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NEWSLETTER

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BRIDGING THE SPECTRUM

SAN FRANCISCO
June 17-21

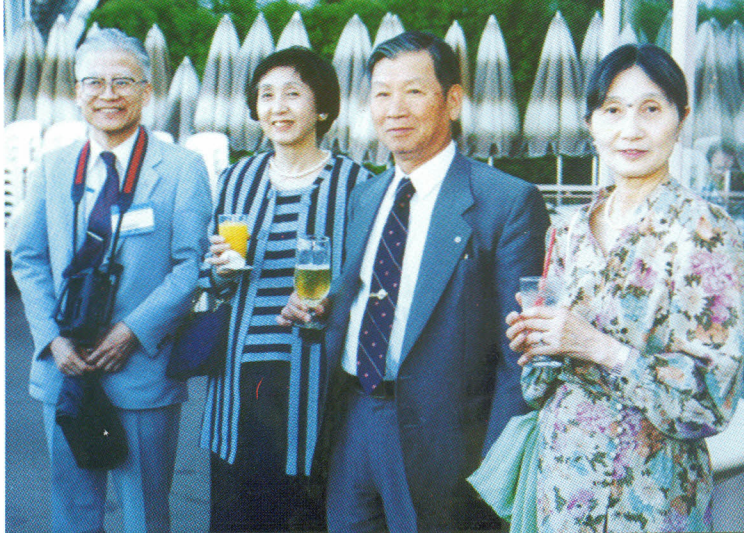
1996

IEEE MTT-S

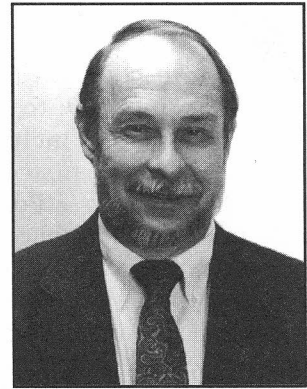
INTERNATIONAL MICROWAVE SYMPOSIUM/EXHIBITION



— Scenes from IMS '96 —



President's Message



by John Wassel
1996 IEEE MTT-S President

The 1996 IEEE MTT-S International Microwave Symposium held in San Francisco the third week of June was most successful. A total of 9,991 people registered for the IMS which makes it the largest in attendance we've ever had. The technical program had over 800 separate technical programs which is a new record also. The 1996 IMS Steering Committee, chaired by Jim Crescenzi, were gracious hosts who had done their homework in pre-



Jim Crescenzi, 1996 IMS Chairman.

paring for the IMS. All events were well planned with no obvious difficulties during the symposium. To the IMS Steering Committee, thanks for a job well done!

The AdCom meeting was held on Saturday evening and most of Sunday, 15-16 June, prior to the start of the IMS. Jerry Fiedziuszek and Derry Hornbuckle, the Technical Program co-chairmen, presented a summary of the Technical Program. The program included 466 papers, 8 focused sessions, 6 panel sessions, 1 evening rump ses-

sion, and 26 workshops. Papers were submitted from 38 countries and 6 continents. A record 139 papers were submitted to be reviewed for the December *IEEE MTT-S Transactions* issue. The Microwave and Millimeter-Wave Monolithic Circuits Symposium advance registration was summarized by Mahesh Kumar, this year's General Chairman, and the 47th Automated Radio Frequency Techniques Group (ARFTG) Conference, chaired by Ken Wong, also expected record attendance.

Preparations are also underway for the next series of microwave symposia. Claude Weil, Chairman for the 1997 IMS Steering Committee, summarized the preparations for Denver next year. Later in the week, the 1996 and 1997 IMS Steering Committees met for a lunch meeting to discuss the preparations made for San Francisco and to recap their experiences with the past week. I've always thought of this luncheon meeting as one of unity between the two conferences and a generous sharing of ideas and suggestions to make the IMS even better in the future. We're all enriched by this tradition and the excellent improvements are evident from year to year.

For the future symposia, Fort Worth will be the site for the 2004 IMS. Karl Varian is the Chairman for the Dallas-led IMS Steering Committee. Another change is in the offing for next year in that the Microwave and Millimeter-Wave Monolithic Circuits

Symposium will be changing its name and focus. The new name is the RF Integrated Circuits Symposium or RFIC for short and the focus will be on ICs for the lower frequencies, L- and S- Band or below. This change is due to partly to the increased interest in wireless applications and partly to the unique applications developing for microwave and RF circuit applications. The Technical Committee chaired by Frank Sullivan also is actively considering the formation of an RFIC Committee to provide additional emphasis in this area.

So far this year, eleven new MTT-S chapters have been established mostly in the former Soviet Union and one more is presently under consideration. This is a joint endeavor with the Electron Device Society and is being organized by Rolf Jansen, our Division IV Director and MTT-S AdCom member, and Bill Van Der Vort, Executive Director for EDS. The Antennas and Propagation Society has also joined with MTT-S and EDS to lend further support for these new chapters. We expect to continue some financial support for these chapters for at least the next three years. The support is a partial subsidy of the IEEE dues and travel aid for key chapter members to attend IEEE meetings.

This year at the IMS, the gift to the attendees was a CD ROM which contains all three volumes of the 1996 *IEEE MTT-S Interna-*

tional Microwave Symposium Digest, the 1996 IEEE Microwave & Millimeter-Wave Monolithic Circuits Digest, and indexes from 1989 to 1995 for MTT-S publications including the ARFTG Digest. This effort was undertaken by Roger Pollard, who heads the AdCom Publications Committee, and by Richard Ranson, the editor of the IMS Digest. A motion was passed at the AdCom meeting to prepare a set of CD ROM's which will have all of the MTTs archival publications and to distribute these sets to all MTT-S members. There are a number of questions being raised as to how we best use the new technologies and how we realize a revenue stream from the new electronic media. We intend to pursue these options and will be depending upon our members to evaluate these services and provide us the necessary feedback.

As for membership, MTT-S had a peak membership in 1991 of about 10,500 members. The membership declined steadily for several years reach-

ing a low of about 8,400 members in 1994. We are again seeing a slight rise with the present number being 9,088 at the end of March. Along with the membership decline, we have experienced a corresponding rise in our reserves because of lower publication costs and meeting expenses that were needed for our members. At present, we have reserves of \$3.1 million which is about 1.5 years of operating expenses at our present operating budget of around \$2.1 million. We are an extremely healthy society in all aspects and will continue to be so. With the present emphasis in communications services and a corresponding demand for microwave and RF practitioners, we will indubitably see another rise in membership which will bite into our reserves. We need to be prudent in order to meet the exigencies of the future but we also need to be bolder in introducing new services and programs. Your AdCom is working these issues with the prudence typical of our engineering traditions. I'm confident you will be pleased with the results of their actions.



Associations are probably the most natural of mankind's undertakings and may be the principal reason we outlasted the dinosaurs. We have evolved from hunting bands through medieval guilds to our present extremely complex organizations. However, the fundamental necessity is for us to band together for the common good in order to deal with our common problems. You are a part of our association of microwave professionals and you need to do your share to help keep us happy, productive, and prosperous.

Changes to 1996 Committee Directory

Please mark the following changes in your 1996 MTT-S Directory:

In Section V—AdCom Committee Organization, under G—Publications, following *Transactions* Editor, please add: *Microwave & Guided Wave Letters* Editor: R. Sorrentino; IEEE Press Liaison: M. Golio.

R. E. (Skip) Bryan's phone number is: (919) 472-7117, fax: (919) 472-7452, e-mail: r.bryan@ieee.org.

J. Mike Golio's new address is: Collins Commercial Avionics, Rockwell International Corporation, 400 Collins Road NE, Cedar Rapids, IA 52498, phone: (319) 295-3926, fax: (319) 295-3751, e-mail: m.golio@ieee.org.

Stephen Maas' new e-mail address is: s.maas@ieee.org.

Austin Truitt's address is: Texas Instruments, Inc., 13500 N. Central Expressway, P.O. Box 655474, M/S 245, Dallas, Texas 75265.

Technical Documents Library

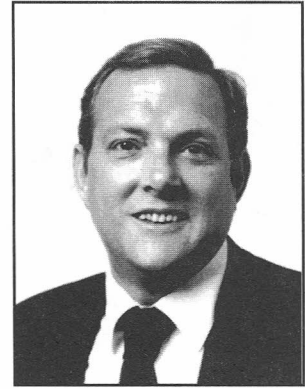
by Kai Chang

Recently a library of technical documents has been added to our research lab, the Electromagnetics and Microwave Laboratory. We are in need of any microwave related journals and books to add to our current collection. Our research staff would greatly appreciate the donation of any such documents to our library. In particular, we are interested in MTT and AP transactions and all of the trade journals. These would serve as a valuable resource for our researchers in their pursuit of graduate degrees.

