item in the area of Meetings and Symposia was the process of selecting a site for the International Microwave Symposium for the year 2000. Excellent presentations were made by the New Jersey and Boston teams; competition was keen, and Boston was selected by vote of the AdCom. Meetings & Symposia Committee Vice Chairman Ed Rezek presented a comprehensive report on additional M&S Committee activities, including updating operational procedures, several motions for conference sponsorship, and discussion of ideas for expanding meeting activities. This overlapped with a Long Range Planning Committee strategic objective, which is to diversify beyond our annual Society conference (the International Microwave Symposium) by sponsoring additional smaller meetings in more diverse locations, including Europe and Asia. It is also considered highly desirable to sponsor topical meetings within North America at locations which have important MTT-S chapter activity but which may lack the centralized commercial base attractive to exhibitors.

We were once again fortunate to have IEEE Division IV Director Kenneth Dawson report on IEEE activities. Ken further enhanced his reputation for thought provoking presentations by questioning such pillars of the IEEE landscape as the *IEEE Spectrum* and the *IEEE Institute* (news supplement to the *Spectrum*). He expressed a preference for more controversial material in the *Institute* that might stimulate member responses and thought provoking letters to the editor. He also indicated IEEE consideration of establishing *email* bulletin boards to facilitate rapid exchange of hot technical news and debates of technical issues. All in all, Ken reports an invigorated IEEE in which there is a very active program of service and product evaluation, and formulation of strategy for future growth and direction.

Dennis Webb recently assumed the Intersocietal Liaison Committee chairmanship, and he reported on the organization of this committee and efforts to recruit volunteers to represent the Society on a variety of IEEE committees. Ron Peterson reported Committee on Man and Radiation activities, including a particular concern about popular press exploitation of "eletrophobia"—fear of the consequences of all varieties of electromagnetic radiation. John Osepchuk reported increasing interest in the application of microwaves to environmental cleanup.

Aditya Gupta reported on the ongoing and ambitious project to update the Operations and Procedures Manual to reflect current practice. Bob Moore (Operations Committee Chairman) also explained a project to streamline the Bylaws and to shift material to the Operations and Procedures Manual, where changes can be facilitated more readily. These documents are particularly important in the governance of a society of such diverse membership and where volunteer committee assignments change so rapidly. In another operational area, MTT-S support for historical activities remains strong. A motion by Steve Stitzer to provide a grant to IEEE Center for the History of Electrical Engineering was adopted.

The Membership Services Committee reported its continuing efforts to recruit new members, with emphasis on students. John Barr presented a plot of MTT Society membership by month over the last seven years that resembled an electrocardiogram! It shows the "heartbeat" of the society somewhat like a sawtooth waveform (with an annual period) superimposed on a longer term trend. There is a precipitous drop in membership at the beginning of each new year, followed by a ramp in new member additions. This stimulated discussion on the causes of dropout, and about our new sources of membership growth. One prediction is that Region 8-10 membership growth is at such a rate that the Society will be equally split with half the membership residing outside its historical base of North America (Regions 1-7) by the year 2000 (it is currently 68% in Regions 1-7).

A membership survey questionnaire was produced jointly by several committees (coordinated by Derry Hornbuckle) and distributed at the Symposium. Even before the survey results are known, some emerging member preferences are being anticipated. Recent IMS have had very strong participation in the workshops. Roger Sudbury reported that short courses have proven popular at other conferences such as the ISSCC. There may be a significant demand for tutorial material, in addition to the classic emphasis on original contribu-

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President's Message

by Peter Staecker

Probably one of the least understood and most helpful activities within IEEE is the Society Review process, a periodic (every 5 years or so) process for *facilitated* Society self-examination. Discussed briefly in the Winter 1993 *Newsletter*, this activity started for MTT in the summer of 1992 with a presentation by Reynold Kagiwada and me to the TAB Society Review Committee. The presentation format is defined and uniform, but the discussions tend to be informal, as the purpose is to help set the course for the Society for the future. Topics discussed include Membership, Finances, Meetings, Publications, Administration, and Chapters. I thought you would be interested in the summary findings of the Committee, their recommendations, and our responses and actions resulting from these discussions.

Membership and Chapters

A number of Societies have felt the pinch of reduced government military spending; of the lowest ranking Societies in growth (Reliability, Ocean Engineering, Aerospace Engineering, MTT, Computer, and Instrumentation and Measurement), many can trace the problem to the job loss suffered by the defense industry. While MTT is suffering, elements of recovery in the microwave component of wireless, automotive, and test and measurement disciplines are evident. Meanwhile, the non-US portion of our membership base continues to show healthy growth. The chapter structure of MTT is among the richest and most diverse in the Institute, and is supported by the Society through Distinguished Lecturer and other educational programs. MTT Chapters are a major source of leadership for the Society.

Finances

MTT is viewed as being a financially stable Society. In recent years, expenses have been growing somewhat faster than reserves, due in some part to the need for underwriting the *Letters* Journal beyond initial subscription support. An advertising campaign is underway to identify new subscribers to this Journal. Our new Administrator, Dick Sparks, is looking closely at cost savings in dealing with IEEE Headquarters, and has already identified a $20K annual savings resulting merely from a streamlined account reporting system. The financial dependence of the Society on exhibitor income from the IMS is of concern as we look to the uncertain times ahead.

Meetings

The International Microwave Symposium continues to be the most highly regarded and best attended microwave conference in the world. Organization is primarily volunteer, with an international technical program committee, and a steering committee composed of local chapter volunteers. Having served on two of these local committees, I can tell you that the gratification of contributing to such a production is immense. Efforts are being made to expand the reach of this meeting to include telecommunications (in 1993 we were co-located with the National Telesystems Conference, and in 1994 the relationship will be strengthened in San Diego) and other commercial microwave applications. There has been a call to move the IMS to offshore locations . . . while this would disrupt the strong exhibitor participation of this particular meeting, efforts are being made to become more closely aligned in a technical sense to existing and planned offshore meetings . . . to achieve the same objective.

Publications

Both the *Transactions* and the *Letters* Journal are highly regarded, as discussed in the Winter *Newsletter*, although the *Transactions* suffers the occasional complaint as being too theoretical. In the past, these publications have been "bundled" with membership dues, making marketplace validation of the *Transactions* criticism impossible to measure. In 1994 the Society will be "unbundling" these publications, while at the same time, introducing a tutorial or review component to the *Transactions* to widen its appeal among younger Members.

Administration

Although the Administrative Committee is described by the Review Committee as *comprehensive,* there is criticism levelled at our election process—which (like 12 other Societies) although admitting candidates from throughout the membership, allows only the 18 voting members of AdCom (as well as the three Past Presidents) to vote in an election. In popular elections where rank-and-file involvement is 100%, name recognition wins, but is neither necessary nor sufficient to yield an effective contributor to the Committee. In this environment, corporate memory falls to paid administrative staff, which is not a bad idea, just different. If you attend any MTT AdCom meeting, you will probably see no fewer than 10 Past Presidents, each of whom is more than willing to dispense liberal doses of corporate wisdom. For those who are interested, the AdCom selec-

(Continued on page 22)

MTT-S Meetings & Symposia Committee Report June 1993 AdCom Meeting

Ed Rezek

Elliot Cohen

Following is a summary of the Committee business concluded at the June 12-13, 1993, AdCom meeting in Atlanta, Georgia.

- Cooperative sponsorship was approved for the 1994 Ultra-Wideband and Short-Pulse Electromagnetic Conference to be held in Brooklyn, New York, on April 7-10, 1994. This conference was cooperatively sponsored by the Society in 1992 and was a great success, drawing nearly 150 registrants. The conference focuses on advanced technologies for generating, radiating, detecting and characterizing Ultra-Wideband and Short-Pulse (UWB/SP) signals as well as on current and potential applications. The deadline for submission of abstracts for the 1994 UWB/SP conference is December 1, 1993. The point of contact for all correspondence and additional information is Prof. Lawrence Carin, Weber Research Institute. Dr. Carin's telephone number is (718) 260-3876, fax: (718) 260-3906, email: lcarin@tasha.poly.edu.
- Cooperative sponsorship was approved for the 1995 International Symposium on Signals, Systems, and Electronics (ISSSE '95) meeting to be held in San Francisco, California, on October 25-27, 1995. This is the third of these meetings; past meetings were held in Erlanger, Germany, in 1988 and in Paris, France, in September, 1992. The meeting is sponsored by URSI (Union Radio-Scientifique Internationale). The most recent past meeting focused upon signal and information theory, system theory, communication systems, electronics, photonics, and CAD for devices and circuits. It is expected that similar topics will be discussed at the 1995 symposium, but additional suggestions are solicited. Contact the general chairman for additional information: Dr. J. W. Mink, Army Research Office, P.O. Box 12211, Research Triangle Park, NC 27709-2211, telephone (919) 549-4240; fax (919) 549-4310.
- Co-sponsorship was approved for the 1994 National Telesystems Conference (NTC) to be held concurrently with the 1994 IMS in San Diego, California, May 26-27, 1994. The NTC is also sponsored by the IEEE and by AE-S. The NTC focuses on a variety of communication areas including satellite communications, personal communications, aircraft navigation, Intelligent Vehicle Highway Systems, telemetry and remote sensing, radar, etc. The 1993 NTC was held concurrently with the 1993 IMS and had a topical panel session and many technical papers of great interest to Society members. Continued Society involvement was approved. Additional information may be obtained from John Horton, TRW. Mr. Horton's telephone number is (310) 813-1156, fax (310) 812-7111.
- At the January 1993 AdCom meeting cooperative sponsorship was approved for the 1993 International Semiconductor Device Research Symposium (ISDRS-93) to be held in Charlottesville, Virginia, on December 1-3,1993. Following a suggestion from Dr. Ferdo Ivanek, MTT-S Past President, AdCom discussed and approved, at the June 1993 AdCom meeting, the upgrading of MTT participation in this meeting to the co-sponsorship level with the proviso that complete budgetary information be submitted. (This is expected shortly). The ISDRS is an exploratory, university-oriented device research conference which emphasizes new semiconductor devices, including microwave, millimeter wave and photonic devices. It is held every two years, when the International Electron Devices Meeting (IEDM) is held in Washington, DC. (Note: This year IEDM will be held December 5-8 at the Washington Hilton.) The deadline for submission of extended abstracts for ISDRS-93 is September 20, 1993. The deadline for receipt of late news abstracts is November 15, 1993. The point of contact for all correspondence and additional information is Michael Shur, University of Virginia. Dr. Shur's telephone number is (804) 924-6109, fax: (804) 924-8818, email: msgn@virginia.edu.
- The 2nd Topical Meeting on Electronic Performance of Electronic Packaging will be held on October 20-22, 1993, at the Hyatt Regency Monterey, Monterey, California. This meeting is sponsored by MTT with participation of the IEEE Components, Hybrids and Manufacturing Society. The first of these meetings was held in Tucson, Arizona, during April 1992. The conference co-chairpersons are Dr. G. Arjavalingham of the IBM T. J. Watson Research Center and Dr. A. Cangellaris of the University of Arizona. Registration information may be obtained from: Engineering Professional Development, Box 9, Harvill Building, Room 235, Second and Oliver Streets, University of Arizona, Tucson, AZ 85721. The telephone number is (602) 621-3054 and the fax number is (602) 621-1443.
- The Society will have some level of involvement in 16 conferences in 1993. The vast majority of these conferences are cooperatively sponsored; this is the lowest level of IEEE involvement and basically means that the Society endorses the meeting content and recommends participation by Society members. AdCom tasked the Meetings & Symposia Committee with reviewing these conferences with the objective of increasing the level of Society involvement. Increased

involvement will allow a stronger emphasis on topics in the field of interest of the Society and will be a benefit to our membership.

- The Meetings & Symposia Committee presented a questionnaire intended to collect metrics on the conferences presently sponsored by the Society. This will provide the feedback required to gauge the value of Society involvement to our members. This information can also be used to identify those conferences that, by increased MTT-S involvement, can provide the highest impact to our members. The questionnaire has been sent to the five conferences held in the last quarter; the responses were reviewed by AdCom.
- Boston, MA, was approved as the IMS site for landmark year 2000. This decision is highlighted below.

2000 MTT-S Symposium

The location of the 2000 MTT-S International Microwave Symposium was approved at the June, 1993, meeting of MTT AdCom. Excellent proposal packages were submitted by the cities of Atlantic City, NJ, Philadelphia, PA, and Boston, MA. After due deliberation Boston was selected as the host city for the year 2000. Dr. Glenn Thoren is the Chairman of the 2000 IMS, which will be held during the month of June. If you are interested in obtaining further information please contact Glenn at the address below:

Glenn Thoren
Lockheed/Sanders Inc.
MSPTP2-B001
P.O. Box 0868
Nashua, NH 03061-0868
Tel. No. (603) 885-2988, Fax No. (603) 885-3177

Special thanks to George Oltman, Chairman of the Negotiating Committee, and his team members, Dave McQuiddy and Chuck Swift, for doing another outstanding job in carrying out this critical site selection process.

Future MTT-S Symposia

Following is a listing of the International Microwave Symposia sites through 1999 with their chairmen. If you are interested in participating in the planning and preparations for any of these conferences, please contact the appropriate chairman directly; your help will be appreciated and this is a good way to actively support your Society.

- 1994—San Diego, California, May 23-27,1994; Don Parker, Chairman, Hughes Aircraft Co., (310) 615-2576.
- 1995—Orlando, Florida, May 16-18, 1995; Keith Huddleston, Chairman, Martin Marietta Corp., (407) 356-7201.
- 1996—San Francisco, California, June 17- 21,1996; Jim Crescenzi, Chairman, Watkins-Johnson Co., (415) 813-2506.
- 1997—Denver, Colorado; Hussain Haddad, Chairman, Ball Aerospace, (303) 460-2114.
- 1998—Baltimore, Maryland; Steve Stitzer, Chairman, Westinghouse Electric Corp., (301) 765-7348.
- 1999—Anaheim, California, June 14-18, 1999; Mario A. Maury, Jr., Maury Microwave Corporation, (909) 987-4715 x201.

2001 MTT-S Symposium Site Proposals

We have not yet received any letters of intent from sponsors of proposed sites for the year 2001! MTT-S members are strongly encouraged to submit sites for consideration. Since the year 2000 conference will be held in the eastern part of the United States (Boston), it would be preferable to hold the 2001 conference in the middle or western part of the United States. The Site Selection Guidelines for the International Microwave Symposium were updated during 1992 and published in the Winter 1992 *Newsletter*. A copy of these guidelines may be obtained from Eliot Cohen (see end of article) upon request.

MTT-S Symposium Proposals Requested

The following is a listing of future MTT-S International Microwave Symposia dates and deadlines. We are requesting letters of intent from the prospective host chapters by the deadlines noted.

Year	Letter of Intent Deadline	Select By
2001	passed	ASAP
2002	June 30, 1994	June 1995
2003	June 30, 1994	June 1996
2004	June 30, 1995	June 1997

Chapters wishing to host any of these symposia are encouraged to submit their proposals to:

Eliot D. Cohen
MTT-S Meetings & Symposia Committee Chairman
ARPA/ESTO
3701 North Fairfax Drive
Arlington, VA 22203-1714
Tel. No. (703) 696-2214, Fax No. (703) 696-2203

MTT-S and Electronic Mail

Roger Pollard
MTT-S AdCom e-mail Liaison

IEEE has been actively promoting the use of electronic mail (e-mail) as a means of contacting its staff or entities (Sections, Societies, Regions, etc.). Three recent articles in *The Institute* (Nov./Dec. 1992, Jan./Feb. and Mar./Apr. 1993) have described how e-mail may be used and explained the e-mail services offered by IEEE to its members.