If you are interested, please contact us. Our mailing address is:

Texas A&M University
Dept. of Electrical Engineering
College Station, TX 77843-3128

MTT Society Ombudsman



*by Ed Niehenke
Northrop Grumman
P.O. Box 1521, MS-3KI I
Baltimore, MD 21203
(410) 765-4573
(410) 765-2116 Fax
E-mail: e.niehenke@ieee.org*

As your Ombudsman, I have received 7 inquiries from MTT-S members since the last reporting in the Spring 1996 Newsletter. The first inquiry was from a member who required missing back issues of MTT-S and other IEEE periodicals which were sent to the member. One member required confirmation that his IEEE dues was paid. Upon investigation, there was a problem with his credit card which was cleared up, and his dues was paid with prompt mailing of his 1996 IEEE card. One student member who had a paper accepted at the 1996 MTT-S International Microwave Symposium (IMS) needed financial help to come. His professor submitted many letters to different organizations for financial assistance. I suggested that he contact his local MTT-S Chapter for possible assistance. In checking back, the student was able to come to the IMS, his paper presentation was very successful, and he had a wonderful time at the IMS.

One member wanted to know when he would become a life member. I informed the member that he is eligible this year, so next year he will become a life member. To become eligible in 1996, your age plus years of

IEEE membership must add up to 100 and you must have attained an age of 62 minimum during 1996. To become a life member in 1998, in 1997 your age plus years of IEEE membership must add up to 100 and you have attained an age of 61 minimum during 1997.

One member wanted to know how to obtain the IEEE salary survey. Informed member that the last survey was published the first quarter of 1995. The survey can be ordered from IEEE by calling (800) 678-4333 and asking for UH1982. The cost for IEEE members is \$74.95 plus a handling charge. The non IEEE member price is \$119.95 plus handling charge. The next issue will be in the first quarter of 1997. The Institute carries the some highlights of the survey after the publication is prepared.

One member wanted to know the policy concerning acceptance of papers for the MTT-S Microwave and Guided Wave Letters (MWGWL) and was concerned that his paper was not accepted. The MWGWL review committee are entrusted by the MTT-S Society to review the papers and make their recommendations to the editor, who in turn makes the decision based

on the reviewers inputs. The editor has the final say when he reviews the inputs of the editorial board.

The last request was from a person representing a company who requested that a paper which was submitted to the MTT-S Transactions be withdrawn due to an alleged breach of confidentially agreement between the author, his school, and this company. I contacted the MTT-S editor; he received a request from the author's professor to have the paper held until clearance was obtained from the company in question. The editor requested that a person from the school's administration respond. The editor was ready to delay the paper but was subsequently informed by the intellectual property and contracts officer of the university that the legal problems were resolved and it is OK to publish the paper, which was done. The author did request clearance from the company but never received a reply.

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

The MMIC Historical Exhibit

by John Wendler

The MMIC Historical Exhibit was founded by Dr. Robert Pucel in 1987 and made its debut at the Las Vegas MTT-S. Care of the exhibit passed to Fred Schindler from 1994-1995. I'd like to extend a warm "thank you" to both of these gentlemen for the time they spent in assembling the present collection.

The purpose of the exhibit is to preserve samples of significant technological advances in the field of monolithic microwave integrated circuits. Most of the pieces in the collection consist of a sample chip, a photograph of the chip, and representative data. The exhibit is on display annually as part of the larger MTT-S Historical Exhibit.

We are constantly on the lookout for new items for the collection. Much of the current collection is weighted towards research results, because researchers publish, and publication in a peer reviewed journal is one easy test of "significance." Unpublished research results will also be considered when backed with sufficient proof of the claim being made.

Research is not the only fount of "significance," however. It has become apparent, even to this researcher, that production is the real game these days! Accordingly, I'm issuing an invitation to all production foundries and fabless design houses to submit a sample of your single highest volume (1995 production) MMIC to the Historical Exhibit. It is my hope that this will provide an interesting snapshot of the industry in 1995, and that it will balance

the traditional research orientation of the exhibit.

The guidelines are as follows:

1. The product may be active or passive, and must comprise some minimum amount of circuitry. A discrete device is not a MMIC.

2. The product must belong to the organization which is submitting it. i.e., a foundry should submit their own product, not one that is produced for a fabless design house.

3. The product does not have to be published in a catalog, but it must have been in production and available for purchase in 1995. The anticipated customer may be either commercial or governmental.

4. Any silicon MMICs that are submitted must be designed to work above 1 GHz. No such limitation applies to GaAs. The inequity of this rule is cheerfully admitted by the author.

5. The submission must include an approximate production volume for 1995. I am looking for approximately 20% accuracy here, on the honor system. There is no minimum threshold for inclusion; it does not matter if you make one or 50 million units a year.

6. There is no restriction on country of origin; submissions are welcome from inside or outside of the USA.

Submit your nominations and suggestions to:

John Wendler
Raytheon ADC
362 Lowell St.
Andover, MA 01810
Phone: (508) 470-9433
Fax: (508) 470-9345
Preferred e-mail addresses:
wendler@tomcat.adc.ray.com
or
j.wendler@ieee.org.

New Officers for San Fernando Valley

The new chairman and vice chairman of the San Fernando Valley MTT-S Chapter from 6/96 through 12/96 are:

Chairman:

James Weiler, Jr.

TRW

19951 Mariner Ave.

Torrance, CA 90503-1672

Phone: 310-214-5543

Fax: 310-214-5691

e-mail: jim.weiler@trw.com

or j.weiler@ieee.org

Vice-Chairman:

H. Clark Bell

HF Plus

21111 Tulsa Street

Chatsworth CA 91311-1456

Phone: 818-882-7811

Fax: 818-882-7815

e-mail: h.c.bell@ieee.org

Education Committee Activities

Graduate Fellowship Winners

Winners of 1996 Graduate Fellowships were announced at the Microwave Symposium in San Francisco where they received formal recognition at the plenary session. Each awardee received \$5,000 to support their work pursuant to a graduate degree in microwave engineering. The winners, their thesis advisors, and research topics are listed below:

- Andrew Adams
Institution: University of Leeds
Advisor: Dr. Roger Pollard
Research Topic: Microwave and millimeter-wave oscillator array combining techniques
- Chien-nan Kuo
Institution: UCLA
Advisor: Professor Tatsuo Itoh
Research Topic: Application of the FDTD method to the analysis of active circuits
- Vikram Jandhyala
Institution: University of Illinois
Advisor: Dr. Eric Michielssen
Research Topic: Fast multi-level algorithms for solving integral equations
- Ajay Prabhu
Institution: University of Massachusetts, Amherst
Advisor: Dr. Neal Erickson
Research Topic: Millimeter-wave HEMT small-signal and noise characterization utilizing a novel test fixture

Congratulations to the winners. Competition gets keener each year and this year was no exception, with the number (twenty-five) and quality up from last year's submissions.

Special thanks again to Aditya Gupta for his efforts to promote the Fellowship Program and his efficient oversight of the selection process.

1997 Awards

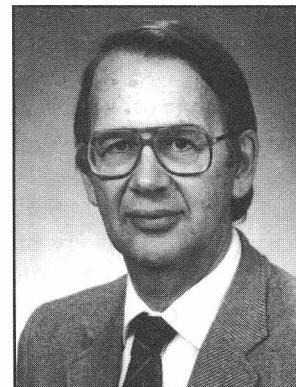
Application deadline for the 1997 competition is 30 November 1996 (see announcement elsewhere in this newsletter). Present intent is to make four awards again in 1997, but expanding the number and/or amount of awards is being considered for future years.

Also to be awarded this year is the Microwave Engineering Scholarship (see announcement elsewhere in this Newsletter). The goal of this fund is to support the education and accreditation of deserving future microwave engineers. One grant in the \$2000 to \$5000 range (depending on contributions received) is planned. Application deadline is 30 November 1996.

Student-Teacher and Research Engineer/ Scientist (STAR)

1995-1996 was the first full academic year for the STAR program. The goal of this program is to promote involvement of society members with local high schools to foster a positive image of engineering careers. This is accomplished through a team consisting of a society member, teacher and female student.

Programs were set up at eight institutions and a STAR e-mail alias was established. Information and experiences are



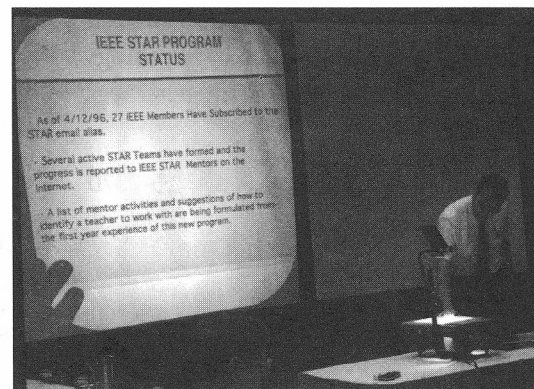
by Denis Webb

shared on the internet. As a result of experiences in the first year a list of mentor activities and suggestions as to how to identify a teacher to work with are being formulated. Society members interested in participating in or learning more about this program should contact:

Julia Brown
Hughes Research Labs
(310) 317-5068 • Fax: (310) 317-5483
e-mail: jbrown@madmax.hrl.hac.com

1997 Microwave Engineering Graduate Scholarship Fund

- Single \$2,000 to \$5,000 award
- IEEE-MTT-S member in good standing
- Enrolled in or applied for enrollment in a recognized graduate school in microwave engineering or related programs
- Recommended by a recognized faculty advisor
- Award based on need, academic and technical achievements and



potential for serving microwave profession and MTT-S

Application Deadline: 30 November 1996. For applications contact:

Dr. Denis C. Webb
Microwave Technology Branch
Naval Research Laboratory
Washington, DC 20375-5347
(202) 767-3312 • Fax: (202) 767-0455
e-mail: d.webb@ieee.org

Requests for materials must be received no later than 30 September 1996.

1997 IEEE Microwave Theory and Techniques Society Graduate Fellowships

- Several \$5,000 fellowship awards each year
- For Graduate research studies in microwave engineering on a full-time basis
- Applicants must have attained high academic achievement in engineering or physics
- Award can be granted in addition to any other support received by student
- Award cannot be used for equipment purchase, travel, supplies, etc.
- Award made to institution for support of named student
- Faculty supervisor must be MTT-S member

Application Deadline: 30 November 1996 For applications contact:

Dr. Aditya Gupta
Westinghouse Advanced Technology Laboratory
Winterson and Nursery Roads
Linthicum, MD 21090, USA
(410) 767-9170 • Fax: (410) 765-7370
e-mail: gupta.a.k.%wec@dialcom.tymnet.com

Requests for application materials must be received no later than 30 September 1996.

1998 IMS Steering Committee Meets on Chesapeake Bay



by Ed Niehenke

the Ravens has started construction, all pluses for our attendees.

The 1998 Baltimore IMS Steering Committee and their families met on Chesapeake Bay to plan for the IMS in Baltimore, just 2 years away. A Crab Feast, a Baltimore tradition, preceded our planning meeting. The members are quite excited about hosting the symposium, and many members attended the well run 1996 IMS and meet with the 1996 San Francisco IMS Steering Committee who gave us many important tips on their successful symposium. The last symposium held here was in 1986, and since then, many new hotels have opened at the Baltimore Inner Harbor, the Baltimore Convention Center has been expanded, the National Aquarium at Baltimore has doubled its size, the Oriole Park at Camden Yards was constructed, and the football stadium for

IMS 98 will be held the second week in June (June 8-12). In polling IMS attendees at San Francisco, 100% want to have a crab feast/bull roast, which is now scheduled for Tuesday, June 9, 1998. Our steering committee is composed of MTT-S members from both Baltimore as well as from the Washington DC area, so we now have 30 volunteers from 15 companies. Steve Stitzer is the Steering Committee Chairman, Roger Kaul is the Vice-Chairman, Ed Niehenke is the Technical Program Chairman and Denis Webb is the Technical Program Vice Chairman. We expect to have our key positions filled this fall, and we are interested in obtaining additional volunteers. Call Steve Stitzer (410) 765-7348 if you are interested.



1996 MTT-S Award Winners

1996 Microwave Career Award

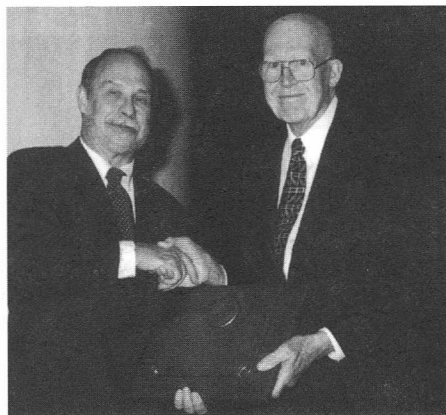
Dr. John H. Bryant

The Microwave Career Award is the highest honor bestowed by MTT-S. It recognizes an individual for a lifetime Career of meritorious service and technical excellence in the field. In 1996, our honored recipient is Dr. John H. Bryant, a former President of MTT-S and an IEEE Fellow.

The award consists of a plaque, a certificate and an honorarium of \$2,000. The Career Award Citation reads: "For leadership in the miniaturization of microwave circuits and interconnections, and for pioneer historical research on radar and the work of Heinrich Hertz."

John H. Bryant (M'50-SM'52-F'67) received a B.S.E.E. from Texas A&M University in 1942. Following active duty in the U.S. Army Signal Corps in England and Europe, and extensive experience with British and American operational radar, he received the M.S. and Ph.D. degrees in 1947 and 1949 from the University of Illinois.

At ITT Laboratories (1949 to 1955) Dr. Bryant was developing traveling-



wave amplifier tubes with applications in broadband electronic countermeasures equipment. The available coaxial type N circuit connectors made it impossible to get broadband, compact, and reflectionless performance.

At the Bendix Research Laboratories Division (1955 to 1962) he organized efforts that resulted in the enabling technology for the first microwave miniaturized connectors. Dr. Bryant and two colleagues, James Cheal and Vincent J. McHenry, who had been largely responsible for this miniaturization, believed it held the potential for an entirely new approach to microwave construction for broadband, compact assemblies to use in missiles and spacecraft, as well as for replacement of waveguide and bulky coax in conventional applications at all microwave frequencies.

They founded Omni Spectra, Inc. in 1962, to manufacture the miniature connectors to military and NASA requirements. The reduced cross-section extended the upper usable frequency to at least the top of K-band (through 26 GHz) and also made practical use of microstrip transmission line circuits.

The much smaller circuit elements, which came with the miniaturization, and the geometry of microstrip were compatible with use of new semiconductor diodes and transistors then becoming available. This fostered the trend to microwave integrated circuits. A complete line of miniature, very low reflection coaxial connectors in categories of circuit connections, interconnections, and cable fittings was produced—complete enough to allow a wide variety of components, devices, and systems to be developed. OSM, for Omni Spectra Miniature, was



by Dave McQuiddy

adopted as a trademark. Other manufacturers came in gradually, beginning in 1964. They largely conformed to the OSM interface and design—an example of voluntary cooperation which led in 1968 to a standard under MIL-C-39012 as the type SMA connector.

Dr. Bryant served on MTT-S AdCom from 1965 to 1970 and was President in 1970. He also served as Chairman of the Southeastern Michigan Section in 1970. He was MTT-S Distinguished Microwave Lecturer in 1986 to 1987 on the topic, "The First Century of Microwaves, 1876-1976." He headed the MTT-S Heinrich Hertz centennial celebration in 1988, produced an exhibit, a book titled *Heinrich Hertz: The Beginning of Microwaves*, and organized a special session of papers at the 1988 Symposium. He has been extensively engaged in documenting and writing on history of electromagnetics and microwaves, and more recently has been concentrating on history of radar including oral history interviews.

John and his wife, Dr. Barbara Everitt Bryant, have two daughters, a son, and eight grandchildren.



1996 Pioneer Award

Dr. Kaneyuki Kurokawa

The Pioneer Award recognizes contributions that have had a major impact on the field and have stood the test of time. The basis for 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. This award recognizes important technical contributions that have had a continuing impact on the practice of microwave engineering over the last several decades.

The recipient this year is Dr. Kaneyuki Kurokawa, a Life Fellow of IEEE. Dr. Kurokawa is well known for his many developments in microwave and optical components while working for Bell Laboratories and Fujitsu. He has been a Fujitsu Fellow since 1994.

The award consists of a plaque and an honorarium of \$2,000. His citation reads: "For pioneering developments on the general theory of microwave solid-state oscillators."

Kaneyuki Kurokawa was born on August 14, 1928, in Tokyo. He received the B.S. degree in electrical engineering in 1951 and the Ph.D. degree in 1958, both from the University of Tokyo. He developed the complete mode theory of microwave resonant cavities and derived for the first time their correct admittance. In 1957, he became Assistant Professor at the University of Tokyo. From 1959 to 1961, he worked on parametric amplifiers at Bell Laboratories, Murray Hill, on leave of absence from the University.

In 1963, he joined Bell Laboratories as a Member of Technical Staff and was later promoted to a supervisor. At Bell, he developed microwave balanced transistor amplifiers, millimeter wave path length modulators, the theory of microwave solid state oscillators, and initiated the development of optical fiber transmission systems. In his power wave paper, he presented the scattering parameter expressions of



the stability factor K , the maximum transducer gain, and the condition for input and output simultaneous matching of two port networks. These S-parameter expressions became standard textbook material. His other contributions include the extension of the variational principle to the propagation constant of waveguides with lossy walls, the actual noise measure, the quality factor of digital switching diodes, and the dynamics of high-field domains in bulk semiconductors. In 1975, after the delivery of a half dozen optical transmitter and receiver modules from Murray Hill to Holmdel for the Atlanta Experiment, Dr. Kurokawa left Bell to join Fujitsu.