The MTT-S maintains an alias on the IEEE e-mail hub (soc.mtt@ieee.org). The AdCom has been keen to encourage the use of electronic mail for communication within MTT-S. Many AdCom members advertise e-mail addresses in the Directory and an increasing amount of AdCom communication is now conducted by e-mail. You should feel free to contact Society officers and committee members by e-mail, either directly or through the IEEE alias. As facilities expand we intend to provide a range of e-mail services, including auto-response files or such things as directories, conference information and publications and, in due course, a bulletin board. In the meantime, please use soc.mtt@iee.org as a channel for requests, comments and feedback to the Society AdCom.

MTT-S Membership Services Committee Report

Mario A. Maury, Jr.

Chapter Officers Meeting at IMS

The Annual Chapter Officers Meeting was held during the IEEE/MTT-S International Microwave Symposium in Atlanta, Georgia, U.S.A. It was held in the evening of Tuesday, June 15, and was preceeded by a reception and dinner. Awards were presented to Chapter Officers in attendance during the dinner.

The meeting was extremely well attended (over 57 total attendees) with a broad representation of all IEEE regions. Mike Golio, who is MTT-S Chapter Activities Coordinator, did an outstanding job of organizing and conducting the meeting.

A large number of MTT-S AdCom members and past Presidents attended, including the current President, Peter Staecker, and Vice President, Jim Crescenzi. Peter welcomed the attendees and stressed the importance of chapter activities to the society and its members. He also thanked the Chapter Officers for their efforts on behalf of the society and re-affirmed AdCom's commitment to supporting its chapters.

Various topics were covered and discussed during the meeting. Mike Golio reported on the results of last year's Chapter Officers survey and that a new survey will be conducted this year. Reinhard Knerr informed the officers present on the various awards offered by the society and encouraged them to submit qualified candidates. John Barr mentioned the various membership recruitment activities underway and solicited Chapter Officers cooperation. The exchange of information from this meeting should help Chapter Officers conduct more effective activities.

There will also be MTT-S Chapter Officers Meetings held in Regions 8, 9 and 10 at the following Conferences; please contact the following people for further information:

- Region 8—European Microwave Conference in Madrid, Spain (9/6–9/93). Contact: Rolf Jansen, 49-2102-83095, fax 49-2102-842391.
- Region 9—SBMO International Microwave Conference in Sao Paulo, Brazil (8/2–5/93). Contact: Denise Consoni, 55-11-815-9322, fax 55-11-211-4308
- Region 10—Asian Pacific Microwave Conference in Hsinchu, Taiwan, China (10/18–21/93), Contact:

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1994 IEEE MTT-S IMS—Small Reunions and Large Reunions

by Don Parker

We are having a wonderful time in San Diego. You will too. I am writing this article while vacationing in San Diego with my wife, children, and their spouses and eight grandchildren. My daughter from Kansas remarked as she arrived, "Oh, the climate here is so pleasant." We had planned to have our family reunion in Navuoo, Illinois and St. Louis. But a week ago with rising floods and predictions for more rain, we hurriedly switched to San Diego. Fortunately, I had enough frequent flyer coupons to get all fifteen of us here.

When my son told our three-year-old granddaughter they were going to San Diego to see the killer whales, she said, "They don't have killer whales in San Diego!"

"Yes, they do and they do tricks."

"Dad, whales don't do tricks."

A lot has changed since 1978 when we last held the Microwave Symposium in San Diego. The downtown section of the city has been revitalized. Many new hotels and the Horton Center Plaza (a shopping center with many unique shops) have opened. More importantly, there is a new Convention Center where we will hold the 1994 International Microwave Symposium during the week of May 22, 1994. (In 1978 the exhibits were held under a tent on the back terrace of the Sheraton Hotel.) This year, the exhibits will occupy only half of the available 250,000 square feet of the convention center's exhibit hall. As of this writing, all the rooms in the convention center are available for our use and the meeting rooms on the third floor are contiguous to each other. Hopping sessions should be very easy! It should also be convenient to find your friends, peers, vendors, and competitors. Incidentally, the convention center is on the shore of the San Diego Harbor and features terrific terraces overlooking the harbor and marina. In addition to the numerous sailboats there are usually a few navy ships in the harbor. The Coronado Bridge arching between the mainland and Coronado Island is a beautiful scene.

Our steering committee is composed of a good mixture of MTT-S veterans and new people from San Diego and Los Angeles. They are excited and are planning a terrific event for us all to enjoy,

Our theme "Waves and Microwaves" reflects the

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MTT-S Membership Services

(continued from previous page)

Eikichi Yamashita, 81-424-83-2161, fax 81-424-80-3801.

Chapter Officers from these various regions should make every effort to attend these meetings since they are very beneficial. They provide information to help you in conducting better activities and an open forum to exchange information and ideas with other MTT-S members with similar interests.

Chapter Officers Handbook

A new handbook was issued at the Chapter Officers Meeting in Atlanta and has been sent out to all chapters. This handbook provides a wealth of information for conducting chapter activities. It also provides the names of people to contact on the Membership Services Committee when you need asistance in specific areas. The following is a partial list of its contents:

- Planning Successful Meetings
- Reporting Meetings
- Reporting Chapter Officer Changes
- Financial Support Chapters
- Technical Speakers
- Travel Funds to MTT Symposium
- Section Financial Support
- Membership Development
- Chapter AdCom Liaisons
- Transnational Committee
- Distinguished Microwave Lecturers
- Videotape Series
- Etc.

Should you not receive your copy or need additional copies, please contact Austin Truitt.

Chapter Financial Support

At the June AdCom meeting, $200 per year additional funding was approved for chapters to conduct local workshops consisting of technical meetings lasting four (4) hours or more. Contact Mike Golio for additional information.

Many chapters do not take advantage of the financial support available from MTT-S. The following is a brief summary of this financial support available on a yearly basis.

- **MTT-S only Chapter**
  $1,400/YR = $500 General Chapter Support + $700 Travel + $200 Workshop
- **MTT-S Joint (other society) Chapter**
  $1,250/YR = $350 General Chapter Support + $700 Travel + $200 Workshop

Please refer to the MTT-S Chapter Officers Handbook 1993-94 for eligibility, etc., information. Submit funding requests through Samir El-Ghazaly using the forms provided in the handbook.

Chapter Reporting

It is extremely important that you submit your reports on a timely basis. Please refer to the handbook for appropriate instructions. Your records must be updated in order for us to provide you with support. Please contact Joe Staudinger.

Chapter Newsletter

We have initiated a Chapter Officers' Newsletter entitled *Transceiver*. The purpose of this is to provide focused information to the chapters concerning their activities. We hope that by providing this forum, we can help to exchange information to help the chapters conduct more effective meetings and to provide specific chapter operating information. Please submit your inputs, articles, etc., directly to Vijay Nair, Editor of the *Transceiver*.

MTT-S Membership Recruitment

The Membership Development Committee headed by John Barr has a membership drive underway. The Membership Booth at the 1993 IMS in Atlanta signed up 110 new MTT-S members.

Membership Booths are also being planned at the following conferences:

- SBMO—Sao Paulo, Brazil (8/2-5/93)
- European Microwave Conference—Madrid, Spain (9/6-9/93)
- APMC—Taiwan, China (10/18-21/93)

The IEEE and MTT-S provide discounts as an incentive to join at conferences. Also chapters should remember that the chapters in Regions 1-6 and 7-10 with the largest membership gain each year can get a $200 award. Contact John Barr for additional information.

New MTT-S Chapters

Since the beginning of the year, three new MTT-S Chapters have been formed; they are all joint chapters. We would like to welcome them aboard and wish their successful operations. They are listed below:

- **Czechoslovakia Section** (Joint with AP)—Dr. Pavel Bezousek, Tesla Pardubice Radar Sys. Div., Opocinek, 53337 Lany Na Dulku, Czech Republic
- **Foothill Section** (Joint with AP)—Dr. S. Michael Saad, Andrew Corporation, 9269 Utica, Avenue, Suite 125, Rancho Cucamonga, CA 91730-5469
- **Toronto Section** (Joint with AP & EC)—Dr. T. Emolie van Deventer, 113 Annette Street #303, Toronto, Ontario M6P 1N8, Canada

Any MTT-S members who are interested in joining any of these chapters, please contact the organizers named above.

Membership Services Committee

The following are the members of the Membership Services Committee:

- Chairman: Mario A. Maury, Jr., (909) 987-4715, fax (909) 987-1117
- Vice Chairman: Roger D. Pollard, (44) 532-332080, fax (44) 532-332032
- Chapter Activities: Mike Golio, (602) 897-5947
- Chapter Records: Joe Staudinger, (602) 732-2803, fax (602) 732-2148
- Chapter Officers Handbook: Austin Truitt, (214) 995-6662, fax (214) 995-3239
- Chapter Communications: Vijay Nair, (602) 897-5922, fax (602) 897-5934
- Chapter Funding: Samir El-Ghazaly, (602) 965-5322, fax (602) 965-8325

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MTT-S Membership Services

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- Int'l Chapter Meeting Liaison: Richard A. Sparks, (617) 275-8179, fax (617) 863-0586
- Microwave Lecturer Program: Kris K. Agarwal, (203) 576-4109, fax (203) 576-4117 (new location)
- Membership Development: John T. Barr, (707) 577-2350, fax (707) 577-5644
- Student Member Development: Roger D. Pollard, (44) 532-332080, fax (44) 532-332032
- Newsletter Editor: John W. Wassel, (214) 995-3216, fax (214) 995-3347
- Feature Articles: John A. Eisenberg, (415) 941-7426

It is the objective of this committee to administrate the services MTT-S provides to its members and chapters and to continually try to make improvements. I have listed above all committee members' phone and fax numbers so you can communicate with any of us if you need any information, assistance or have any suggestions relative to MTT-S activities or benefits.

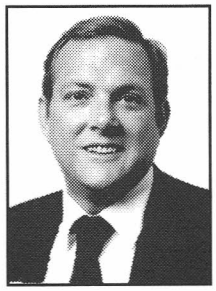
Small Reunions and Large Reunions

(continued from page 9)

broad spectrum of technologies that interest MTT-S members and the proximity of the symposium site to the ocean. Dr. Robert L. Eisenhart, chairman of the Technical Program Committee, is planning for four to five parallel sessions each day in order to cover all the subjects of interest. Dave Rubin (1978 Steering Committee Chairman) is local arrangements chairman for 1994. His committee has a horrendous task, but is still on track. Speaking of track, San Diego has a trolley that runs past all the major hotels and the convention center as well as to Tiajuana, Mexico. Dave's committee is arranging for all participants to have a free pass for the week to ride the trolley at any time and go wherever they desire, including Tiajuana, Mexico. Extra trolley cars will be added to handle our peak load requirements. Our family took the trolley to Mexico; the cars were clean and very comfortable.

Two additional conferences will be held in conjunction with the IMS during Microwave Week May 22–27, 1994. As in the past, the IEEE Microwave and Millimeter-Wave Monolithic Circuits Symposium (MMWMCS) will begin on Monday and will continue on Tuesday in joint sessions with IMS. The National Telesystems Conference (NTC) will begin on Thursday in joint sessions with IMS and will continue through Friday.

We invite all of you to join us in San Diego where the climate for waves and microwaves is "so pleasant." We will have a whale of a killer symposium and maybe even a few new tricks.



MTT Society Ombudsman

Ed Niehenke
Westinghouse Electric Corporation
P.O. Box 746, MS-75
Baltimore, MD 21203
(410) 765-4573, Fax (410) 993-7432

As your Ombudsman, I have received ten inquiries from MTT-S members since the last reporting in the Spring 1993 *MTT-S Newsletter*. Inquiries were from the US, Canada, Australia, China, Europe, India, Israel, and Japan. A summary of the inquiries and action taken are listed below:

- Three inquiries regarding need for IEEE membership and past MTT-S issues (new cards and issues sent to members)
- One inquiry regarding IEEE membership card (new card sent)
- One inquiry regarding need for confirmation of 1993 IMS registration and hotel arrangements (IMS registration confirmation and telephone numbers of hotels sent)
- One inquiry requesting change of name for IEEE membership (new IEEE card with new name sent and IEEE records changed)
- One inquiry requesting back issues of MTT-S (back issues sent)
- One inquiry requesting reimbursement of accommodations at IMS as a selected European speaker as part of agreement between MTT-S and European Microwave Conference (request being processed)
- One inquiry from member requesting overseas colleague to pay his IEEE dues (contacted colleague with request to pay friend's IEEE dues)
- One inquiry from member suspecting a problem with his IEEE membership records (checked with IEEE—membership being investigated)

Members who pay by wire transfer should make sure they include their name, IEEE number, and the dispersement of the draft for membership renewal. If this is not done, IEEE has a problem in applying the money, which delays the renewal process.

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

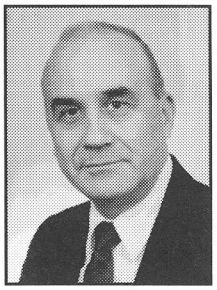
NOTICE

In preparation for the 1994 Committee Directory for the IEEE Microwave Theory and Techniques Society, I request that all AdCom officers, past presidents, life members, committee chairpersons and chapter officers send their contact information for listing directly to me at the following address: John Wassel, Editor, Texas Instruments, P.O. Box 655474, MS 228, Dallas, TX 75265, or Fax (214) 995-3347

Please use only a postcard, letter or fax with legible writing to send me your current address, phone/fax number, and e.mail address. Also, please indicate the office or the commiittee position you hold. I wish to avoid the inevitable errors that result from gathering this information through the usual sources. Hopefully, I'll be able to transcribe this data correctly from having your inputs first-hand. The committee directory will be in the next issue of the IEEE *MTT-S Newsletter*, Issue No. 136, to be mailed in January 1994.

Thanks, the Editor

? What Happened to the *Transactions* ?



by Dan Masse, Editor

Many of you have noted that the *MTT-Transactions* are very late in reaching you and most papers are now submitted more than a year before publication. What happened?

We are suffering from two problems, which while independent have occured almost simultaneously.

The first problem results in you receiving the February issue in June. As of January 1, 1993, the IEEE Publications Dept has switched to electronic publishing, a matter which at first glance would seem simple but proved to be very complex. IEEE was totally unprepared and the Associate Editors in charge of the different Journals were untrained and had to learn "on the job." The great variety of word processor programs was overwhelming and often the equations and special characters have to be entered by hand, after which the paper had to be formated, the figures inserted, etc. It took more than three passes per paper in some cases.

It is to the credit of our Associate Editor, Mr Joseph Pagnotta, that we are catching up and by the December issue, we should be back on schedule. I know it is no consolation to know that fifty percent of the *IEEE Transactions* are behind schedule and that the other 50% will be also when they switch on January 1, 1994. In the meantime if you want to help, try to submit your paper in a TexT or LaTexT format which is the easiest one to handle. Submitting your final manuscript in hard copy will not help since somebody will have to put it on disk.

The other problem has to do with the number of pages published. We operate with a strict page budget which cannot be exceeded without financial penalties. The page budget for 1992 was 2300 pages and for 1993 it is 2400. However, we are now getting more papers submitted, over 450 in 1992 and already close to 250 in 1993. With a 68 to 70% ratio of papers accepted for publication, it means about 2400 pages without counting the advertisements, call for papers, and other information which is included as well as the covers. In addition, we publish about four Special Issues per year. These special issues seem to be favored by the MTT Membership because they address specific topics of actuality. These add at least 800 pages and in many case push back regular papers. The situation has become critical with, at the present time (July), 133 pa-

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Globalization

W. Kenneth Dawson
Division IV Director

These days it is hard to have a discussion at almost any IEEE Board meeting with volunteers or staff without the word "globalization" entering into the conversation. The good news is that almost everybody is for it. The bad news is that the word means different things to different people. Globalization of the IEEE is a very complex topic (hence all the conversations) and I would like to give you some of my thoughts on what it means. In turn, I encourage you send me your ideas on this important, fascinating and potentially risky concept.

Perhaps the first, and even only, aspect of globalization that comes to mind is that the IEEE increase its efforts to attract and hold more non-US members. Changes in the political shape of the world as well as new technologies, especially communications, are valid and appropriate stimuli for the move to increase the diversity of our membership. Today, and even more so tomorrow, members of our profession are working in an environment where the isolation and protection of political boundaries are fast disappearing. To continue to serve its members and prosper the IEEE must take this into account in its long-range planning. So, quite naturally, the first thing that comes to mind is to seek more members from non-US countries.