At Fujitsu, he directed the efforts to develop optical fiber systems, array and simulation processors, Josephson junction IC 's, and silicon on insulator technology. From 1985 to 1989, he was in charge of Fujitsu's Atsugi Laboratories, where HEMT devices and distributed feedback lasers were successfully developed. During this period, in addition to his managerial duties, he personally clarified the head crash mechanism of hard-disks, which had plagued the hard-disk industry for almost a decade.

Dr. Kurokawa became Director of Fujitsu Laboratories in 1979, Managing Director in 1985 and Vice President in 1992. He has been Fujitsu Fellow since 1994. From 1986 to 1989, he also served as a Visiting Professor at the Institute of Industrial Science of the University of Tokyo. Dr. Kurokawa is the author of *An Introduction to the Theory of Microwave Circuits*, published by Academic Press in 1969. He is an IEEE

Fellow, a member of the Association of Computing Machinery, and the Institute of Electronics, Information and Communication Engineers. He received the Certificate of Appreciation from the International Solid-State Circuits Conference in 1965.

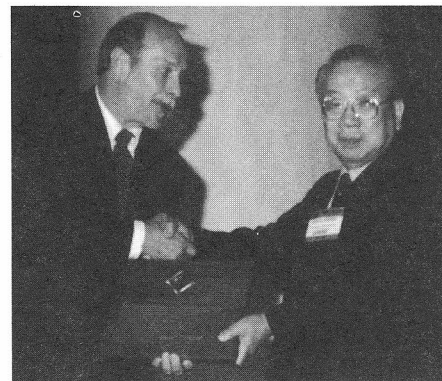
1996 Microwave Applications Award

Dr. Kikuo Wakino

The Microwave Application Award is presented aperiodically to individuals for an outstanding application of microwave theory and techniques. The eligibility requirements are creation of a new device, component or technique, or a novel use of components or both. The award consists of a plaque, certificate, and an honorarium of \$1,000.

Dr. Kikuo Wakino, the 1996 recipient, was responsible for the development of low-loss, temperature-stable, dielectric resonators at Murata Manufacturing Company. Dr. Wakino is an IEEE Fellow. His award citation reads: "For pioneering the development of low-loss, temperature-stable, ceramic dielectric resonators."

Dr. Kikuo Wakino was born August 30, 1925, in Kyoto Japan. He received the B.S. degree in Physics and Doctor of Engineering in Electrical Engineering, both from Osaka University in 1950 and 1980, respectively. He joined Murata Manufacturing Co. Ltd. in 1952 and engaged in the research and development of dielectric materials for ceramic capacitors. By the end



of 1952, he had established techniques for producing temperature compensated, high K ceramic capacitors.

In 1955, Dr. Wakino started research and development work on the Lead Zirconate Titanate (PZT) ceramics group for application to piezoelectric devices, such as ceramic IF filters, piezoelectric transducers, etc. In 1960, he established a mass production line for PZT ceramics. He started research and development work on dielectric ceramics for microwave application in 1971, and succeeded in demonstrating ultra low loss, temperature stable dielectric ceramics and dielectric resonators in 1973. He organized and conducted an R&D working group for dielectric resonators and microwave filters in 1973.

Dr. Wakino and his colleagues developed a miniaturized 4.5 GHz bandpass filter using the ring type TE_{01d} mode resonator (the first practical microwave filter using temperature stable dielectric resonators), and reported this work at the MTT-S Symposium in Palo Alto in 1975. In 1978, the local oscillator for a satellite broadcast receiver was developed by his group and produced for this class of applications. He lead a developmental project for a miniaturized filter using the coaxial type (TEM mode) dielectric resonator for 800 MHz band mobile telephone system in 1981. The development was extended to the monoblock type diplexer for portable telephone terminals in 1982. These filters have been designed and manufactured for most of the cellular mobile telephone systems. Filter circuit volume for these applications has been reduced from 270 cm³ in 1978 to 0.7 cm³ in 1994. He also conducted an extended program to develop high power filters for cellular base stations. Using low loss and linear (Zr,Sn)TiO₄ resonators, his group eliminated cross talk problems between neighboring channels and developed high power filters for cellular base stations. Several types of dielectric resonators and filters have been built and supplied as a key device in satellite transponders.

Dr. Wakino is the author and co-author of more than 30 papers in international journals and holds more than 20 patents. He has presented 7 invited talks at the symposiums and workshops of MTT-S and the American Ceramic Society. He is a Fellow of IEEE and of the American Ceramic Society. He received both the Blue Ribbon Medal and Fellow Award of The Science and Technology Agency of Japanese Government in 1988. He also received the Award of Technical Progress from Japanese Ceramic Society in 1978. He is a member of the American Physical Society, the Physical Society of Japan, and the American Ceramic Society.

1996 Microwave Prize

The Microwave Prize is awarded annually to the author or authors of a paper published in the *IEEE Transactions on Microwave Theory and Techniques*, or any other IEEE publication, that is judged to be the most significant contribution in the field of interest to the Society in the calendar year preceding that in which the selection is made.

The 1996 Microwave Prize is awarded to Heng-Ju Cheng, John F. Whitaker, Thomas M. Weller, and Linda P. B. Katehi for their paper entitled "Terahertz-Bandwidth Characteristics of Coplanar Lines on Low-Permittivity Substrates", *IEEE Transactions on Microwave Theory and Techniques*, vol. 42, no. 12, December 1994, pp. 2399-2406.

Dr. Heng-Ju Cheng

Heng-Ju Cheng (S'93-M'95) was born in Taiwan. He received the B.S. and M.S. degree from National Chiao-Tung University, Taiwan, and the Ph.D. degree in electrical engineering from the University of Michigan, Ann Arbor, MI, in 1985, 1987 and 1995, respectively.

On completion of military service in 1989, he joined the Industrial Technology Research Institute, Taiwan,

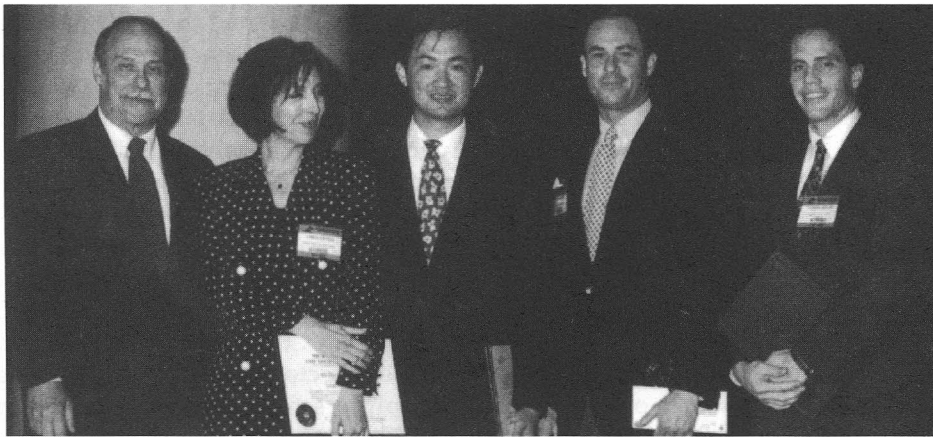
where he designed the CCD (charge-couple device) sensors for imaging applications. From 1990 to 1995, he was a research assistant at the University of Michigan where he did research on the characterization of high-speed electronics in the mm-wave region by optically-based sampling techniques. Since 1995, he has been an associate scientist in Picometrix Inc. where he is involved in the design of high-speed photodetectors and wideband analog amplifiers for fiber communication and high-speed instrumentation.

Mr. Cheng is the recipient of the Technology Achievement Award from the Industrial Technology Research Institute, Taiwan, in 1990, and the Rackham Pre-Doctoral Fellow from the University of Michigan in 1994.

John F. Whitaker

John F. Whitaker was born in Penn Yan, NY in 1959. He received the B.Sc. degree in Physics from Bucknell University in 1981, and the M.Sc. (1983) and Ph.D. (1988) degrees in Electrical Engineering from the University of Rochester. As an undergraduate research fellow, and later as a Laboratory for Laser Energetics Graduate Student Fellow, he investigated novel means of generation, propagation, and measurement of picosecond electrical signals. His thesis was on the distortion mechanisms affecting ultrafast electrical signals on broadband, open-boundary transmission lines, including those utilizing low and high temperature superconductors.

Upon completion of his dissertation he continued his research under a Postdoctoral Fellowship at the Laboratory for Laser Energetics at the University of Rochester, working in picosecond optical electronics. In 1988 he accepted a faculty position as an Assistant Research Scientist within the Department of Electrical Engineering and Computer Science at the University of Michigan. In 1991 he became coordinator of the Ultrafast Technology Area within the Center for Ultrafast Optical Science, when the research group with which he is affiliated was awarded



Left to right: John Wassel, Linda Katehi, Heng-Ju Cheng, John Whitaker, and Tom Weller.

this NSF Science and Technology Center. He continues in this role and as an Associate Research Scientist, and in 1995 he was named as a Visiting Associate Professor at the University of Savoie in France.