The acquisition of more non-US members (as I am) has many consequences which we should appreciate and anticipate. Before discussing some of these I would like to give my conclusion first so that my comments will, I hope, not be misunderstood. It is that globalization is a "good thing" but in order for it to be a benefit to all members, current and future, we have to chart a careful and well understood course.

New members will have to receive services. At present members living outside North America receive poorer service than those inside, and it costs more. To retain current non-North American members and attract new ones services will have to be improved, as they will for all members, and this will cost more money. In the foreseeable future technology can and will provide solutions that come close to making the cost of services independent of location—after all, that's one of the things we are supposed to be good at. In the meantime, however, all members must be prepared to accept the cost either in dollars or in a somewhat less than satis-

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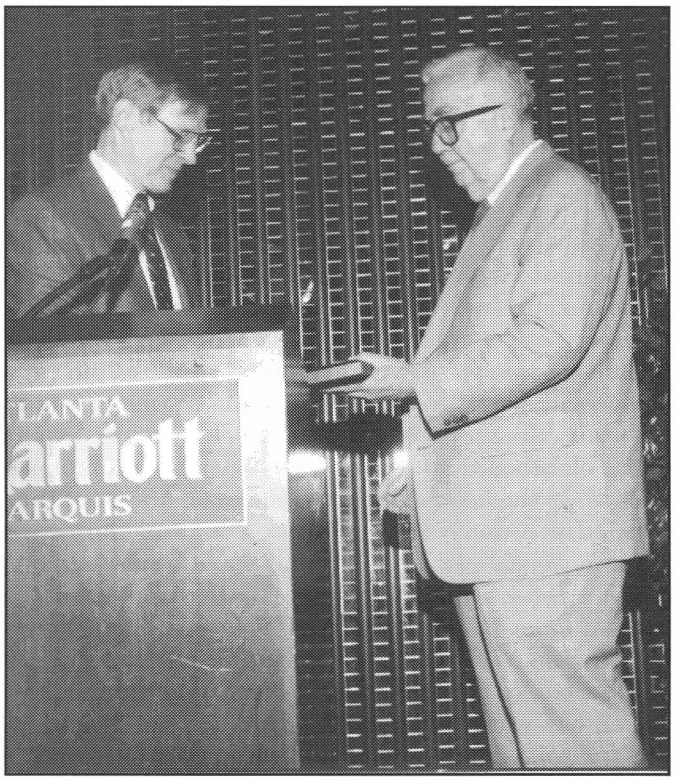
The Invention of the Ferrite Gyrator and Subsidiary Devices

by C. Lester Hogan

Dr. Lester Hogan was one of the 1993 recipients of the IEEE MTT-S' Pioneer Award. At the request of Professor Lionel E. Davis of UMIST, Dr. Hogan sent him a copy of his presentation at the Special Ferrite Session during the 1993 International Microwave Symposium. The following account is Dr. Hogan's recollection of how the ferrite gyrator was invented in the early 1950's at Bell Labs.

The ferrite gyrator and several related microwave devices were conceived and reduced to practice in less than three months at the Bell Telephone Laboratories in late 1950. Although I have told of this work many times in conversation, the story has never been published.

On joining Bell Labs on August 1, 1950, I was assigned to the research department under Dick Griswold. After the usual indoctrination required of all new members of technical staff, I asked Dick Griswold about the various activities going on under his direction and asked him if there was any particular activity that he wanted me to join.



Dr. C. Lester Hogan receives the 1993 IEEE MTT-S Pioneer Award from MTT-S AdCom President Peter Staecker at the IMS Awards Banquet.

His reaction was, "Les, this is a very large laboratory with a wide variety of activities. I think you should spend a week or two wandering into as many activities as you can absorb. In addition, this will allow you to become acquainted with a large number of individuals in the laboratory. You never know when one or another might be able to help you." His final remark was, "If you have any spare time, I suggest you read an article in Philips Research Review. A bright young man at Philips by the name of Tellegen has written an article that suggests that a new passive circuit element appears to be possible even though his suggestions for achieving this device seem less than exciting." The unique part of this hopefully new circuit element was that it violated the law of reciprocity. Tellegen's analysis was limited to a four-pole network.

So for the next two weeks, I introduced myself to dozens of scientists-engineers at the Laboratory. In between these visits I read and reread Tellegen's paper.

About nine months earlier, I had taken an advanced course in optics from Professor Cheney at Lehigh University. During this course, he had discussed an 1890 paper by Lord Rayleigh. He pointed out that his proposed device, when and if it was achieved, would violate the reciprocity theorem. Rayleigh's device was intended to operate in the optical region, while Tellegen's was intended to work in the lower frequencies then used for radio transmission. A few weeks after Rayleigh's article appeared in print, a letter to the editor objected that the device, if built, would violate the second law of thermodynamics. In a reply of a few lines, Lord Rayleigh refuted this objection. Figure 1 shows Rayleigh's view of his newly predicted device.

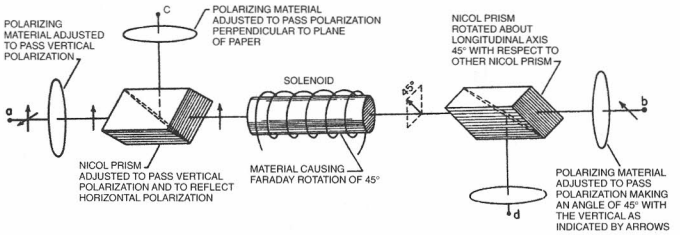


Figure 1.
Lord Rayleigh's proposal of an optical frequency circulator.

The Faraday rotation of the materials then known was much too small to build the device which Rayleigh conceived, and as a result he was unable to actually demonstrate the device.

Soon after Lord Rayleigh's proposal, the Faraday rotation of iron was found to be of the order of 100,000 degrees per inch, but measurement of the Faraday rotation of magnetized layers of iron required use of extremely thin layers of iron evaporated onto micro-

scope slides. Less than one degree of rotation was possible before light transmission through the iron was nil.

During my period of roaming around the labs in order to become acquainted, I had visited the metallurgical department and had been introduced to the existence of ferrites. I realized that all the ferrites I had seen were opaque to frequencies in the optical region. However, because they were insulators, it seemed reasonable to hope that the metallurgists could build a ferrite that was essentially transparent at X-band frequencies.

So I returned to the metallurgical department and explained exactly what I was trying to build. Their first question was what permeability I was hoping for. I told them I didn't care what the permeability was as long as I could build a magnetic coil strong enough to magnetize the ferrite. Immediately they smiled and said they were certain they could build a ferrite with almost zero loss at X-band frequencies. They said that if they created a ferrite with a permeability of 1,000, their regular customers asked for 10,000. When they achieved this their customers demanded 100,000. While they had created such materials, the high permeabilities were accompanied by high losses at the frequencies I needed.

Actually, they had already made a magnesium-manganese ferrite with extremely low losses at all frequencies even at microwave frequencies. Their customers had little use for this formulation because the permeabilities of these devices were low. Since I had no need for high permeabilities, they guaranteed that I would need some rather delicate equipment in order to measure the loss. They indicated that for any practical application, the loss would be close to zero. They also said that in less than a week they would have a ferrite which would make me happy. As might be expected, I walked out of their lab and more or less floated back to my own laboratory.

Even with this elation, I realized that there were still a few problems left. In the first place, I had not yet calculated the rotation that I would obtain in a ferrite cylinder with a thickness between 1/8 to 1/4 inches in diameter. Also, I realized that I needed to build a piece of microwave plumbing that changed from a rectangular to circular and then back to rectangular microwave guide. I knew very little about the construction of microwave devices. The entire theory of such were developed during WWII, and in the past four years I had little time for anything that did not lead me to my PhD in the fastest way possible. So I took two approaches to shorten the learning of this new knowledge. I borrowed Southworth's book from the Bell Labs library and, a few days later, I made an appointment to visit the Holmdel Labs which were the center of knowledge in the Labs for these activities. About a year earlier, D. Polder had published a complete mathematical paper that predicted the behavior of infinite plane waves when propagating through a magnetized ferrite. The solution was there, but the author did not yet know that this problem was already solved.

So my solution was to find someone else in the Laboratory who might be bright enough to help solve this problem in an exact mathematical way. After a few misses, I decided to walk in to Bill Shockley's office and see if I could get some help. I had no sooner described my attempt to build a microwave gyrator with a host of subsidiary devices, when he literally jumped out of his chair, went to his blackboard and started to help me find a simple but satisfactory prediction of Faraday rotations at microwave frequencies. Without any reference to any source of information, he put an equation on the blackboard that supposedly predicted the Faraday rotation at optical frequencies. To satisfy both of us, we put values for iron that was magnetized in the direction of propagation of the wave. It did indeed produce values of the order of 100,000 degrees. He then put into the equation the ratio of optical frequencies to those of microwave frequencies and produced numbers that were smaller than I hoped for, but did not put the microwave device out of the ball game. I am certain that my expression and my expectation made it obvious that I was a little dejected by the numbers we had predicted. He recognized this disappointment immediately, and urged me to continue my effort to build these devices. He said, "It is essential that you continue to build the device." He pointed out that the potential of such a device was overwhelming, and was worthy of an enormous effort on my part. He also pointed out that our analysis was not exact, but a prediction from an equation that was valid in the optical region and could be off by a factor of ten when the problem was solved in a more exact manner.

In any event, I had an appointment to visit Holmdel in the next few days. When I arrived there, I found them much more excited about this unusual device than any other group I had talked to. Of course their business was microwave transmission and the idea of a device with such properties was to them a magic wand. After describing the properties of such a device, I went to the blackboard and roughly sketched the plumbing I needed. In the least, I needed a piece of equipment that coupled a round wave guide to a rectangular wave guide on each end of the round wave guide without causing reflections of the wave at the connection. To make it more difficult, the coupling at the far end of the device must be rotatable so I could measure the amount of rotation. To my surprise, they went to a cabinet and pulled out a device that was exactly what I needed.

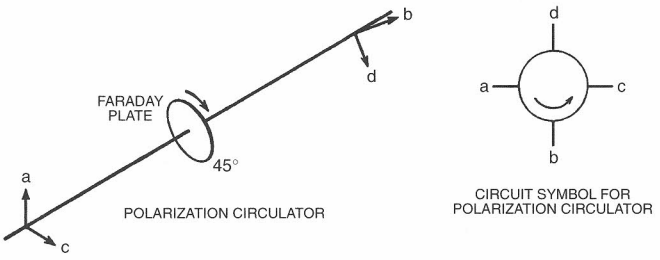


Figure 2.
The first proposed and executed microwave circulator.

Next, I asked if it was possible to put devices on each end of the round guide that had the properties of a directional coupler. The purpose here was to build a microwave element that mimicked Lord Rayleigh's optical system. Lo and behold! They pulled another device out of the cabinet that was exactly what I was asking for. The problem here was that this device had metal elements inside the round wave guide that were "tuned" to make certain that 100% of the energy that was perpendicular to the horizontal guides would be diverted to the extra guides. The tuning was a delicate process and was effective only in a small band width. My purpose, of course, was to build an element that had four inputs (or outputs) so that we could demonstrate the element that was later named a circulator. They then informed me that the same device could be obtained with two magic tees. That suggestion had reached beyond my understanding of microwave plumbing. They then went to the blackboard and sketched out how this device could be obtained in a much simpler way. (Figure 3) Actually, today circulators are built in much simpler ways and neither of these approaches survived after a few years.

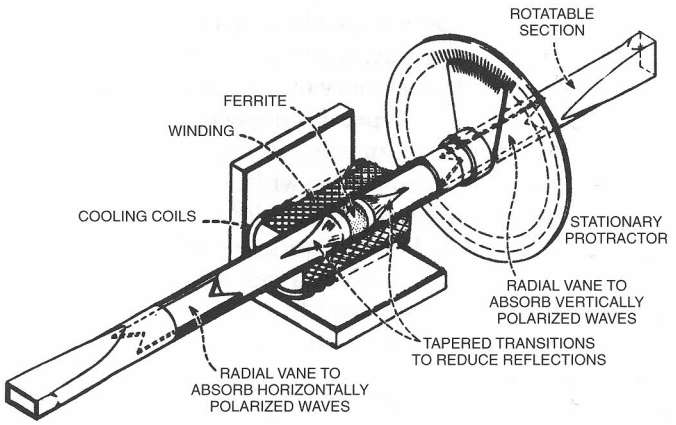


Figure 3.
World's first gyrator
(detail of test chamber in which rotations were measured.

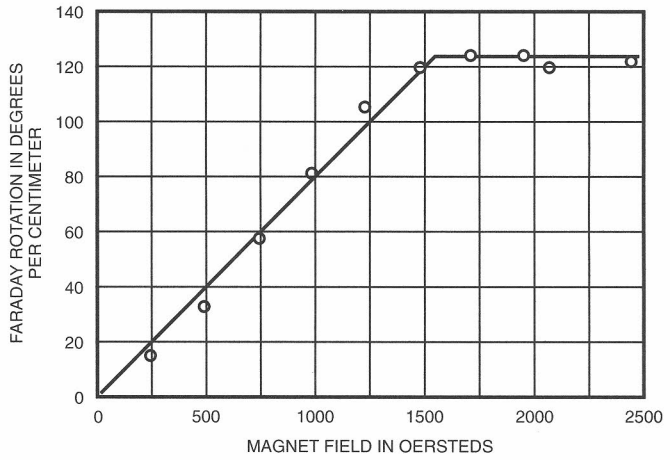


Figure 4.
Angle of rotation versus applied magnetic field for a thin disc of manganese zinc ferrite.

We agreed that the elements I needed could and would be built within a week. With that commitment, the only thing else I needed was a system that had microwave generators and accurate detectors. Several times in the last several weeks I had visited W. A. Yager's laboratory. He had told me that he probably had the best equipment in the entire Laboratory. His equipment had accurately controlled generators and the most delicate system for measuring losses in the devices that were placed in the system. He immediately promised the use of his equipment but also the use of his technician who was skilled in the use of the equipment. I explained to him that in a week all of the pieces I needed would be available and it would take only an hour or so to put them all together for my measurements.

To the best of my recollection today, the only thing I built myself was the coil that surrounded the round section of the wave guide. It was much larger and much more powerful than was needed, but I felt it was better to have a large coil that could create fields well beyond what was needed.

Within one week all of the elements were sitting on my desk awaiting the final decision as to whether this microwave gyrator would be the world's first. The next morning I took all the equipment to W. A. Yager's laboratory and I don't believe it took more than an hour to put the setup together. We then started taking data on rotations and losses associated with the passage through the magnetized ferrite. By mid-afternoon we had all the data we needed. The results are shown in Figures 4 and 5.

During that one afternoon, we obtained data on Faraday rotations and insertion loss of one ferrite. Rotations as high as 120 degrees were obtained with insertion losses of 2 db. In addition, we did build a microwave gyrator and a microwave isolator, but did not have the necessary equipment to build a microwave circulator.

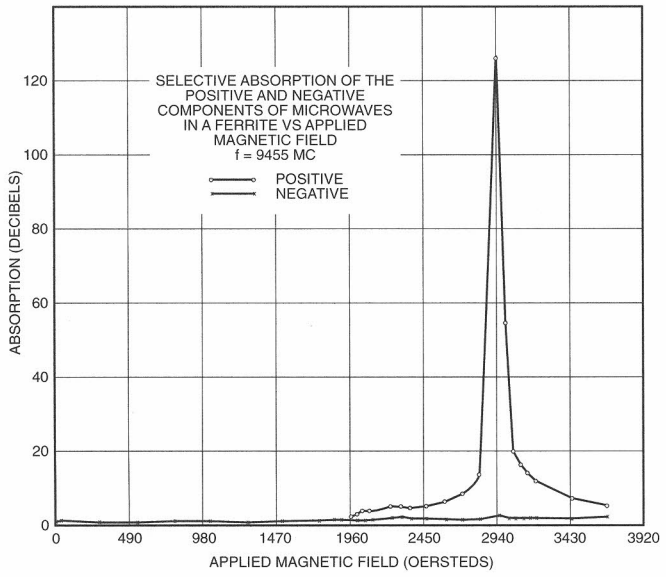


Figure 5.
Data observed in 1951 using more advanced ferrites.

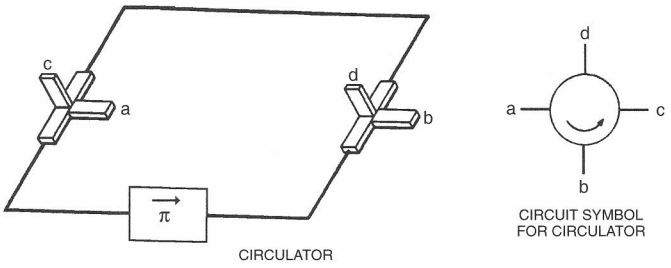


Figure 6.
First circulator using magic tee's.

Within a month of these first experiments, we came across a paper by D. Polder in Phil. Mag., 40, pp99-115 (1949). He had published the very first analysis of the behavior of infinite plane waves propagating through magnetized ferrites. The values we obtain in the wave guides differed from Polder's by less than 2%. With his analysis and our ability to build all the microwave plumbing we needed, we were able to build all the elementary elements (gyrator, circulator, and isolator) within six months and ferrites were obtained that gave insertion losses of the order of 0.8db.

As I look back on the period at Bell Labs when the microwave gyrator and its subsidiary devices were reduced to practice, I am both pleased and stunned. Philips Laboratory asked the question as to the reality of these devices in a practical, useful form. They aroused me and perhaps many other engineers in the world into various approaches for the achievement of this practicality.

I spent many days attempting to find the basic materials and the particular design that would make this elusive circuit element a truly useful contribution. The host of approaches which I stumbled through are almost countless. Most of them were theoretically capable but, after a few mathematical analyses, they all failed the test of practicality.

Tellegen's paper convinced me that the basic element of all these approaches had one thing in common. They all violated the theorem of reciprocity. So my activities became centered upon this one attribute of the gyrator. I approached each material and each device structure in light of its property of violating this one theorem.

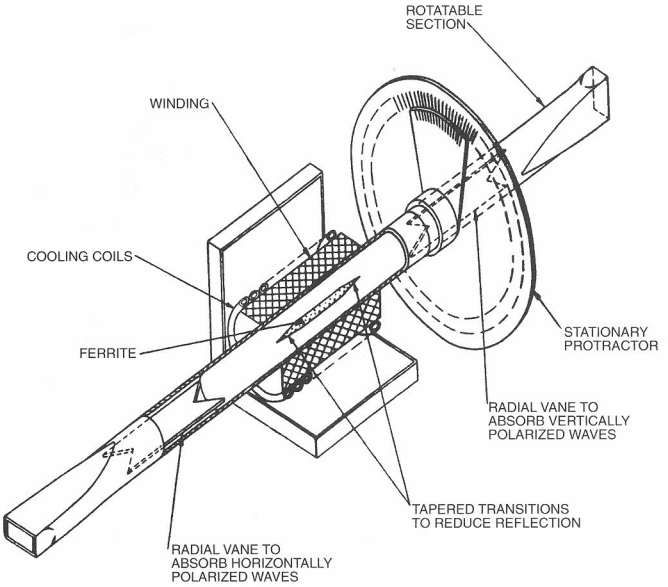


Figure 7.
Typical form used in 1951 for achieving lower loss and better ferrite performance.

While it may sound like a typical movie, the ideas of Lord Rayleigh popped into my mind in the late evening after my wife, Audrey, and I had retired for the day. She had her favorite book, and I had a pad of paper and a pen. After proving that a few more approaches were also impractical, the memory of Lord Rayleigh's optical device that violated reciprocity popped into my mind. I leaped out of bed, dug up some of my old lecture notes and read again the discussion which Professor Cheney had described to our class. The violation of the reciprocity theorem was spelled out quite clearly, and the device which he had proposed was indeed an optical circulator, even though that word had not yet been coined. Even though I realized that there were still a few mountains left to climb, I was convinced that a microwave version of Rayleigh's optical device had much more promise than the dozens of other suggestions that had been proposed by Tellegen and by myself. After a couple of hours of playing with the numbers, I climbed back into bed and told Audrey that I thought I had found the solution to the problem that had plagued me for the last few weeks.

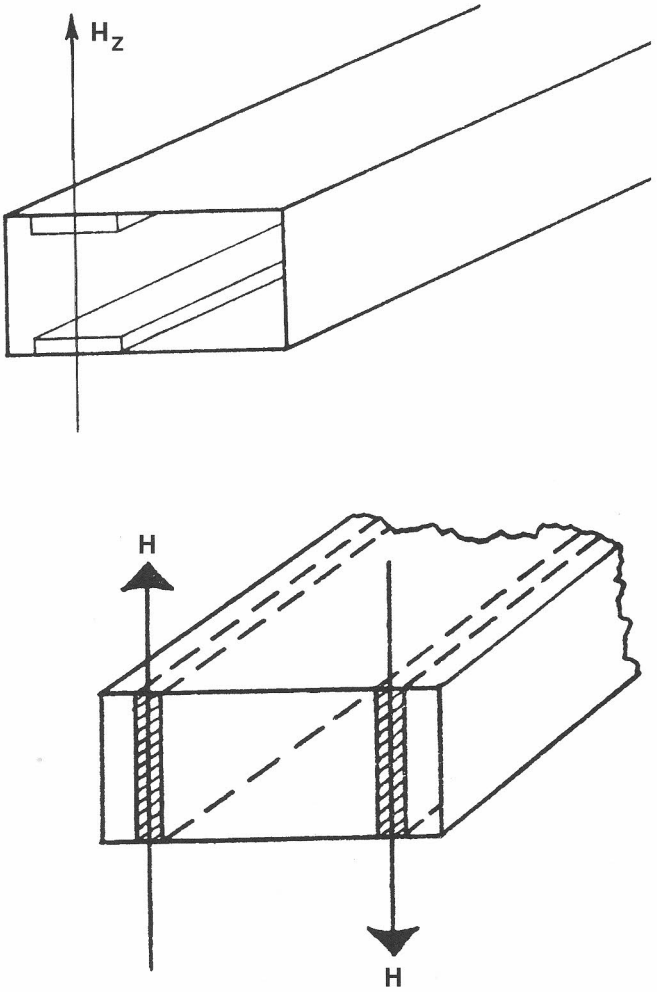


Figure 8.
Rado's simplified phase shifter.

In the early visits to various groups within Bell Laboratories, I had visited the metallurgical group that made and tested ferrites in addition to dozens of other projects. I had learned from them that these relatively new magnetic materials were not electrical conductors and they did indeed have low losses at very high frequencies. These properties were known and were emphasized to me by this group. This knowledge seemed to be exactly what I wanted, but since that visit was part of my own personal attempt to get acquainted and I did not carry with me a goal for the use of this information, I had not asked for accurate information as opposed to general information.

Since my knowledge of microwave plumbing was even more primitive than my knowledge of ferrite materials, I needed to return to W. A. Yager, tell him precisely what I wanted to do, and ask him if I could use his equipment when the time arrived in a few weeks that I would need such equipment. Again on his part, he was enthused about my feeling that this new and unique microwave device appeared to be possible, and his answer was an absolute yes. He explained that he took measurements of materials with his equipment, and then spent many days at his desk analyzing the data which he had accumulated. When he was analyzing his data, the equipment was idle and he was happy that it could be used to prove the viability of such a strange and new micriwave device.

I am still stunned today, when I look back at the positive attitude which every one at Bell Labs had even though the data needed to prove that it was really going to be practical for use did not yet exist.

In the next several days, I spent my time revisiting every one that might help me. In every case the senior people in these laboratories were thrilled that they could contribute to my goal. Every person I visited gave me enormous amounts of information and urged me to continue rapidly with my approach. Somehow they believed it would work and were very confident that I had struck on an idea that was a winner. This attitude was present in every group I contacted whether it was at Holmdel, at Yager's lab, or in the ferrite group. They helped me hone my ideas, and they were anxious to build any piece of material or device that were necessary to prove the validity of the approach.

It is obvious to anyone that I could not have gone from a basic idea to a working model in a few short weeks, if I didn't have a dozen or more people from four different groups in the Labs working for me. These people freely gave their time, their knowledge, and their enthusiasm.

The patent was applied for in December of 1950 and within two weeks, the Department of Defense placed a secrecy order on the patent and on all the devices described in the patent. This secrecy order was not lifted until December of 1951. This is the reason why the publication of this effort was not published until January of 1952. There can be no doubt that I was a very lucky individual for many reasons. The first reason was the fact that I was working at the Bell Telephone Laboratories. In addition to this, I had a boss who gave me the time and the encouragement to become acquainted with many of the individual labs in this great technical resource. Most of all, I found all of the people I visited encouraged me and actually guided me so that I could achieve the success of this endeavor in a very short time.

Just as the transistor whose first efforts were the point contact and then the grown junction transistor to the MOS and diffused junction integrated circuits, so has the growth of the microwave ferrite devices taken one to a level that is so far beyond this early device, that I have to ask the young men today to explain to me how it works. Today advanced circulators can have three or four ports depending on their use. Some of the very high frequency devices that are built today are so small that an entire circulator with its package is about

the size of four dimes stacked on top of each other. Their uses are so many that it would take many pages to describe them in any detail. Their performance exceeds the early devices by a factor of 100 or more.

Pioneer Award

The Pioneer Award recognizes contributions that have had major impact on the field and have stood the test of time. The basis for the nomination is an archival paper in the field of interest of MTT-S, published at least twenty years prior to the year of the award; that is, it recognizes important technical contributions that have had a continuing impact on the practice of microwave engineering, for a period exceeding two decades.

Dr. C. Lester Hogan, retired President and Chief Executive Officer of Fairchild Camera and Instrument, was one of the 1993 recipients of the Pioneer Award. Dr. Hogan is cited "FOR PIONEERING THE APPLICATION OF FERRITES TO MICROWAVE DEVICES." His paper, "The Ferromagnetic Faraday Effect at Microwave Frequencies and its Applications," Bell System Technical Journal, Vol. 31, pp. 1-31, January 1952, is the seminal paper publication on microwave ferrite devices.

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

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

John Eisenberg

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

MTT-S Historical Exhibit

by Steve Stitzer

The Historical Exhibit at the 1993 International Microwave Symposium was very well attended this year—one could hardly miss it in the middle of the commercial exhibit hall. We must thank Howard Ellowitz and Harlan Howe of Horizon House for arranging the elaborate superstructure advertising our presence. It was visible from nearly anywhere on the floor. I am sure that many additional people found the exhibit unexpectedly as they made their rounds through the hall.

We must also thank Bill Edwards and Tim Kemerley and their crew from the Wright Laboratory, Solid State Electronics Directorate at Wright-Patterson AFB, for bringing their excellent exhibit on phased array antennae. This display included the MERA (molecular electronics for radar applications) and SSPA (solid state phased array) from Texas Instruments, and the Westinghouse Bl-B and F-22 (mockup) antennas, a large selection of array modules, and a well done pictorial display illustrating the history of the development of phased array antennae. This added a nice touch to the Historical Exhibit.

Thanks to Professor Jim Brittain of Georgia Tech's School of the History of Technology for organizing the facilities and for running the video show. Thanks also to Fred Schindler of Raytheon, who has taken over for Bob Pucel in maintaining the MMIC exhibit. I was pleased to meet Dr. Bill Asprey of IEEE/Rutgers University Center for the History of Electrical Engineering. Bill brought us a preview copy of the new book *Rad Lab*, oral histories documenting WWII activities at the MIT Radiation Laboratory. Most of the interviews were conducted at the 1991 IMS in Boston. I had a chance to read a few of the 41 interviews, and found them fascinating and entertaining. Unfortunately, one interviewee wanted to make some editorial changes, so we had to give the preview copy back. This book will be available this summer through the IEEE Center for History of Electrical Engineering at Rutgers University. The Center supports a number of ongoing professional writing efforts on the history of electrical engineering, and has a speakers' bureau as well.

I tried to have an active display running again this year, comprising an X-band slotted line setup with a 2K25 klystron source and a Rad Lab designed TAA-16HV VSWR meter. Unfortunately, some electrolytic capacitors in the klystron power supply had broken loose, causing a short. As soon as I had that repaired,

(Continued on page 25)

Letters to the Editor

Dear Editor Wassel,

The Yugoslav MTT Chapter has organized a meeting devoted to Nikola Tesla contributions to the development of radio. In remembrance of the fiftieth anniversary of Nikola Tesla's death, the meeting was held on July 8, 1993, at the Nikola Tesla Museum, Belgrade.

Prof. Aleksandar Marincic, Director of the Nikola Tesla Museum, gave a very inspired lecture about Tesla's discoveries and presented a lot of unpublished materials from the museum archives.

Prof. Aleksandar Marincic has been studying Tesla's work since 1960 when he was scientific advisor at the Nikola Tesla Museum. He is recognized as one of the most distinguished experts of the legacy of Nikola Tesla. Prof. Marincic edited *Nikola Tesla Colorado Springs Notes 1899-1900*, which covered Nikola Tesla's high frequency work.

Please find enclosed an abridged form of the lecture illustrated with a few of Tesla's unpublished drawings from Nikola Tesla Museum archives.

I hope that you will find the text of this lecture interesting to publish in the *MTT-S Newsletter*, because this is the right time for remembering the genius of Nikola Tesla.

Sincerely yours,
Branka Jokanovic
Yugoslavia MTT Chapter Chairman

Nikola Tesla Contributions to the Development of Radio

by Professor Aleksandar Marincic
Director
Nikola Tesla Museum
Belgrade

Some less known facts discovered in the Archives of Nikola Tesla Museum in Belgrade

Soon after Nikola Tesla finished his main research in the field of low frequency alternating currents, somewhere around 1890, he intensified investigations into higher frequency alternating currents. In his famous lecture before AIEE in 1891 at Columbia College[1], and even much more in his next lecture in 1892 held in London[2] and repeated in Paris, Tesla disclosed his research in the field on high frequency and high potential alternating current. In a series of attractive experiments, he explained the behaviors of high frequency currents and their possible use in electrical lighting because it is more economical and produces more natural light than the light of an ordinary incandescent lamp. Tesla's coil appeared for the first time—the resonant transformer in combination with a spark gap, acting as the high frequency, high voltage generator. This apparatus soon became a part of every physics laboratory, and is a common item even today. Another attractive experiment of Tesla's was with "tubes devoid of any electrodes," which, in his words, could produce "sufficient light to read by. The light effect is, however, considerably increased by the use of phosphorescent bodies such as yttria, uranium glass, etc." Tesla never patented such tubes, but obtained patents on special single electrode tubes with a spherical radiating button.

Throughout his life Tesla several times referred to his bulb, made sometime in 1892, which when excited produced a brush "of extreme sensitiveness to electrostatic and magnetic influence." He thought it might find use in telegraphy. Many other aspects of vacuum tubes were discussed by Tesla, especially in his 1892 lecture which even today one can read with great interest and can disclose, depending on his background knowledge, the essence of many future discoveries. To illustrate this we mention here Tesla's single conductor covered with dielectric which he suggested to be used for very high frequency current transmission at large distances! This type of transmitting device resembles Goubau wire, the dielectric covered conductor waveguide, studied many years later[3]. Tesla also suggested that gas companies may be interested in developing a technique of transmitting high frequency currents through metal tubes as he found that metal would behave like an insulator and gas as a good conductor for high frequency currents. This arrangement we know today to be a type of surface waveguide which supports guided waves.