Involved in ultrafast electronics and optics for 15 years, Dr. Whitaker has had extensive experience in the application of electro-optic sampling and other optically-based measurement techniques for the characterization of electronic materials and devices. His research activities while at Michigan have included the development and measurement of terahertz-bandwidth transmission lines, the application of electro-optic-sampling-based network analysis for high-speed electronic device testing, internal-node testing of integrated circuits, subpicosecond electrical

Characterization of nonstoichiometric (and particularly low-temperature-epitaxially-grown) semiconductors, and the generation of terahertz radiation bursts and their applications for spectroscopy. He is currently interested in applying terahertz optoelectronic techniques to the development of subpicosecond streak cameras. Dr. Whitaker has authored or co-authored more than 70 papers and two book chapters, and presented 12 invited talks at major conferences and symposia. He has graduated three Ph.D. students and supervised research activities for seven others, and he serves as a consultant to industry on various topics involving fast pho-

toconductivity and guided pulse propagation.

Besides the IEEE Microwave Theory and Techniques Society, he is a member of the IEEE Lasers and Electrooptics Society and the American Physical Society.

Dr. Thomas M. Weller

Dr. Thomas M. Weller received a Ph.D. degree in electrical engineering from the University of Michigan in 1995. His graduate research focused on electromagnetic modeling of microwave circuits and planar antennas, and on the development of silicon-based micromachined components. His dissertation is entitled "Micromachined High Frequency Transmission Lines on Thin Dielectric Membranes." Currently, Dr. Weller is an Assistant Professor in the Department of Electrical Engineering at the University of South Florida. His teaching responsibilities include courses on electromagnetics theory and microwave/mm-wave theory and techniques. His research interests lie in these same areas, and extend to related uses of silicon micromachining. Dr. Weller is also very interested in engineering education.

Prior to joining USF, he was a Research Assistant at the University of Michigan (1990 to 1995), a Member of the Technical Staff at Hughes Aircraft Company (1988 to 1990), and a Research Assistant at the Environmental Research Institute of Michigan (1986 to

1988). Dr. Weller will serve as the vice-chairman of the IEEE MTT/AP/ED Florida West Coast Chapter in 1996.

Linda P. B. Katehi

Linda P. B. Katehi, Professor of EECS, received the B.S.E.E. degree from the National Technical University of Athens, Greece, in 1977 and the M.S.E.E. and Ph.D. degrees from the University of California, Los Angeles, in 1981 and 1984, respectively. In September 1984 she joined the faculty of the EECS Department of the University of Michigan, Ann Arbor. Since then she has been interested in the development and characterization (theoretical and experimental) of microwave and millimeter wave printed circuits, the computer-aided design of VLSI interconnects, the development and characterization of micromachined circuits for millimeter-wave and submillimeter-wave applications and the development of low-loss lines for terahertz-frequency applications. She has also been studying theoretically and experimentally various types of uniplanar radiating structures for hybrid monolithic and monolithic oscillator and mixer designs.

She has been awarded the IEEE AP-S W. P. King (Best Paper Award for a Young Engineer) in 1984, the IEEE AP-S S. A. Schelkunoff Award (Best Paper Award) in 1985, the NSF Presidential Young Investigator Award and an URSI Young Scientist Fellowship in 1987, the Humboldt Research Award and The University of Michigan Faculty Recognition Award in 1994. She is a Fellow of IEEE, and a member of IEEE AP-S, MTT-S, Sigma XI, Hybrid Microelectronics, URSI Commission D and a member of AP-S AdCom from 1992 to 1995. Also, Prof. Katehi is an Associate Editor for the IEEE Transactions f AP-S and MTT-S.

Prof. Katehi has graduated 11 Ph.D. students and is presently supervising 15 Ph.D. graduate students. She has been the author and co-author of more than 220 papers published in refereed journals and symposia proceedings.

1996 Distinguished Educator Award

Dr. George I. Haddad

This Award was inspired by the untimely death of Professor F. J. Rosenbaum (1937-1992), an outstanding teacher of microwave science and a dedicated MTT-S AdCom member/contributor. The award is given to a distinguished educator in the field of microwave engineering and science who exemplifies the special human qualities of the late Fred J. Rosenbaum. Fred considered teaching a high calling and demonstrated his dedication to MTT-S through tireless service.

The award consists of a plaque and an honorarium of \$1,000. The awardee must be a distinguished educator, recognized, in general, by an academic career coupled to many years of service to the microwave profession. The effectiveness of the educator should be supported by a list of graduates in the field of microwave science who have become recognized in the field. The candidate shall also have an outstanding record of research contributions documented in archival publications. The candidate shall also have a record of many years of service to MTT-S.

The recipient of this year's award is Dr. George I. Haddad of the University of Michigan. The citation reads: "For leadership in teaching, research and in the microwave profession."

George I. Haddad received the B.S.E., M.S.E., and Ph.D. degrees in electrical engineering from The University of Michigan. In 1958 he joined the Electron Physics Laboratory, where he was engaged in research on masers, parametric amplifiers, detectors, and electron-beam devices. From 1960 to 1969 he served successively as Instructor, Assistant Professor, Associate Professor, and Professor in the Electrical Engineering Department. He served as Director of the Electron Physics Laboratory from 1968 to 1975. From 1975 to 1986 Dr. Haddad served as Chairman



of the Department of Electrical Engineering and Computer Science. From 1987 to 1990 he was Director of both the Solid-State Electronics Laboratory and the Center for High-Frequency Microelectronics. He is currently the Robert J. Hiller Professor and Chairman of the Electrical Engineering and Computer Science Department and Director of the Center for High Frequency Microelectronics. His current research areas are microwave and millimeter-wave solid-state devices and monolithic integrated circuits, microwave-optical interactions and optoelectronic devices and integrated circuits.

Dr. Haddad received the 1970 Curtis W. McGraw Research Award of the American Society for Engineering Education for outstanding achievements by an engineering teacher, The College of Engineering Excellence in Research Award (1985), The Distinguished Faculty Achievement Award (1986) of The University of Michigan, and the S.S. Attwood Award of the College of Engineering for Outstanding Contributions to Engineering Education, Research and Administration. He is a member of Eta Kappa Nu, Sigma Xi, Phi Kappa Phi, Tau Beta Pi, the American Society for Engineering Education, and the American Physical Society. He is a Fellow of the IEEE and a member of the National Academy of Engineering.

Dr. Haddad has supervised more than 50 Ph.D. graduates, many of whom are presently leaders in the microwave community.

Professor Haddad was a member of the steering committee and chairman of the technical program committee for the 1968 International Microwave Symposium. He was a member of the Administrative Committee from 1968 to 1976 and editor of the *MTT Transactions* from 1968 to 1971. He received the MTT-S Distinguished Service Award in 1977.

1996 Distinguished Service Award

Dr. Rudolf E. Henning

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's honoree is Dr. Rudolf E. Henning who has served our Society for over thirty years. He has served as Chairman of MTT-S AdCom (the title is now President) and as Chairman or Co-Chairman of three National or International Microwave Symposia. He is an IEEE Fellow.

His citation reads: "For distinguished service to the profession, the IEEE and the Microwave Theory and Techniques Society."

Born in Hamburg, Germany, Dr. Henning received B.S.E.E., M.S.E.E., and D.Eng.Sc. degrees in 1943, 1947 and 1954, respectively, from Columbia University. In 1944 and 1945 he served in the U.S. Army.

For the last 25 years he has been with the University of South Florida in



Dr. Lawrence Dunleavy accepting for Rudolf Henning.

Tampa, Florida, where he is currently a Distinguished Service Professor. Other positions there included Associate Dean and Department Chairman. In recent years, he concentrated on developing a strong USF microwave/millimeter-wave capability providing R&D support to industry in such areas as experimentally validated computer-aided circuit design and device modeling. The first half of his engineering career was spent in industry with the Sperry Rand Corporation, where he headed the engineering staff of the Sperry Microwave Electronics Company in Clearwater, Florida, for 13 years. As its Chief Engineer, he was responsible for applied research, product development and production support operations covering a wide range of microwave system, equipment and component products (e.g. electromagnetic surveillance systems, microwave radiometric systems, radar performance analyzers,

active and passive components, both ferrite and semiconductor, microwave integrated circuits).

Throughout his career Dr. Henning has been professionally active. He is a Life Fellow of the IEEE who joined the IRE and the AIEE in the 1940's and MTT-S in 1954. He was a member of MTT-S AdCom from 1966 to 1971 and its chair in 1968. He was chairman of MTT-S's 1965 National and 1979 International Microwave Symposia and its co-chairman in 1995. On the local level, he chaired the Florida West Chapter of the MTT-S in 1983/84 and 1991/93. Current MTT-S activities include member of its Past President's Council, of its Awards Committee and of Technical Committee #6 on Microwave and Millimeterwave Integrated Circuits.

Other IEEE activities include chairing the IRE/IEEE's Florida West

Coast Section in 1962 and member of its executive committee since 1980, SOUTHEASTCON 1987 Technical Program Chairman, 1985 Instrumentation and Measurement Technology Conference Associate Chairman, and an officer of several other IEEE conferences. Non-IEEE professional service involvement includes the Florida Engineering Society, where he focuses on education and outreach to pre-college students. His awards include the Citation of Honor by IEEE's United States Activities Board (1992), IEEE's Centennial Medal (1984), MTT-S/ARFTG's Automated Measurements Career Award (1986), in addition to many regional and local recognitions. He represented IEEE as an ABET Program Evaluator and is a member of Tau Beta Pi, and Sigma Xi, the American Society of Engineering Education (ASEE) and a registered Professional Engineer in Florida.

1996 IEEE Fellow Awards



Adalbert Beyer

Ten MTT-S members who were evaluated by our Society were elected to the grade of Fellow. The grade of Fellow is conferred in recognition of unusual professional distinction. It is awarded at the initiative of the IEEE Board of Directors after a rigorous nomination and evaluation process. Individuals receiving this distinction have demonstrated extraordinary contributions to one or more fields of electrical engineering, electronics, computer engineering and related sciences. This grade is not conferred automatically on nomination; only a fraction of



Radoslaw Biernacki

those nominated are honored by elevation to the grade of IEEE Fellow.

Professor Adalbert Beyer

For the development of numerical field analysis techniques and their application to the design of new reciprocal and nonreciprocal millimeterwave finline components.

Dr. Radoslaw M. Biernacki

For contributions to the theory and implementation of microwave and



Chun-Hsiung Chen

analog CAD technology.

Professor Hans H. Brand

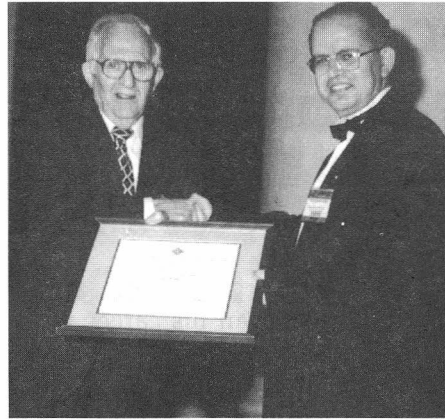
For contributions to microwave networks, for their applications to real-time imaging systems and for the extension of microwave technology into the terahertz region.

Professor Chun-Hsiung Chen

For contributions to the development of variational methods and other numerical methods applied to copla-



James Crescenzi



Victor Hanna



Mike Golio



Paolo Lampariello



Christopher Snowden

nar waveguides and various other structures.

Dr. E. James Crescenzi, Jr.

For contributions to the development of microwave amplifiers, integrated circuit technology, and miniature receivers for defense applications.

Dr. Victor Fouad Hanna

For contributions to the development of advanced numerical techniques for analysis and modeling of passive microwave and millimeter-wave circuits.

Dr. J. Mike Golio

For contributions to the characterization, parameter extraction, and modeling of microwave transistors.

Professor Paolo Lampariello

For pioneering investigations of leakage effects on open waveguides

with application to a new class of millimeterwave antenna.

Professor Christopher M. Snowden

For pioneering work on the development and application of physical models to the design of microwave and millimeter-wave semiconductor devices and circuits.

Dr. Charles T. Stelzried

For pioneering development of low noise ground antenna systems used for deep space tracking.

Other Fellow Awards

The following seven new Fellows are also MTT-S members but were evaluated by other IEEE Societies.

Dr. Donald G. Bodnar

For contributions to the understanding of the polarization character-

istics of reflector and phased array antennas, and for techniques for measuring polarization characteristics of antennas.

Dr. Richard B. Dyott

For developments in optical fibers and optical fiber components.

Professor Nader Engheta

For contributions to the electromagnetic theory of complex media.

Dr. Andrzej W. Kraszewski

For contributions to the science of microwave measurements and the development of techniques for measuring water content in moist substances and permittivity, density, and mass of particulate dielectric materials.

Stanley J. Kubina

For leadership in computational electromagnetics for EMC analysis and design and in electrical engineering education.

Professor Tetsuo Nishi

For contributions to linear and nonlinear circuit theory.

Professor John L. Volakis

For contributions to computational electromagnetics, including hybrid finite element and high frequency methods.

Theodore S. Saad to Receive IEEE Richard M. Emberson Award

Theodore S. Saad, retired president and chairman of the board of Sage Laboratories, Inc., was honored by the Institute of Electrical and Electronics Engineers (IEEE), the world's largest technical professional society, at its annual Honors Ceremony on 22 June in Montreal.

Mr. Saad received the IEEE Richard M. Emberson award for his 40 years of distinguished service and outstanding leadership in advancing the technical objectives of the IEEE at numerous levels of Society Section and Institute activities.

He co-founded Sage Laboratories in 1955 and is the co-founder of two technical publishing companies. He was also the creator and editor of the *Microwave Engineer's Handbook*. As a working engineer, he developed many

microwave components and received 17 patents.

Mr. Saad began his career with Sylvania after graduating from Massachusetts Institute of Technology with a bachelor's degree in electrical engineering in 1941. He later worked for the MIT Radiation Laboratory. In 1945, he joined the Submarine Signal Company, and in 1949 helped to form Microwave Development Laboratories, Inc., where he was vice president and chief engineer.

Mr. Saad was one of the first members of the IEEE Microwave Theory and Techniques (MTT) Society where he has been editor of the Society's *Transactions* and lectured throughout the United States. As the historian of the MTTJ he was also responsible for the creation of the MTT Historical

Collection. He was elected an Honorary Life Member of the MTT in 1974 and received the Society's first Distinguished Service Award in 1983 and the Society Career Award in 1992. In 1984, he received the IEEE Centennial Medal.

He is a Fellow of the IEEE and the American Association for the Advancement of Science. He was also an advisor to the National Bureau of Standards' Radio Standards Engineering Division from 1967-71.

The IEEE has nearly 315,000 members in 150 countries. The Institute is leading authority on areas ranging from aerospace, computers and telecommunications to biomedical engineering, electric power and consumer electronics.

Recent Developments in Power Electronics— Selected Readings

The Educational Activities Board of the Institute of Electrical and Electronics Engineers, Inc., announces the publication of *Recent Developments in Power Electronics—Selected Readings*, written by Muhammad Harunur Rashid, Ph.D, P.E., and C. Eng., Professor of Electrical Engineering, Purdue University at Fort Wayne, Indiana.

Recent Developments in Power Electronics—Selected Readings is a collection of recent articles published in IEEE transactions and conference proceedings. The papers in this book deal with the in-depth analysis, design, and applications of power electronic circuits and systems. This book

will provide information on the characteristics of state-of-the-art power semiconductor devices; principles of operation of static power conversion; pulse-width modulation (PWM) techniques for voltage and frequency control; thyristor commutation techniques; relative advantages and disadvantages of various conversion topologies; and analysis and design considerations of power electronic circuits.

To order the course reader, use product number HL5728 (ISBN 0-7803-2311-4). The price is \$39.95 for IEEE members, and \$49.95 list. The book may be ordered from

the IEEE, 445 Hoes Lane, PO Box 1331, Piscataway, New Jersey 08855-1331. Make checks payable to IEEE. For single sales call (800) 678-IEEE; for company or institutional sales, call (800) 701-IEEE; or fax (908) 981-9667.

Please add the following shipping and handling charges: for orders totaling \$1.00 to \$50.00, add \$4.00; \$50.01 to \$75.00, add \$5.00; \$75.01 to \$100.00, add \$6.00; \$100.01 to \$200.00, add \$8.00; over \$200.00, add \$15.00. Call for overseas Air Freight charges. Credit card orders (MasterCard, Visa, American Express, and Diner's Club) are accepted.

1996 MTT-S Student Paper Competition —An Important Investment in Our Society's Future

by G. Rick Branner and Robert C. Owens
Co-Chairmen

Introduction

During the past several years, the IEEE MTT-S International Microwave Symposium has sponsored a student paper competition for participants from universities throughout the world. The fundamental objective of this competition has been to provide a forum to recognize and reward research which has been conducted primarily by an individual student in the field of Microwave Engineering. It is well understood that the future of our society rests on our ability to attract promising young students who are extremely enthusiastic about our profession and its potential. For the first time in the present format, the competition was held simultaneously with regular symposium sessions. It is a firm conviction of the architects of this competition that a separate judging

session should be conducted during the daytime sessions of the International Symposium.

To ensure the quality of student competition papers was comparable with that of other Symposium papers, the competition papers were submitted directly to LRW Associates for consideration as regular symposium papers and evaluated as such by the Technical Program Committee. However, each contest paper was clearly designated as a "Student Paper" to expedite the distribution of the appropriate contest information sent to each student author subsequent to the TPC review.

All student authors whose papers were accepted for a regular Symposium session (oral or open forum) were invited to participate in the com-

petition which was held in two contiguous sessions on Wednesday morning and afternoon of the Symposium. This procedure permitted all contest submissions to be evaluated on an equal basis, independent of how they were presented in their assigned regular Symposium

sessions. The contest results were announced and prizes and certificates were presented at the annual MTT-S Awards Banquet on Wednesday evening. In a manner similar to the previous Symposium, prizes donated by the Hewlett-Packard Company were presented to the winners of this year's contest.