In February 1893, Tesla delivered a lecture "on light and other high frequency phenomena" before the Franklin Institute, Philadelphia, and before the National Electric Light Association in St. Louis in March. This lecture is very important for the history of radio, especially because it has never been fully appreciated by many historians. One can find partial explanation of why this was so in Tesla's lifestyle. He was, as a historian of radio wrote, an "inveterate romantic, always ready to identify what was with what should be."[4] It was mentioned by many who knew Tesla's work that one found Tesla's name associated with important inventions in radio in the early history of radio technology, but as the years passed, his name was hardly mentioned after 1915. In 1943, Wheeler[5] stated that Tesla "is entitled to either distinct priority or independent discovery of:

- The idea of inductive coupling between the driving and the working circuits.
- The importance of tuning both circuits, that is, the idea of an 'oscillation transformer.'
- The idea of a capacitance loaded open secondary circuit."

Professor Alexsandar Marincic, Director of the Nikola Tesla Museum in Belgrade, delivering the memorial lecture to the Yugoslav MTT-S Chapter.

Tesla attempted to realize a practical system, with the financial assistance of J. P. Morgan around 1900, but then began to slow down his research and soon he was outside the main developments in the field of radio. When Morgan learned from Tesla's letter that his Long Island Laboratory had been intended to be not only the World Radio Center, but also an experimental station for his wireless energy transmission, Morgan stopped any further support to Tesla. In spite of all of Tesla's efforts to persuade Morgan to continue financing, "no more advances" was the typical answer which would be sent by J. P. Morgan.

At the time of this disaster for Tesla's research in the field of radio, he already had several important patents such as the integrate and damp receiver (as we would call it today)[6], double-circuit selective space telegraph system[7], which is in fact a kind of so-called "spread-spectrum system," and a patent on a radio controlled boat[8], in addition to a set of basic four tuned circuit patents applied in September 1897[9]. To obtain the latter patents, Tesla had to perform an experiment before the Examiner in Chief of the U.S. Patent Office. This was concluded from an original slide found in Nikola Tesla Museum, Belgrade (see Figure 1). These patents are important for the history of radio, as they were subjects of a long lawsuit with the Marconi Wireless Telegraph Company of America, who alleged Tesla had used wireless devices that infringed on the Marconi patent no. 763772 of the 28th of June, 1904. After twenty-seven years, the United States Supreme Court in 1943 invalidated the fundamental radio patent of Marconi as containing nothing which was not already contained in patents granted to Lodge, Tesla and Stone[10].

In 1899, Tesla went to Colorado Springs, where he built an experimental station with a huge spark gap transmitter. For several months he experimented with various transmitter and receiver arrangements and wrote notes which were published in 1978 by the Nikola Tesla Museum[11]. It is interesting that this work was referenced in 1974 by J. R. Wait in his Introduction to the Special Issue on Extremely Low Frequency (ELF) Communication[12], where it was stated that "many of Tesla's early experiments have an intriguing similarity with later developments in ELF communications."

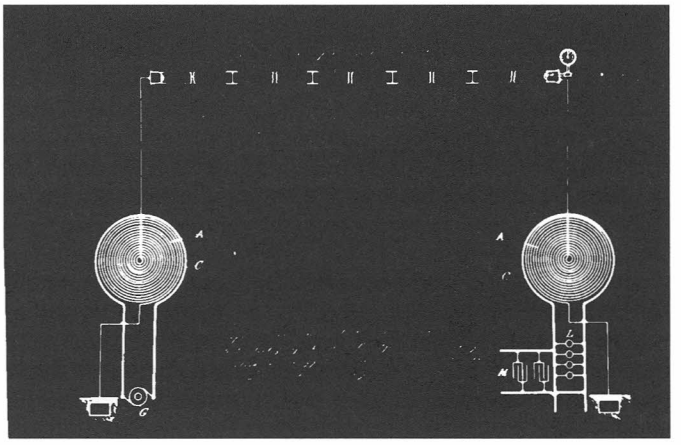


Figure 1.
Diagram of apparatus demonstrating transmission of electric power through rarified gas. (Tesla's own slide now at the Nilola Tesla Museum, Belgrade)

Returning from Colorado Springs, Tesla was at his peak. Everything seemed to him to work perfectly, especially after he obtained support from J. P. Morgan for his new laboratory to be built on Long Island. This he intended to make the World Radio Center and started to collect machines and other equipment. He managed to build a house, which stands today, and almost finished a huge antenna tower. However, he ran out of money and, as we explained earlier, his sponsor refused further support: "a factor here was Marconi's successful demonstration in 1901 of transatlantic signal transmission using much simpler and far cheaper instrumentation."[12] Tesla continued for some time to fight and look for other sources of finance, but after several years he had to stop his further work on the Long Island plant. Meanwhile, he submitted a patent on something that resembles his tower feed[13], but it took twelve years to obtain the patent. In the Archives of Nikola Tesla Museum in Belgrade, we have discovered several drawings which are obviously prepared to be patent documents, but we do not know whether they were refused or never submitted. These drawings show antennas, or perhaps probes, to be driven with a low frequency generator in order to excite a standing wave on the earth (Figure 2). There are also a number of pages concerning his work in the Long Island Laboratory, as well as many typed pages with explanations of Tesla's wireless energy transmission. Unfortunately, notes from Long Island are not as systematically written as the Colorado Springs Notes, but they are certainly interesting to read. They show the great difficulties with which Tesla had to cope in trying to explain various phenomena with a limited knowledge and a stubbornness to stick to his "disturbing electric charge" theory. It is fascinating, however, that Tesla managed to predict the existence of standing waves, and even to calculate the Earth resonance on the basis of his simple l/4 model. He calculated the basic Earth resonance to be 6 Hz[14]. He predicted further resonances at 18 and 30 Hz. Today, we know these resonances as Schuman resonances[15], which were calculated in 1952 and measured in 1962. Measured values are around 7, 14, and 21 Hz. These measurement results are obtained from the power spectral density of the horizontal magnetic field density. The resonances are observable only when the atmospheric noise level at the measuring site is low. In his St. Louis lecture in 1893, Tesla explained how one could measure this with a generator, but neither he or anyone else, until today, seem to measure the Earth resonances this way. Problems with the direct measurements are obvious if we imagine measuring resonances of a huge resonator with a very small transmitting probe and a relatively closely spaced receiving probe!

Today we have a relatively well developed theory of propagation of ELF in the Earth-ionosphere cavity. Calculations clearly show that for a vertical current source (as proposed by Tesla), the principal field in the Earth-ionosphere waveguide standing wave behavior is obvious (see Figure 3). In a way, this proves Tesla's "theory" that at ELF the field will be weakest at the equator, and stronger as we approach the antipode. Of course, Tesla's estimate that the Earth is so huge that it will be of negligible resistance is not correct to the extent that one can ignore it, but we see that several resonances are the reality. Tesla was aware of antenna problems as we can see from his 1897 patent:

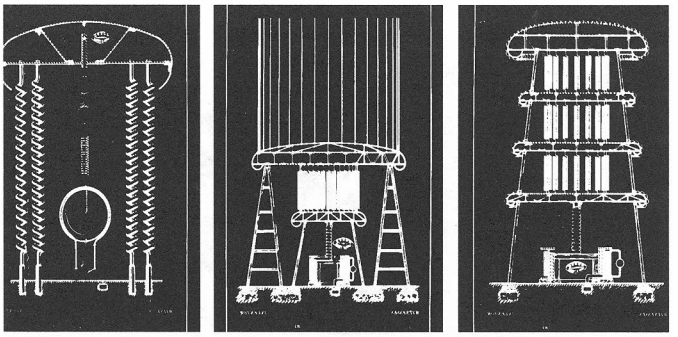


Figure 2.
Various types of Tesla's low frequency antennas for exitation of Earth resonator. (Unpublished material from Nikola Tesla Museum, Belgrade)

"As to the elevation of terminals, it is obvious that this is a matter which will be determined by a number of things, by the condition of the atmosphere, and also by the character of the surrounding country."

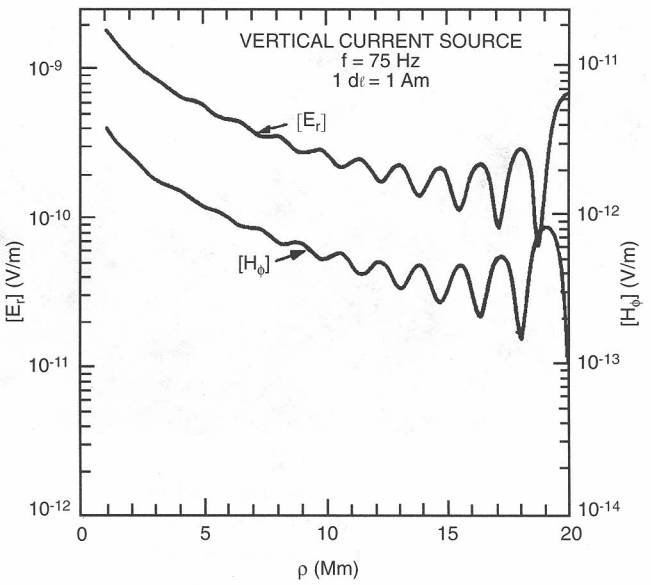


Figure 3a.
Principal fields in the Earth-ionosphere waveguide radiated by a vertical electric current source. (Unpublished material from Nikola Tesla Museum, Belgrade)

He wanted to reach higher air strata in an effort to create a kind of an ionized medium which will easily pass high frequency current. He modified his model later by stating that the terminal may be low but that the voltage must be of the order of one hundred million volts. It seems to us that until his death he was convinced that his wireless transmission model would work,

and we may say that it is a great pity that he could not perform experiments with ELF which would have lead him to be more realistic in his expectations. Tesla's efforts to mentally develop a wireless energy system with limited scale experiments and insufficient theoretical knowledge proved that mere genius cannot overcome the weakness of such an approach.

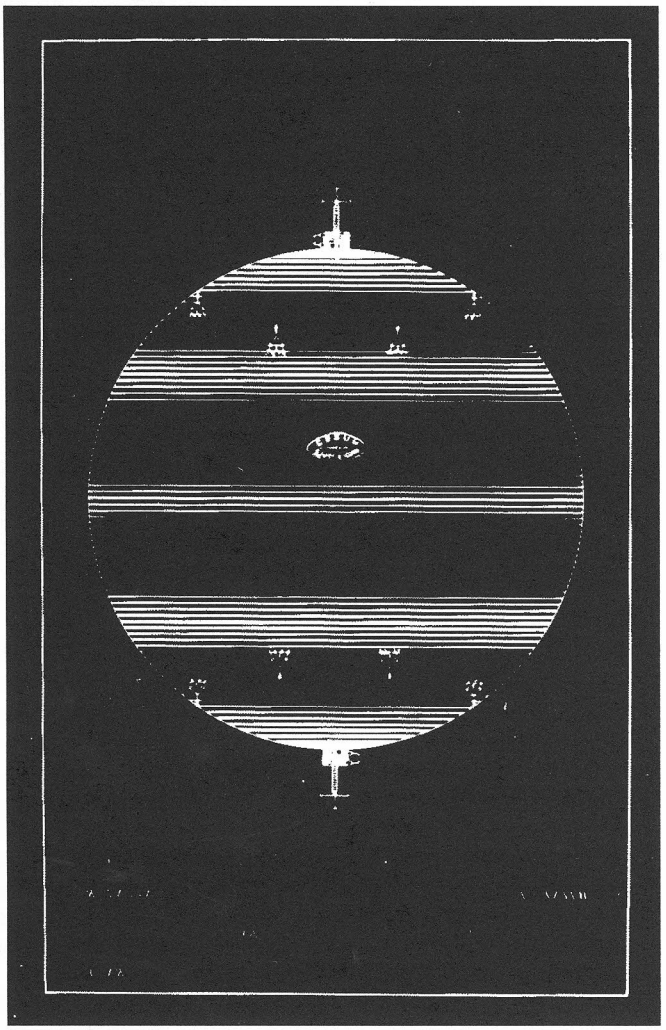


Figure 3b.
Nikola Tesla's transmitting and receiving antennas and the standing waves along the Earth globe. (Unpublished material from Nikola Tesla Museum, Belgrade)

Fortunately for mankind, Tesla not only thought about his wireless system, but devoted his genius to developing some interesting and valuable inventions in the mechanical engineering field, which covered at least his next twenty years of active research.

Until his death fifty years ago, Tesla continued to work, but as far as we know, no significant inventions originated from this period of his life.

The scientific community has not forgotten Tesla and his work, and numerous gatherings were organized to celebrate his anniversaries in the USA, Yugoslavia and some other countries in Europe. The IEEE Power Engineering Society has delivered the Nikola Tesla Award yearly since 1976 to the electrical engineer who has made a significant contribution to power engineering. There is also the Nikola Tesla Award given by the Nikola Tesla Fund in Serbia.

References

[1]"Experiments with alternate currents of very high frequency and their application to methods of artificial illumination," Columbia College, NY, May 20, 1891.

[2]"Experiments with alternate currents of high potential and high frequency," IEE, London, February, 1892, The Royal Institution of G.B., London, February 1892, Societe Internationale Francaise des Electriciens, Paris, Societe Francaise de Physique, Paris, 1892.

[3]Goubau wire

[4]Hugh G. J. Aitken, "The Continuous Wave, Technology and American Radio, 1900-1932," Princeton University Press, Princeton, NJ, p. 171.

[5]L. P. Wheeler, "Tesla's Contribution to High Frequency," Electrical Engineering, NY, August 1943, p. 355.

[6]"Apparatus for Utilizing Effects Transmitted from a Distance to a Receiving Device Through Natural Media," Pat. No. 685955, Nov. 5, 1901, Applied June 24, 1899.

[7]"Method of Signaling," Pat. No. 723188, Mar. 17, 1903, Applied July 16, 1900.

[8]"Method of and Apparatus for Controlling Mechanism of Moving Vessels or Vehicles," Pat. no. 613809, Nov. 8, 1898, Applied July 1, 1898.

[9]"System of Transmission of Electrical Energy, Pat. No. 645576, Mar. 20, 1900, Applied Sept. 2, 1897.

[10]United States Reports, Vol. 320, Oct. 1942, Oct. 1943, Washington, Marconi vs. U.S.

[11]Nikola Tesla, "Colorado Springs Notes 1899-1900," Nikola Tesla Museum, Belgrade, 1978.

[12]J. R. Wait, "Historical Background and Introduction to the Special Issue on Extremely Low Frequency (ELF) Communications, IEEE *Trans. on Comm.*, COMM-22, No. 4, April 1974, p. 353.

[13]"Apparatus for Transmitting Electrical Energy," Pat. No. 1119732, Dec. 1, 1914, Applied Jan. 18, 1902.

[14]"Art of Transmitting Electrical Energy Through the Natural Mediums," Pat. No. 787412, Apr. 18, 1905, Applied May 16, 1900.

[15]M. L. Burrows, "ELF Communications Antennas," Peter Peregrinus LTD, 1978, p. 195.

Abridged form of the lecture delivered before Yugoslav IEEE MTT Chapter on July 8, 1993, in Belgrade. The lecture was given in remembrance of the fiftieth anniversary of Nikola Tesla's death.

President's Message

(continued from page 6)

tion process considers *service* in a number of Society activities: the Chapter structure, AdCom committee work, Conference steering committees and Technical Program Committee participation. This process is international in scope and therefore inclusive rather than exclusive.

Customer Relations

One of the issues raised by the Review Committee is that of customer relations. First, who is the customer? (I hope they are reading this article, but many probably are not.) Second, what does the customer want and/or need? As a first attempt to define some of these issues, we circulated a survey at the Atlanta IMS, and received approximately 150 responses. The AdCom is extremely interested in these member and potential member responses, and will be reporting on and acting on the findings of this survey in the near future.