Contest Submissions

There were 43 student papers submitted to the Technical Program Committee for the 1996 Symposium. Although these papers were labeled explicitly as student contest papers, they were evaluated by the Technical Program Committee without any special consideration of their status as such. Of these, 24 were selected by the TPC for presentation in a regular session, and all authors of the accepted student papers were invited by letter to present their work at the special contest session. Of the accepted papers, 23 students accepted the invitation to participate and all made presentations at the contest judging session. Table 1 lists statistics for student paper submissions, accepted papers and contest participants for the 1991-1996 Symposium years.

As can be seen from the table, there was exceptional response to this year's symposium, with interest in-



Table 1. Numbers of Student Papers Submitted, Papers Accepted for Presentation, and Contest Participants for Recent Symposia.

Year	Location	Papers Submitted	Papers Accepted	Contest Participants
1991	Boston	32	8	7
1992	Albuquerque	30	15	12
1993	Atlanta	31	10	9
1994	San Diego	25	14	12
1995	Orlando	20	11	11
1996	San Francisco	43	24	23

creased over 100 percent from the previous year.

Procedure

The letter sent to all student authors whose papers were accepted for the Symposium provided information about the time, location and format of the contest session, pointing out explicitly that their participation would require an additional presentation of their work at the session. Each student was asked to respond directly to the contest chairman whether or not he or she could participate.

Potential judges for the student paper contest were contacted at the Technical Program Committee meeting in January 1996. Sign-up sheets were placed at each table and an announcement was made during the meeting. Approximately 10 volunteers were identified, including two previous student paper contest chairmen. One month before the Symposium, a letter was sent to each volunteer requesting confirmation of their availability to serve as a contest judge. These letters were followed up in several cases by electronic mail and/or phone calls. All of the original judges eventually participated in the contest session. Previous contest sessions had involved either five (1991, 1993, 1994, 1995) or seven (1992) judges. A minimum of four to five judges is probably required to ensure that the overall evaluation of the contest presentations is uniform and fair, and it is believed that as many as 10 judges would be advisable. This year, the judges, to whom we would like to express our

appreciation, were:

- Michael H. Thursby
- John M. Owens
- Chuck Holmes
- Peter Sturzu
- Robert Weigel
- Joy Lasker
- Stoyan I. Ganchev
- James F. Harvey
- Laurence P. Dunleavy
- Alphonse Riddle

Cash prizes were provided by the MTT-S for first, second and third place contestants, in the amounts of \$500, \$300 and \$200, respectively. As in the previous year we solicited donations of electronic equipment from the Hewlett-Packard Company. The prizes provided by HP were as follows:

- First Prize: One HP 48G Calculator
- Second Prize: Two HP 38G Calculators
- Third Prize: Four HP 32S Calculators

A contribution of \$100 was also provided by the Watkins-Johnson Company. As seen by the numbers, there were one first, two second and four third place prizes awarded this year. The total list price for these three items (as of 1996) was \$565.00. Acknowledgments of the prize donations were listed in the description of the student paper contest in the Symposium program, and in the program for the Awards Banquet.

Each student participating in the contest received two tickets to the Awards Banquet on Wednesday evening. These were provided to the contest chairman in advance and

given to the students prior to the banquet.

Due to exceptional response, two contest sessions were necessary. They were held on Wednesday at 10:30 to 12:30 and 1:30 to 3:30 p.m. at the Microwave symposium in Moscone Center. The time and location of the sessions were included in the one-page schedule of events in the Symposium program book. The room in which the session was held seated approximately 200 people, and approximately 100 people attended the sessions.

Contest

Based on this success and improved attendance at the session, we would like to reiterate that the Student Paper Presentations should be a regular session held during the daytime with the other sessions of the conference. We believe this will increase the attendance beyond the students, their advisors, and a few interested people. Evening sessions have been shown to be hampered by other conflicting IMS activities as well as non-conference related activities. The students would appreciate a larger audience, and, as this is an excellent session with an emphasis on presentation as well as technical content, all symposium attendees should have a more convenient opportunity to attend.

Each contestant was permitted ten minutes for his or her oral presentation. Attendance at the contest session was open to all who had registered for the Symposium, including advisors of the student contestants. (At the 1992 meeting in Albuquerque, advisors were not permitted to attend the contest session.) Because of the large number of contestants involved (23), it was necessary to adhere as closely as possible to the time limits for each presentation. The entire session lasted four hours, ending at 3:30 p.m. All papers were presented within the specified time frame.

The presentations were assessed on the basis of technical content (15



L-R: G. R. Branner, R. C. Owens, John Wassel, and Sanjay Raman.

points), clarity of presentation (10 points), and visuals (5 points), utilizing a standard evaluation form. The judges met immediately after the second session and determined the order of finish of the first three places based on total points scored. The contest judges unanimously indicated how impressed they were by the overall quality of the student papers in this year's contest. Additionally, they highly recommended that evaluation of the student papers by the TPC as regular Symposium papers be continued.

As mentioned above, all student contestants were provided tickets to the annual MTT-S Awards Banquet. All students were encouraged to sit at two tables specifically designated for that purpose. The winners were notified at the beginning of the banquet in order to expedite the awards process, and these individuals were called to the podium in groups (third place, second and first) and awarded certificates by John Wassel, the society president. The following students were winners in this year's competition:

First Place

Sanjay Raman, University of Michigan, Ann Arbor, MI: *A 94 GHz Uniplanar Subharmonic Mixer*.

Second Place

A. Alexanian, University of California, Santa Barbara, CA: *Quasi-Optical Traveling-Wave Amplifiers*; L.

Mullen, Drexel University, Philadelphia, PA: *Full Scale Hybrid Lidar-Radar System*,

Third Place

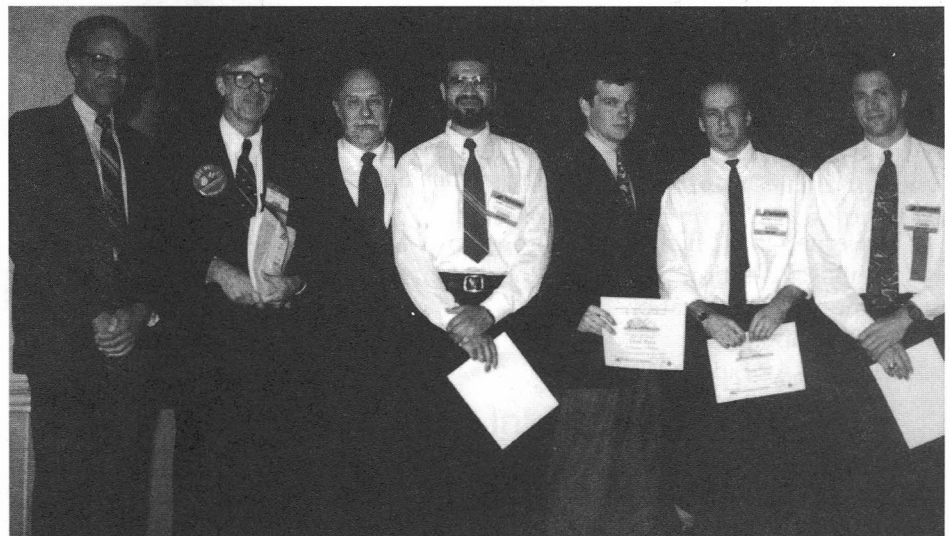
A. Adams, University of Leeds, Leeds, UK: *Method of Moments and Time Domain Analyses of Wave-guide-based Hybrid Multiple Device Oscillators*; T. J. Ellis, University of Michigan, Ann Arbor, MI: *MM-Wave Tapered Slot Antennas on Micromachined Photonic Bandgap Dielectrics*; H. M. Fahmy, Univer-

sity of Toronto, Toronto, Ontario, Canada: *A Discretized Integral Equation Approach for Solving Microstrip Circuits Embedded in Inhomogeneous Waveguides*; T. Wilke, University of Wisconsin, Madison, WI: *Novel Micromachined LIGA Microstrip Transmission Lines and Filters*.

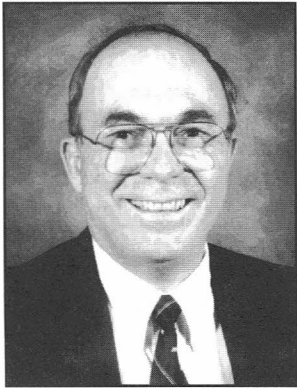
In conclusion, the 1996 Student Paper Contest was an encouragement to students and other society members. We hope the enthusiasm generated this year can be continued, and the best and brightest of our universities will be attracted to build the next generation of the MTT Society.



L-R: G. R. Branner, R. C. Owens, John Wassel, A. Alexanian, and L. Mullen.



L-R: G. R. Branner, R. C. Owens, John Wassel, A. Adams, T. J. Ellis, H. M. Fahmy, and T. Wilke.