IEEE Policy on the Use of Metric (SI) Units

by R. V. Snyder

The IEEE Board of Directors has established a Comittee on Metric Policy. The mission of this *ad hoc* committee is to develop a metric policy for the IEEE that all interested parties can accept and support. Members of the Committee have been designated by most of the Boards, Committees and Societies of the IEEE. I have been acting as the MTT representative to the various meetings of this Committee. The Committee plans on making its recommendations to the Executive Committee of the Board of Directors by October, 1993. A draft policy has been circulated to the sponsoring groups for their review and comment. To date, the vast majority of comments from those groups and from IEEE members has been in support of the draft policy. At the recent meetings of the IEEE Standards Board and the Regional Activities Board and the Publications Board supported the concept and suggested changes and improvements. The MTT AdCom endorsed this policy statement during the June meeting in Atlanta. The present draft of the policy is given below. While it clearly establishes the metric system as the system of measure for the IEEE, it provides for a transition period and it allows for exceptions even after that transition phase on an individual basis for limited periods.

The U.S. is only one of two countries in the world—and the only industrialized country—not officially using the metric system, or as it is formally known, the International System of Units, abbreviated "SI." SI, the modern version of the metric system, is based on the kilogram, meter and second. It includes all the familiar electrical units like the volt and the ampere.

The original reason for the use of the metric system was its rational basis and the ease of conversion between units of the same quantity. Today, additional impetus is provided by the worldwide nature of business and industry, and the imperative for the United States to compete effectively and efficiently in world markets. The United Kingdom, from whom we got our traditional system of weights and measures, and faced with the same need to compete internationally, began its conversion to the metric system in 1865.

Major United States manufacturers, including Ford and General Motors, converted to the metric system more than twenty years ago. ("Come Away With Me, Lucille, in My Metric Oldsmobile?" "Chevrolet, the Heartbeat of Ametrica?") The policy of the Society of Automotive Engineers is to use only metric, as is the policy of the American Society of Civil Engineers, the National Society of Professional Engineers, and many United States government agencies including the National Institute of Standards and Technology (the former NBS). New maps of the Coast and Geodetic Survey are now being issued in metric. NOAA requires its contractor reports to use the metric system. Most publications of the IEEE, including *Spectrum*, use the metric system exclusively.

The metric system in the United States is not new. In 1866 Congress authorized the use of the metric system in this country, and supplied each state with a set of standard metric weights and measures. In 1875, the United States was one of the original seventeen signatory nations to the International Treaty of the Meter. In 1893, metric measurement standards were adopted as the fundamental standards for length and mass in the United States, and our "customary" measurements have been defined in relation to the meter and the kilogram ever since.

More recently, Congress adopted the Omnibus Trade and Competitiveness Act of 1988, which designated the metric system as the "preferred system of weights and measures for United States trade and commerce." It is also required for all federal business related activities by a "date certain and to the extent economically feasible, by the end of fiscal year 1992."

The IEEE Metric Policy Committee, which held its third meeting on July 8, 1993, welcomes comments from IEEE members. Comments can be addressed to its Chairman, Dr. Bruce Barrow, via E-Mail: b.barrow@ieee.org or c/o Ms. Anne O'Neill, IEEE Service Center, Box 1331, Piscatawnay, NJ 08855. The policy, in its most recent form reads as follows:

All IEEE Organizational Units will:

- Actively support the use of the International System of Units (Le Systeme International d'Units, or SI) the modernized metric system.
- Use SI units to express measured and calculated values of quantity in all IEEE publications including standards.
- Use the current issue of IEEE Standard 268, the American National Standard for Metric Practice.
- Promote the understanding and use of SI in education at all levels, both within the profession and in society at large.

Plans for implementation of this policy by January 1, 1998, at latest, shall be developed by the major boards of the Institute and reported to the Board of Directors by January 1, 1995. Necessary exceptions to this policy, such as where a conflicting world industry practice exists, must be evaluated on an individual basis and approved by the responsible major board of the Institute for a specific period of time. The major board responsible for the publication or activity will be responsible for implementation.

For MTT members, this means we should continue to inch along towards full use of the metric system!

My thanks to Dr. Bruce Barrow and Rick Gould for the support and information during preparation of this article.

Dick Snyder serves as the MTT-S representative to the IEEE Metric Standards Board, a subcommittee of the IEEE Standards Committee.

The IEEE Press publishes a convenient guide for conversion factors in various usage. The title is "Units and Conversion Charts, A Handbook for Engineers and Scientists," by Theodore Wildi, IEEE Press (1991) ISBN 0-87942-273-4. This book is available in soft-bound and hard-bound editions.

—Ed.

Globalization

(continued from page 12)

factory service.

In an attempt to improve services the IEEE has opened offices in Brussels and Singapore. Concurrent with the opening of the Singapore office the Canadian region was closing its office because improved communications and procedures at Piscataway made it redundant. No matter where one locates an office there will not be many members who find it convenient to drop in for a chat or to pick up material. Rather they will use the telephone, fax or e-mail, all of which introduce little or no distance dependent delays. Even if the delay problem is solved, there are other less tractable ones: different languages, different local customs, different currencies and different time zones for example. In principle they could all be solved by a centralized, appropriately trained, very talented staff working around the clock and backed up by extensive and comprehensive financial and communications systems. In practice I don't see this working in as seamless a way as one would wish, hence the need for a few regional offices. I suspect it would be hard to justify more than the current set on any reasonable combination of economic and service grounds.

It should be noted that not all members have access to the required communications systems and we need to develop a strategy which will increase their access to such systems. In particular we must be able to support properly the volunteer leadership around the world and, working through them, extend a high level of service to more and more regions of the world. I picture the global IEEE as having a decentralized volunteer leadership strongly backed up by a largely centralized staff. A centralized staff can supply better in-depth assistance more quickly than a widely dispersed one.

Most people join the IEEE in order to keep abreast of technical developments. Others want to obtain a window on the US electrical engineering scene. This is true for a number of US as well as most non-US members. The IEEE should also provide US members with a window on technical developments in other parts of the world. Attracting a larger number of non-US members and encouraging them to publish in IEEE journals would enhance this global window on technology developments. The extra-cost group insurance plan is an important service for US and some Canadian members. Another attraction for some US members is the representation made on their behalf by the United States Activities Board to all levels of government, the type of activity one expects of a national organization.

I believe it is important for the IEEE to maintain this diversity of activities as it becomes more global. In recent times USAB has been much more sensitive to the transnational goals of the Institute. As a result former tensions have changed to collaborations and there is no reason why this should not continue. In other countries the IEEE should be supportive of equally broad-minded national organizations by either entering into formal association with them as is being done in Canada or serving as a technical resource when needed. This strategy certainly fits in with the way the profession is going. It acknowledges the special needs and aspirations of US members while at the same time being supportive of the needs of others. In my mind a global IEEE is one which has a distinct, but somewhat muted, US flavour. It welcomes non-US members and does its best to give all members, no matter where they live, the same high level of service.

If there is to be a truly international organization of electrical engineers I believe it can be formed only by a consortium of groups each of which has some form of national allegiance. Because of its size, strong international membership, and the high quality of its products and services the IEEE would prosper and become a major player in such a world organization. Within this organization the IEEE would have a natural way in which to expand the market for its products and services around the world. At the same time, the IEEE would be more attractive to US members through its ablity to supply, in a convenient way, products and services derived from other members of the world organization.

Not all people agree with my assessment of globalization and how the IEEE should approach it.. Many of you, I am sure, have opinions on the topic and I would very much like to hear them. It is a difficult question—one that has no easy answers. Therefore it is important that as many views as possible be heard and understood before the IEEE's approach to globalization is finally charted.

AdCom Highlights

(continued from page 5)

tions at our technical meetings. Clearly, membership survey results will be studied carefully by the AdCom.

Publications activities have focused on maintaining the rapid turn around for papers in the *Microwave & Guided Wave Letters*, and in servicing the large number of papers accepted for publication in the *Transactions on Microwave Theory and Techniques.* Dan Masse, *Transactions* Editor, reports that publication delays caused by transitioning to electronic publishing at IEEE Headquarters should be considerably reduced by the time of publication of this newsletter. It is a problem currently affecting most IEEE technical society publications (except those who have not yet started the inevitable transition to electronic publishing). The AdCom expressed very strong support for the *Transactions*, and appreciation of the dedication of our editors during such times of transition.

This report is concluded with a request for feedback. Frankly, it's a challenge to strike a balance on this material—to convey the breadth of work addressed at an AdCom meeting, while avoiding too much detail. Comments and feedback would be appreciated! They may be directed to Jim Crescenzi, j.crescenzi@ieee.org, or (415) 813-2506.

1993 SBMO International Microwave Conference/ Brazil

by Denise Consoni
MTT-S Transnational Committee
Region 9 Coordinator

During four days, from 2 to 5 August, nearly 200 people, a quarter of them coming from all over the world, met in São Paulo, Brazil, to talk about their preferred subject: microwaves, optoelectronics, their applications and impact on present and future global and personal communications. The weather and the number of attendees may have been somehow under expectations; cold and rainy Brazilian winter surprised many visitors, and widespread economic crisis limited the participation of international and national professionals. However, the members of the Steering Committee felt comforted by the atmosphere of friendship, interest and co-operation that evolved from the Conference.

The keynote talk on "Broadband Spread Spectrum Multiple Access for Personal and Cellular Communications," delivered by Dr. Donald Schilling, brightly opened the technical sessions and the discussions that would continue during those four days about trends, advantages and drawbacks of modulation methods, access techniques and technologies that are being employed in Personal Communication Networks.

The 103 technical papers that comprised the Conference Proceedings, 29 invited among them, were related to Devices, MMICs, Optics, Ferrite Structures, High Power Microwaves, Millimeter and Submillimeter Waves, Active Circuits, Microwave Applications, Radar and Signal Processing, Planar Structures, Filters, Electromagnetic Theory, Education, Antennas, Optoelectronics, Resonators, Propagation, Waveguide Structures, Chiral Materials and Applications and Communication Systems. Technical Sessions were well attended and enriched by interesting comments and questions. The Panel Sessions, however, made for the most effective forum in the meeting. "Commercial Applications of Microwaves and RF" (presenting innumerable examples, popular and innovating, of wireless and wired applications), "Microwave Medical Applications" (raising the delicate and general concern subject of effects of microwave radiation on the human body) and "Telecommunications Activities in Latin America" (bringing very illustrative information on telecommunication systems and developments in Brazil, Venezuela and Uruguay) extended through lunch time, keeping alive the participants' interest. A Short Course on Microwave Ovens and a Seminar on Normalization of Communication Systems was offered (in Portuguese) to Brazilian attendees. A room was reserved for the exhibition of technical videos on various subjects: Superconductivity, Lightwave Communications, CAD of MICs and others.

The Exhibition was small (8 exhibitors, including Industries, University and Research Centers), but well visited, creating space for good interactive conversations during the friendly coffee breaks, in the intervals between a "café ainho" (small cup of the very flavored Brazilian coffee) and a "pão de queijo" (popular cheese rolls, freshly baked).

In the social evening events, a cocktail party on Monday and a generous barbecue dinner on Wednesday, accompanying persons and participants shared experiences and impressions in an informal atmosphere.

On Wednesday, members of the IEEE MTT-S had the opportunity to live an "historical moment," in the words of Dick Sparks, who coordinated the very first Region 9 (Latin America) Chapter Chairpersons' Meeting. Dick, acting as the Transnational Committee Liaison, brought out the new policies with a view to the globalization of the IEEE, and the importance of incrementing joint efforts with local Scientific Societies (as is the case with SBMO, the Brazilian Microwave and Optoelectronics Society), for achieving efficient professional interaction throughout the world.

When the Conference was over, a new Committee had already volunteered for organizing the next International Conference in Brazil. It is planned to be in Rio de Janeiro, 1995. We hope to see you all there!

MTT-S Historical Exhibit

(continued from page 18)

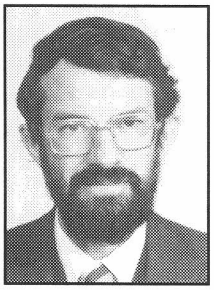
and had a signal to look at, the TS-148/UP spectrum analyzer began to act up. That didn't get repaired until I got home—a resistor and a neon lamp used as a voltage regulator had become erratic. Aside from those problems, it is interesting to see 50 year old microwave equipment still working.

As always, I encourage you to consider donating those one of a kind microwave artifacts to the MTT-S Historical Collection. Your editor, John Wassel, donated a few items at this year's Symposium. Several people have asked me "Why don't you have a . . ." Well, we can't exhibit what we don't have! I am also very much interested in obtaining data, catalogs, etc. on tubes, microwave and otherwise, to help identify and date some of the artifacts we and this Historical Electronics Museum already have.

The Historical Collection is back on display at the Historical Electronics Museum, in its new location close to BWI airport outside Baltimore, MD. Stop in if you are in the area; the Museum is open daily from 9 a.m. to 3 p.m. and the first Saturday of each month. For information, call (410) 765-2345. I can be contacted at Westinghouse at (410) 765-7348, or fax (410) 993-7747.

The 1992 Asia Pacific Microwave Conference

AUGUST 11-13, 1992
ADELAIDE, AUSTRALIA



by Dr. Don Sinnott
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August 1992! You mean it's that long since the 1992 Asia Pacific Microwave Conference, APMC'92? High time a report appeared in the *MTT Newsletter*. Blame the delay on my job change, or just general human slothfulness, and read on.

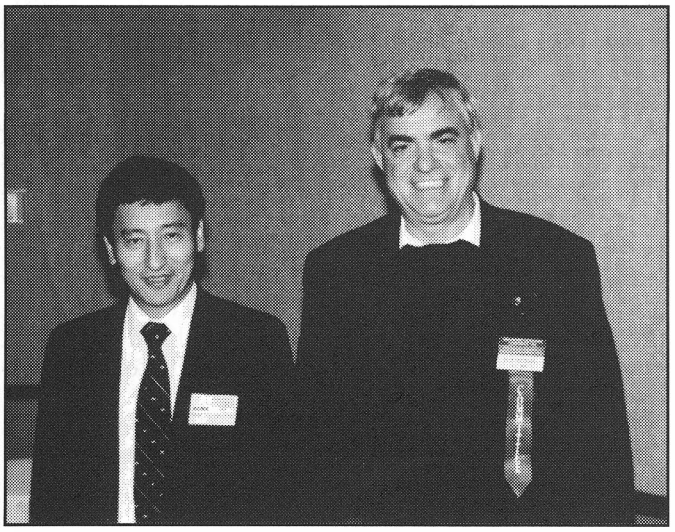
Origins and Organisation of the Conference

The Asia Pacific Microwave Conference, APMC, was born in India in 1986 and from then on it became a regular two yearly event in the Asia Pacific region. 1986 Delhi, 1988 Beijing and 1990 Tokyo. At the 1990 Conference the APMC International Steering Committee, the closest thing APMC has to a continuing between-conference organisation, accepted a bid from Australia to host the 1992 Conference in Adelaide, Australia. It endorsed a plan submitted by the IEEE South Australia Section (we had no MTT Chapter at the time within the Section) to sponsor the Conference. So we were away and running. We also picked up a running mate—a regular annual Australian conference, the Symposium on Millimetre and Submillimetre Waves, approached our Committee and we agreed to run the two conferences concurrently in Adelaide.

Seed funds came from both the South Australia IEEE Section and the MTT Society and an organising committee was established, with heavy representation from staff of the Adelaide based elements of the Australian Defence Science and Technology Organisation.

An early decision was the venue—Adelaide is blessed with an excellent purpose-designed Convention Centre which can provide a range of meeting rooms from committee size up to a basketball court with tiered seating. The Convention Centre is not an accommodation facility, but its central location, adjacent to the major city hotels, meant there was no problem with accommodation for delegates.

L-R: Prof. Tapan Parker, Syracuse University, Syracuse, New York, USA; Dr. Russell Dearnley, Andrew Antennas, Australia; and Dr. Dan Sinnott, APMC '92 Chairman.



L-R: Prof. Tatsuo Itoh, University of California, and Dr. Nick Fourikis, Chairman of Millimeter Wave Symposium (which was held in Argentina with APMC '92).

The agonies of organising a conference are well known to many of the readers of this *Newsletter,* and we on the APMC'92 committee had our fair share of them. Employment of a professional conference organiser did resolve the greater part of the administrative difficulties and we were fortunate to have in the organiser we selected one who had prior experience in this sort of technical conference. The Committee retained responsibility for the technical aspects—the technical program, refereeing of papers and the assembly of the proceedings.

One of the things which is at once APMC's unique value but can also be its Achilles heel is the fact that the Asia Pacific is a region diverse in language and culture. The "up" side was the experience at the conference of talking with and learning from people from many countries, with a range of experiences and differing approaches to research. The "down" side was the occasional difficulty in communicating in English—the variety of accents at the conference was truly amazing—and the variability in standards of mail delivery, fax and electronic mail. An early snag was a belated realisation that a critical Call for Papers mailing went by surface mail to some countries. Fortunately we were alerted to this in time, by reports of its non-arrival with our international colleagues—and could remail the material by air.

L-R: Prof. E. Yamashita, Japan, Chairman of APMC '90 International Steering Committee; Prof. Srivastava, University of Delhi, India; and Dr. Probir Bandopadhaya, NASA.

The Conference Itself

The conference itself was a considerable success, in terms of technical content, delegate interaction and numbers. Our "best outcome" delegate target was 300, with a breakeven in the region of 220. From past experience in running conferences in specialist areas of technology in Australia, we felt that we had a reasonable feel for expected numbers. But then again, Australia is a long and expensive plane ride for many potential delegates, the world economy is none too healthy, and there were closely related conferences near in time to APMC'92, the European Microwave Conference for one. So we were pleased enough with our final registration figures of 266, of whom 77 also registered for the parallel millimetre wave symposium. Geographically the delegate list broke down as follows.

Country	Attendance	Papers
Australia	125	49
Brazil	1	1
Bulgaria		2
Canada	5	7
Denmark	1	1
Egypt	2	1
Finland	2	1
France	8	7
Germany	4	8
Hong Kong	1	4
India	3	16
Indonesia	2	
Italy	8	7
Japan	49	36
Korea	1	
Malaysia	1	1
New Zealand	2	1
Portugal	1	1
PRC	7	27
Singapore	3	5
Spain	3	4
Switzerland	1	
Taiwan ROC	5	3
Thailand	1	1
Turkey		1
UK	11	12
USA	18	27
TOTAL	**266**	**223**

The Technical Program

Under the capable chairmanship of Noel Martin a program of 223 papers was assembled from responses to the Call for Papers. Noel assembled an international committee of referees and came up with an excellent selection for the Program. There were major segments on Superconductivity, Antennas, Microwave Power Applications, MMIC, Medical Applications and Broadband Transients, to mention but a few. The program ran in three parallel verbal presentation streams plus posters and the single stream millimetre wave conference.

Stalwarts of the Publications Committee, Bevan Bates and wife Jenny did a great job in putting together the camera-ready material, coping with the variety of paper sizes used in the region and the inevitable agonies of waiting for that last paper in the session to arrive so the page numbering could be concluded. We ended up with a very professional set of

Drs. Stuart and Cheng Anderson with Prof. Uslengi, University of Illinois.

proceedings, running to two volumes totalling 974 A4 pages available to delegates on registration.

One of the bugbears of modern-day conferences is the author no-shows. We had our suspicions about the intention or ability of some authors to attend. We took some commonsense insurance by putting at the end of sessions papers for which we had some doubts. In a depressing number of cases we were right. There was also a scattering of no-shows embedded within sessions which gave the session chairman the unenviable choice of bringing later papers forward, to the dismay of session hoppers who found they then missed a paper they had targeted, or declaring a mid-session recess which might dissipate the audience.

What to do about no-shows is a continuing problem for conference organisers. It is a special consideration for conferences such as APMC which attract an international authorship where a significant proportion of authors submit papers more in hope than expectation of institutional support to attend. Sadly, a minor percentage, it appears, had no intention of attending—getting a paper published in the *Proceedings* was their aim.

What to do? A non-refundable author deposit at the time of paper acceptance, say $100, is one suggestion. An international "black-list" is another (and we did advise APMC'93 of no-shows we considered did not have adequate excuse). Either way, it is a regrettable reflection on engineering research professionals and the "publish or perish" syndrome.

Workshops

Three workshops were held in conjunction with the conference and attracted a good attendance. The workshops were on "Millimetre Wave Technology," organised by Jim Wilkse of Georgia Tech, "Anatomy of a Numerical Technique," by Tapan Sarkar of Syracuse University, and "Wideband Imaging and Sensing Polarimetry," organised by Wolfgang Boerner of the University of Illinois. Papers from the "Polarimetry" workshop were published as part of the conference proceedings so were available to all delegates, whether or not they registered for the workshops.

Trade Exhibition

It was modest—14 stands—but it was good both for delegates and exhibitors. Generous inter-session breaks during which coffee was served in the exhibit area ensured good attendance at stands.

The Social Side

A welcoming reception on the first night proved a popular warm-up session and an introduction to Australian wines for many of our visitors. Adelaide is the centre of major wine producing regions of Australia, and the local produce was well received. The theme of wine continued into the Conference Dinner, held in a winery south of Adelaide. Buses took delegates for a 40-minute ride, with spectacular night views of the city en route, to a winery where delegates had opportunity to sample a wide variety before taking their seats for the dinner. The only problem was that Adelaide's usually Mediterranean climate deserted us in favour of icy winds and rain for the duration of the Conference, making it a bit cool in the "outdoorsy style" winery. But the wine lessened the pain! A feature of the evening was a local Taiwanese group's "fan dance" (not the sort you're thinking of) which introduced the Chairman of APMC'93 and allowed him to urge delegates to join with the Taiwanese hosts of APMC'93.

The South Australia Chapter MTT/AP

Given the impetus of APMC'92 and the enthusiastic championing of Bevan Bates, one important outcome has been the establishment of a joint MTT/AP chapter in South Australia. A Chapter Chairman's meeting was held during APMC'92, and Bevan attended as a "prospective" South Australian Chapter representative. One advantage of submitting this report late is that I can report that the Chapter is established and that Bevan has been elected as the inaugural Chairman.

And for the Future . . .

As alluded to in the report, APMC'93 is to be hosted by Taiwan, 18-21 October 1993. The organising committee of APMC'92 wishes their counterparts for 1993 every success in carrying forward APMC on an annual basis. There are bids in to host APMCs until the end of the century and there are some other potential hosts seeking reconsideration of the current host listing. If enthusiasm to host the conference is any guide APMC is well and truly of age and is a solid part of the worldwide microwave conference scene.

Technical Activities Board Report

by Peter Staecker

Issues related to publications and meetings dominated the TAB meeting held in late June.

Publications

The Publications Board continues to be very busy, finishing reviews and approvals for 4 new Society Magazines and one technical journal. In other pub-related activities:

Guidelines on Newsletters have been proposed and approved. Details include format of title and masthead (which may effect the "look" of this newsletter) and formal copyright agreements on certain articles. All newsletters will be reviewed periodically by Pub Board.

Ironically, at the Institute level, the transition to all-electronic publication of Society technical journals is taking its toll on timely dissemination of technical information. I received my February issue of MTT Transactions shortly before attending the TAB meeting in late June. The problem seems to be that IEEE tried to move too fast into this area, and has become choked in backlog. The problem will take at least another 6 months to be solved.

A proposal from the TAB Products Council on Electronic Delivery of IEEE publications is proceeding to the implementation stage. CD ROM is the vehicle of choice, with one disc per month capable of holding information for each of the All Periodicals Package and Conference Proceedings. Pricing issues are being considered together with encryption methods to simultaneously allow production uniformity and customer selectivity. Milestones for completion of the project were presented, which include first product shipments in early 1995. A funding amount of $8K was approved by TAB to finalize details of the proposal and to develop demonstrations.

Meetings

About 25% ($30M) of IEEE income is derived from meetings. A uniform audit procedure with IEEE staff audit and uniform fee structure was proposed and approved which should reduce costs of the audit process to Societies.

In an important matter brought before TAB by the Technical Meetings Council, a modified Institute policy on the proprietary nature of submitted manuscripts was passed which extended the feature to abstracts and papers for conferences. The following wording was approved: *"IEEE Policy requires that referees treat the contents of papers and abstracts under review as privileged information not to be disclosed to others before publication or presentation. The Conference shall ensure that referees are aware of this policy. It is expected that no one with access to a paper/abstract under review will make any inappropriate use of the special knowledge."*

In another meeting related activity, an IVHS *ad hoc* Coordinating Committee was formed which will coordinate technical activities with IVHS America. The purpose of this committee (14 Societies represented so far) will be to add IEEE support to defining and disseminating technical content of this initiative.

Other Items of Interest to MTT-S

The Society Field-of-Interest Statement, probably not well-known by the rank-and-file IEEE member, will take on increasing significance in the future. In the 1995 IEEE membership brochure, this statement will be used to describe the offerings of each Society.

In the area of Society/Council member fees (for 1994), because of the unbundling of Transactions and Letters Journal, MTT membership is tied with Broadcast Technology at $8 for lowest in the Institute. Only Circuits and Systems is lower at $5. All other Societies are $10 or more.

The RAB/TAB Transnational committee approved a proposal to increase electronic communication among Chapters, and to encourage Societies to appoint Chapter Coordinators with access to electronic communication. Roger Pollard (r.pollard@ieee.org) is the MTT liaison. Status: 44% of sections connected, while 18 sections have plans for BBS.

Whatever Happened to the *Transactions*

(continued from page 12)

pers in the backlog. Final versions of papers received today will not be published before May 1994.

The good news is that at its June meeting the MTT-S AdCom has authorized a page budget of 2800 pages. We will publish 12 regular issues of the *Transactions* and four special issues as part B in certain months. This action will permit us to reduce the backlog and avoid "bumping" regular issues. The only other solution would be to be much more strict in the acceptance of papers, a very unpopular approach in the mind of most authors.

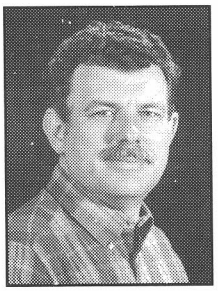
I hope you now understand our problems and that you will be patient and forgiving for the inconvenience we may have caused you. We are trying our best to serve your needs. Your comments and inputs are always welcome.

IMS '93 Is History

(continued from page 3)

professional services of Horizon House (Howard Ellowitz and Harland Howe) and of LRW Associates (Larry and Margaret Whicker) and we owe them our sincere appreciation for doing a terrific job in helping us with some of the big ticket items like exhibits, program booklet, digests and mailings. Their advice and cooperation were first-rate. Putting on the '93 IMS has been a challenge and treat. We're sure that Don Parker and his Committee in San Diego will outdo us all in '94. We hope that they do; we look forward to relaxing and *enjoying* that one!

ARFTG Highlights Fall '93



by John T. Barr, IV

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

41st ARFTG Conference—
Information Management and Automated Test
("Now That I Have All This Data, What Do I Do With It??")

The 41st ARFTG Conference was held in Atlanta, Georgia, on June 18, 1993, as part of the MTT-S International Microwave Week. The theme of this one day technical conference was Information Management and Automated Test ("Now That I Have All This Data, What Do I Do With It??"). In attendance were 92 paid technical attendees plus 8 tables that were in the concurrent exhibitors' room. Attendees discussed a wide range of subjects including: as automated tests now generate more and more data, how do we use this data—what can be learned from analyzing large amounts of data, how do we present to the user the raw or analyzed data and how do we store and retrieve in the future this information. Other topics covered included vector calibration techniques and devices, device modeling techniques, and other measurement techniques.

Presented papers were:

- "Full Characterization of Low-Noise HEMPTs Using Only Noise Figure Measurements," A. Caddemi
- "A Novel Procedure for Network Analyzer Calibration and Verification," V. Adamian
- "The Multi-State Two-Port: An Alternative Transfer Standard," G. F. Engen
- "An Automated Non-Linear Transistor Characterization System With a High-Level Language User-Interface For Easy Control, Visualization and Data Management," F. M. Ghannouchi
- "Lessons Learned on a LAN Network," J. G. Burns
- "The Reflection Analyzer—Architecture and Implementation," G. Hjipieris
- "Measurement of Dielectrics and Ferrite Materials," H. E. Stinehelfer
- "Automated Testing and Statistical Process Control—From Wafer to Product," D. Glajchen
- "A Sapphire Resonator for Microwave Characterization of Superconducting Thin Films," C. Wilker
- "On the Design of New Integrated Microprobes (NIMP) for Non-Linear On-Wafer Device Characterization," R. G. Bosisio
- "Application of Multi-dimensional Large- and Small-Signal Impedances and S-Parameters," M. Odyniec
- "Calibration and Measurement Considerations for Deriving Accurate Temperature Dependent Equivalent Circuits," J. E. Pence
- "The Acquisition and Analysis for Microwave Characterization Data for Process Control and the Development of Statistical Design Tools," E. Schirmann
- "Using Hypertext to Manage Microwave Data," B. Berson
- "Hybrid Inductor Modeling at L-Band Using 1-Port Fixtured S-Parameter Measurements," W. R. Gaiewski
- "Design Considerations for Digital Interconnects in Lossy Dielectric Medium," A. P. Agrawal
- "The ARFTG Measurement Comparison Program, A Status Report," R. Judish

Conference Chair was J. Greg Burns, Conference TPC was R. A. Henle and Exhibit Chair was James C. Rautio. A post-conference digest is available, contact: Henry Burger, ARFTG, 1008 East Baseline Road, No. 955, Tempe, AZ 85283-1314. Cost is $20.00 for an ARFTG Member and $35.00 for a non-member. An additional $9.00 is requested for airmail outside the USA.

Looking Forward to the Future
42nd ARFTG Conference—
"RF and Microwave Testing for Commercial Applications"

ARFTG will hold their 42nd Conference in San Jose, CA, on December 2 & 3, 1993. The conference theme is: "RF and Microwave Testing for Commercial Applications." For applications such as personal, cellular and satellite communications, collision avoidance and mavigation, and Gigabit rate processing, expectations are that production test costs will be continuously reduced. To meet this challenge of automatic RF techniques development for the commercial electronics industry, papers are invited on such topics as optimization and reuse of test plans, design for testability, automated calibration and verification, fast test algorithms and equipment, test executives, links to computer-aided design and manufacturing, and fixturing and interconnects suitable for multiple connections. Papers are invited which identify problems and/or solutions in this area. In addition, papers concerning all other areas of microwave measurements and design are welcome.

In addition to the technical presentations, the attendees will have ample time for informal discussion among themselves during the breaks and during the provided lunches and dinner (your spouse is invited to the Awards Banquet at no extra cost). There will be time for discussions with vendors and viewing of exhibits to see the latest in automation and measurement products. The registration fee includes technical ses-

(continued on next page)

Second International Conference on Ultra-Wideband, Short-Pulse Electromagnetics

Weber Research Institute, Polytechnic University
Brooklyn, NY 11201

April 5-7, 1994

L. Carin, L. B. Felsen, S.U. Pillai
Conference Co-Chairmen

This second conference on Ultra-Wideband (UWB), Short-Pulse (SP) Electromagnetics, which follows the first conference held at Polytechnic University during October 8-10, 1992, is intended to assess further developments in advanced technologies for generating, radiating, and detecting UWB/SP signals; in mathematical methods for characterizing their propagation and scattering; and in current as well as potential applications. Special emphasis will also be placed on UWB/SP systems and time-domain data processing. Contributions in these and related topics are solicited.

Sample categories are:

- UWB sensing of terrain, ocean scatter, and subsurface properties
- SP antennas, radars, and systems
- UWB/SP for target detection and identification, and for targets in clutter
- Phase space techniques for UWB/SP modeling and data processing
- Wavelets and multi-resolution algorithms
- Digital MMIC circuits
- UWB/SP materials characterization

The conference is sponsored by the Weber Research Institute of Polytechnic University and is cooperatively sponsored by several US government agencies including the Air Force (A. Nachman, AFOSR, and A. Terzuoli, AFIT), the Navy (T. Tice and R. Dinger, NRaD), and the Army (L. Jasper, ARL). The conference is also cooperatively sponsored by the Microwave Theory and Techniques Society and by the Antennas and Propagation Society of the IEEE. The conference format includes non-overlapping oral and poster sessions.

A one-page abstract must be submitted for review by November 15, 1993; authors will be notified by December 15, 1993 as to whether their paper has been accepted for presentation. The abstract should be sent to Professor L. Carin, Weber Research Institute, Polytechnic University, Six MetroTech Center, Brooklyn, NY 11201 or via e-mail to lcarin@stealth.poly.edu. Please contact L. Carin at (718) 260-3876 if there are any questions.

ARFTG Highlights

(continued from previous page)

sions, exhibits, and all meals and break refreshments, one year membership in ARFTG and conference digest of the presented papers.

Those interested in participating should contact Conference Chair: Kevin Kerwin, Hewlett Packard-MWTD, 1400 Fountaingrove Parkway, Santa Rosa, CA 95403, phone (707) 577-4061, fax (707) 577-4787; or Conference TPC: John Grubb, Hewlett Packard-MID-1URM, 1212 Valley House Drive, Rohnert Park, CA 94928, phone (707) 794-4474, fax (707) 794-3844. Those interested in exhibiting should contact: James C. Rautio, Sonnet Software, Inc., 135 Old Cove Road, Suite 203, Liverpool, NY 13090-3746, phone (315) 453-3096. Deadline for paper submissions will be October 1, 1993.

No More Post-Conference Digest!!

ARFTG has published a post-conference digest since spring 1982. A recurring request has been to make the digest available at the time of the conference. With authors being better prepared (with use of word processors and other desktop tools) and the use of "quick" printers, ARFTG will now be offering "available-at-conference" digests. .This will start with the Fall 1993 (42nd) San Jose conference. There will be some changes in the timeline for authors and all prospective authors should consult the Call for Papers for details.

Measurement Professional? or Interested in Learning More?

We will be looking forward to discussing the latest in measurement automation and accuracy with you in San Jose. ARFTG brings you the latest in RF, microwave and millimeter wave analysis, design and measurement. State-of-the-art papers are presented twice a year. If you are involved in automated measurement techniques, come and join your peers and keep current with our ever-evolving technology. For more information on ARFTG or future conferences, write: John Barr, Santa Rosa System Disision-3US-Q, Hewlett-Packard, 1400 Fountaingrove Parkway, Santa Rosa, CA 95403, or e-mail: j.barr@ieee.org.

1994 IEEE National Telesystems Conference
San Diego Convention Center
San Diego, California
May 26-27, 1994

New Horizons for Advanced Telesystems Applications

CALL FOR PAPERS

The 1994 IEEE National Telesystems Conference (NTC '94) Will be held on May 26-27, 1994, in San Diego, California. NTC '94 will be held concurrently with the 1994 IEEE Microwave Theory and Techniques Society (MTT-S) International Microwave Symposium and Exhibition at the San Diego Convention Center.

Authors are given the opportunity to submit original papers on recent developments in all aspects of Telesystems, with emphasis on the conference theme of ADVANCED TELESYSTEMS FOR THE FUTURE. Areas of interest include, but are not limited to, the following topics:

- Dual Use Technology Applications
- Advanced Technology for Telesystems
- Aircraft Navigation/Landing Systems
- Communications Systems & Networks
- Infrared Imaging Systems
- Intelligent Transportation Systems
- Active Array Radar Systems
- Acoustic Array Systems
- Satellite Communications Systems
- Space Navigation Systems
- Telemetry and Remote Sensing
- Telerobotics/Unmanned Vehicles
- Tethered Systems & RPVs
- Simulation and Systems Modeling

Papers emphasizing telesystems applications of advanced MMIC, Microwave, and Photonic technologies are encouraged. However, all papers concerned with the telesystems applications will be considered.

Full papers for an 18-20 minute presentation and inclusion in the Conference proceedings will be selected on the basis of a 500-1000 word summary. Paper submission requirements are as follows:

1. Ten (10) copies of a 30-50 word abstract on a single separate sheet. This sheet should include the title and author(s) of the paper.
2. Fifteen (15) copies of a 500-1000 word summary with supporting illustrations. The title and author(s) of the paper should be included on the front page of the summary.
3. A separate sheet listing the title and author(s) of the paper along with a complete mailing list, telephone number (and fax number, as appropriate) for each author. Indicate which of the above area(s) of interest are addressed by the paper.

ALL PAPER SUBMISSIONS MUST BE RECEIVED BY DECEMBER 1, 1993.

Late submissions will not be considered.

Mail submissions to:

NTC '94
c/o LRW Associates
1218 Balfour Drive
Arnold, MD 21012
(410) 647-1591
Fax: (410) 647-5136

Authors will be notified of the status of their submissions by February 1, 1994. Authors of accepted papers will receive copywrite release forms and instructions for publications and presentations. Print-ready copies of acceptable papers are due by March 15, 1994.

For additional information about the technical program/papers submissions, please contact John Van Egmond, ITT Gilfillan, Van Nuys, California [(818) 902-2037, fax (818) 901-2536] or Chuck Shipley, Technology Service Corporation, Santa Monica, California [(310) 450-9755, fax: (310) 425-3175]. For additional information about NTC '94, please contact Bob Bolger, ARINC Research Corporation, San Diego, California [(619) 222-7447, fax: (619) 225-1750].

Co-sponsored by
IEEE Aerospace and Electronics Systems Society
IEEE Microwave Theory and Techniques Society
San Diego IEEE Section

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IEEE National Capital Area Council
Atlanta IEEE Section

CALL FOR PAPERS

IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES

SPECIAL ISSUE
ON

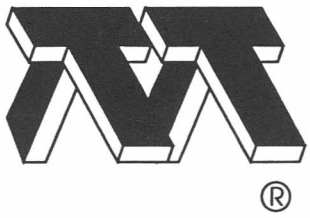
EMERGING COMMERCIAL AND CONSUMER CIRCUITS, SYSTEMS AND THEIR APPLICATIONS

MTT-S Technical Committees on Microwave and Millimeter-Wave Integrated Circuits (MTT-6), and Microwave Systems (MTT-16) are jointly sponsoring a special issue of the IEEE Transactions on Microwave Theory and Techniques on "Emerging Commercial And Consumer Circuits, Systems And Their Applications," to be **published in JULY 1995**. **The purpose of this special issue is to highlight the diverse commercial and consumer applications of RF, Microwave and Millimeter-Wave integrated circuits (ICs) and systems**. Relevant topics of interest include, but are not limited to, the following areas:

- Cellular/Wireless Personal Communication Systems(PCS)
- Satellite Communication and Navigation
- VSAT Systems
- Mobile Satellite Systems
- Automotive Applications
- Digital Satellite Transmission
- Spread Spectrum ICs
- Point of Sales, Personnel Security & Identification
- Dual Use of Technology (Military and Civilian)

Fazal Ali of Westinghouse and **John Horton of TRW**, will be the guest editors of this special issue. Prospective authors are requested to **submit five copies** of the paper describing original work in the above mentioned areas **by MAY 31, 1994** to:

Fazal Ali
Guest Editor, MTT Transaction Special Issue
Westinghouse Electric Corporation
Advanced Technology Labs.
MS-3K11, P.O. Box- 1521
Baltimore, MD. 21203.
TEL. (410)-765-4540
FAX.(410)-765-7370



AUTOMATIC RF TECHNIQUES GROUP

CALL FOR PAPERS

The Automatic Radio Frequency Techniques Group will hold their 42nd Conference in San Jose, California on December 2 and 3, 1993. The Conference theme is:

RF and Microwave Testing for Commercial Applications

For applications such as personal, cellular, and satellite communications, collision avoidance and navigation, and Gigabit rate processing, expectations are that production test costs will be continuously reduced. To meet this challenge automatic RF techiques developed for the defense industry need to be distilled and merged with manufacturing techniques developed for the commercial electronics industry. Papers are invited on such topics as optimization and reuse of test plans, design for testability, automated calibration and verification, fast test algorithms and equipment, test executives, links to computer-aided design and manufacturing, and fixturing and interconnects suitable for multiple connections. Papers on other RF measurement or computer-aided design topics will also be considered.

Technical presentations should be informal 20-minute talks using viewgraphs or 35 mm slide illustrations. For early acceptance and preconference publicity, authors are requested to submit two copies of both a one-page abstract and a 500 to 1000 word summary with illustrations providing sufficient technical content for proper evaluation and explaining the paper's usefulness to the conference attendees before September 3, 1993. The deadline for submission of finished papers with abstracts is October 1, 1993. All accepted papers will be published in the conference digest, to be distributed at the conference. Manufacturers interested in exhibiting at the conference should contact the Exhibits Chairperson for information and applications forms. Contact the Conference Chairperson, Mr. Kevin J. Kerwin, (Phone (707) 577-4061, FAX (707) 577-4787) for any additional information.

Submit abstracts and papers to:

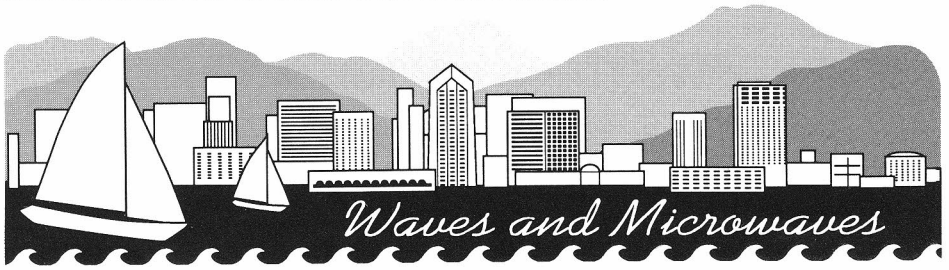
Mr. John P. Grubb
Hewlett-Packard Company
MS 1URM
1212 Valley House Drive
Rohnert Park, CA 94928-4999
Phone (707) 794-4474
FAX (707) 794-3844

For exhibits information contact:

Dr. James C. Rautio
Sonnet Software, Inc.
Suite 203
135 Old Cove Road
Liverpool, NY 13090-3746
Phone (315) 453-3096
FAX (315) 451-1694

1994 IEEE MTT-S
International Microwave Symposium

May 23-27, 1994
San Diego, CA



CALL FOR PAPERS

The 1994 IEEE-MTT-S International Microwave Symposium week will be held in San Diego, California, May 23-27. Contributed papers are solicited describing original work in the microwave field. Typical topics and technical areas of interest appropriate for the Symposium are listed below, but any paper concerned with the utilization and application of microwave theory and techniques will be considered.

- Biological Effects and Medical Applications
- Passive Components
- Filters and Multiplexers
- Ferrite Components
- Acoustic and Surface Wave Components
- Sources and Control Components
- Non-Linear Modeling and Analysis
- Transistor Power Amplification
- High Power Sources and Control
- Low Noise Receivers and Detectors
- Microwave Integrated Circuits
- Monolithic Circuits and Modules
- Millimeter and Submillimeter Wave Technology
- Field Theory
- EM Analytical and Numerical Techniques
- CAD Procedures, Techniques, and Modeling
- Guided Waves and Propagation Characteristics
- Measurement Theory and Techniques
- Microwave and Communications Systems
- Phased Arrays
- Active and Quasi-Optic Antennas
- Lightwave Technology and Techniques
- Superconductivity Technology
- Manufacturing, Production and Packaging
- Digital Signal Processing

Please indicate your preference for full length (20 minutes), short (10 minutes) or the interactive forum presentation. Full length papers should report significant contributions, advancements or applications of microwave technology. Short papers typically report specific refinement in the state-of-the-art. The interactive forum papers provide an opportunity for authors to present theoretical or experimental material in poster format, display hardware, perform demonstrations, and conduct discussions in an informal manner with interested colleagues.

The Program Committee will honor the author's preference where possible, but reserves the right to place the paper in the category it considers most appropriate consistent with the constraints of the technical program.

Paper submission requirements are as follows:

1. Ten (10) copies of a 30-50 word abstract on a single separate sheet. This sheet should indicate the title and author(s) of the paper.
2. Fifteen (15) copies of a 500-1000 word summary with supporting illustrations. The title of the paper and author's name(s) should be on the front page of each copy.
3. A separate sheet with the complete mailing address (and FAX number, as appropriate) of the author, a statement indicating the author's preference of full length, short or interactive forum presentation and a prioritized list of up to three areas from the preceding list, appropriate for reviewing and sponsoring your paper.

ALL PAPER SUBMISSIONS MUST BE IN ENGLISH AND RECEIVED BY DECEMBER 1, 1993.
Late submissions will not be considered.

Mail submissions to:

MTT-S SYMPOSIUM 1994
c/o LRW Associates
1218 Balfour Drive
Arnold, MD 21012 USA

Authors will be notified of the status of their submissions by February 1, 1994. Authors of accepted papers will receive copyright release forms and instructions for publication and presentation. Final manuscripts for publication in the Symposium Digest will be required in early March, 1994.

NOTE: Authors are cautioned to obtain all required company and government clearances prior to submittal. A statement signed by author(s) stating that such clearances have been obtained must accompany the final manuscript of accepted papers to be published in the Symposium Digest.

Additional information is available through Horizon House Bulletin Board and *EMLIB* on Internet. Self-extracting files can be down loaded from Horizon House at (617) 769-9901 (8, N, 1). Internet access is via anonymous FTP at *microwave.jpl.nasa.gov* (128.149.76.31) using the pub/MTT94 directory.

ANNOUNCEMENT OF STUDENT PAPER CONTEST

A student paper contest for full-time students (9 hours/semester graduate, 12 hours/semester undergraduate) will be held as part of the 1994 Symposium. To be considered, there should be no more than two authors, with the student as the lead author of the paper. The second author should attach a statement that his/her contribution is primarily advisory. Papers should be submitted in the above manner with an additional notation of "Student Paper". Student papers will be reviewed the same as all other conference papers. Papers accepted for the competition must be presented by the student author at the Symposium and will be judged for content, presentation, and visual materials. First, Second and Third prizes will be awarded.

ADDITIONAL SOLICITATIONS

I would like to take this opportunity to offer an invitation to all MTT-S members to provide suggestions on any aspects of the Technical Program for the Symposium. All suggestions will receive my personal review. Consider this to include ideas for Workshops, Panel and Focused Sessions. Be prepared to support your ideas with some time and effort if needed. Remember, this is an organization of volunteers. Contact Bob Eisenhart, Technical Program Chairman at (818) 702-1380 or Fax (818) 702-4064.

"We Have a Winner!!" MTT-S Membership Drive

by John Barr

One of the roles of the Membership Development Committee is to expand the membership of the MTT-S. By increasing the membership we expand the breadth of knowledge and technical strength of our professional community.

In May 1993 a direct mailing was made to MTT-S members recently in arrears and non-MTT-S IEEE members with Technical Interest Profiles (TIPs) similar to present MTT-S members. By July 1, the mailing had attracted 194 new MTT-S members. As an additional incentive, all these new members were entered in a drawing for an HP95LX PalmTop Computer—and we have a winner!: Mark T. Leney of Endicott, NY. We welcome Mark and the other new members to MTT-S.

The Membership Development Committee runs new member booths at the International Microwave Symposium and other microwave conferences worldwide. This year at the Atlanta 1993 IMS, 110 new members joined MTT-S. This is a good example that could be followed by chapters to approach the non-members who attend local meetings and conferences and who just need a little encouragement and easy convenience to join.

I would like to challenge each chapter to recruit 20 new members this year. The MTT-S AdCom awards $200 each year to the chapters in Regions 1-6 and Regions 7-10 with the largest gains in membership. For those needing suggestions and supplies for a membership drive or booth, contact: John Barr, MTT-S Membership Development, Hewlett-Packard-SRSD-3US-Q, 1400 Fountaingrove Parkway, Santa Rosa, CA 95403, (707) 577-2350, e-mail. j.barr@ieee.org

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