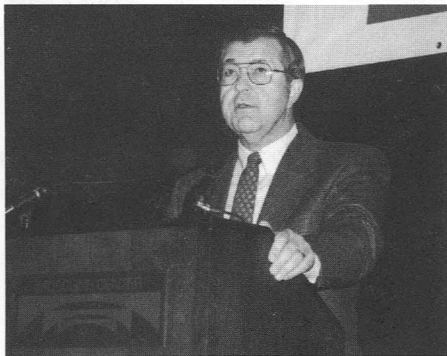
E. James Crescenzi, Jr.

**Thanks for Making
the Symposium a
Record-Breaking
Success!**



by Joseph Barrera

1996 IEEE/MTT-S International Microwave Symposium/Exhibition



Vice Chairman Joseph Barrera Opens the Plenary Session.

The news is surely out by now, but in case you hadn't heard, the 1996 Microwave Week registration was 9,957, and it set a clear record in attendance. This unadjusted total number (it's consistent with the way registra-

tion has been reported over the years) has a small amount of duplication built in. It is safe to report that nine thousand individuals attended an event of the 1996 Microwave Week in San Francisco. Specific registration statistics are provided in Table 1.

To our minds there were at least six outstanding successes at the 1996 International Microwave Symposium and MTT-S Microwave Week:

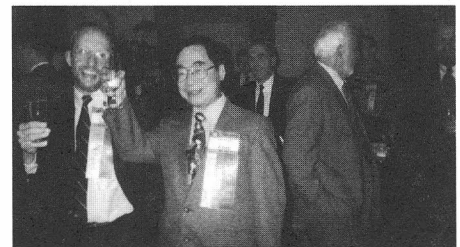
Quality and Quantity of Technical Papers

461 papers were presented (55% of those submitted) at the International Microwave Symposium, and there is a

consensus that the papers were noteworthy for excellence and relevance. Non-defense markets in which most of our membership is currently employed were very well represented.

Record Workshop Participation

The participation in workshops at 2496 was up 65% over last year (which



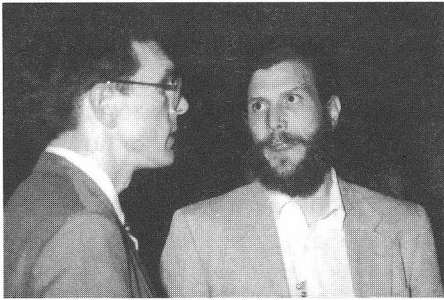
TPC Co-Chairman Derry Hornbuckle and ARFTG Chairman Ken Wong, and associates.



CD-ROM Digest Editor Roger Pollard, Registration Chairman Vernon Dunn, and Exhibition Manager Harlan Howe, relaxing after a very busy week.

Table 1. Registration Statistics

International Microwave Symposium	2,299
Full Registration	1,749
One-Day Registration	550
Workshops	
People Attending Workshops	^a 1,400
Workshops Attended	2,496
Panel Sessions	1,289
Exhibition	7,029
MMWMC	585
ARFTG	163
Total Registration (all events)	9,957



Convention Center Arrangements Chairman Dan Swanson and Interactive Forum organizer Alfie Riddle.



MTT-S President John Wassel conferring with 1995 IEEE President J. Thomas Caine.

had broken all previous records)! You are clearly intent upon learning new fields, and you show a strong preference for the informal workshop format. There were about 1400 workshop attendees. Each person attended 1.8 workshops on average!

Record Shattering Exhibition Participation

The exhibition attendance was truly record-breaking at 7,029 people! Attendance from California was particularly strong (over 50%), which proves why San Francisco is so popular for Exhibitors.

Superb Digest and CD-ROM

The digest and CD-ROM were comprehensive and very professionally edited. The CD-ROM is the first ever produced by the MTT-Society. The hard-copy 3-volume digest set a page and (unfortunately) weight record at 14 pounds. Both digests will serve as valued and often-used references for our microwave community.

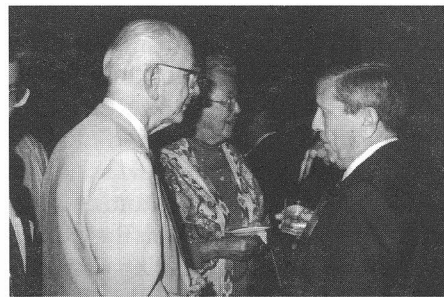
Steering Committee Preparations Paid Off

The dedication of your '96 IMS Steering Committee and the MMWMC and ARFTG Steering Committees was apparent. The events were very well planned, and nearly all activities were executed smoothly and with minimum inconvenience in spite of the record number of participants.

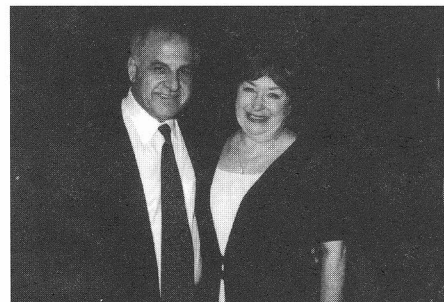
People Love San Francisco!

San Francisco once again proved to be a favored location for our Microwave Week. The Moscone Convention Center is a world-class facility; the weather cooperated, and the city generally lived up to its fine reputation as a preferred convention and/or vacation destination.

The Microwave Week experience began for most technical participants with a workshop! Arrangements for the record 26 workshops were lead by Special Sessions Chairman Paul Khanna and workshop organizers Chuck Holmes and Edmar Camargo.



George and Jean Matthaei with Seymour Cohn.



Distinguished Educator Award Recipient George Haddad and Mary Haddad.

190 speakers contributed their expertise to making these a highly valued aspect of Microwave Week. The growth in workshop attendance (57% over record-setting Orlando) is sending a loud and clear message regarding your preferences. You clearly see workshops as an essential way to expand skills, and a welcome, if not preferred opportunity for informal interaction.

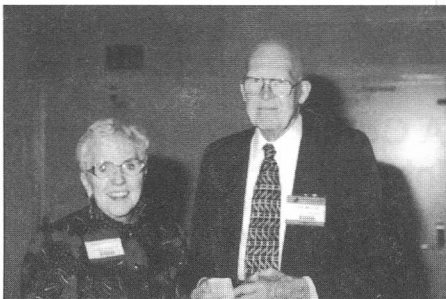
The International Microwave Symposium Plenary Session, chaired by Joe Barrera, featured an overview of society status and an awards presentation by 1996 MTT-Society President John Wassel, as well as the two invited Plenary speakers. US Federal Communications Commission (FCC) Chairman Reed Hundt addressed the pro-active role of the US regulatory environment in fostering increased competition amongst service providers while also achieving flexibility to encourage technical innovation. Chairman Hundt's message was conveyed by video due to a requirement that he testify that day before the US Congress. FCC Scientist Michael Marcus represented Chairman Hundt at the session, at which he made some brief comments and fielded several questions about regulatory policy. The second Plenary Session speaker, Edward F. Tuck, vice chairman of Teledesic Corp. and partner of Kinship Partners (a California venture management company), spoke on "The Electronic Social Fabric," Mr. Tuck claimed "Microwave is the most important transmission medium through which those changes will be achieved, and represents an immense, immediate commercial opportunity". This upbeat message was appropriate as a prelude to the record-breaking attendance at the symposium and the exhibits.

A Comprehensive, High-Interest Technical Program

Our Technical Program Committee Co-Chairmen Derry Hornbuckle and Jerry Fiedziuszek and all TPC

members certainly can derive great satisfaction from the tremendous success of the technical program. It was particularly important to the future of the IMS that our traditional system of issuing an open Call-for-Papers (enhanced in clarity by this year's committee) and conducting a comprehensive and fair paper review process has again resulted in very high quality, highly relevant contributions. The topics of this year's sessions provided an accurate mirroring of the activities of the most creative engineers in our industry. As our membership has shifted to predominantly commercial activities, with the most popular field being telecommunications and wireless, the content of the technical papers has followed these changes. Defense funded research was still well represented, but it can be claimed that the 1996 International Microwave Symposium was the first to fully reflect the dominant shift towards commercial work.

One of the more difficult tasks for the Technical Program Committee was to decide how to accommodate the extra papers - increase the number of parallel sessions or extend the symposium day to provide more time for paper presentation. Sessions were lengthened from the normal 90 minutes to 110 minutes (start earlier and run longer!), so that the number of parallel sessions could be maintained at five. In spite of our concerns, this change elicited minimal comment from those attending the sessions. Apparently, microwave engineers are accustomed to working long hours! By the way, contrary to one magazine report, the lunch period was not shortened (it was 1 $\frac{1}{2}$ hours, just like in Orlando).



Microwave Career Award Recipient John H. Bryant and Barbara Everitt Bryant.



Student Paper Session Organizers Professors Rick Branner and Bob Owens.

From a Steering Committee viewpoint, it was particularly rewarding to observe the acceptance and popularity of the Interactive Forum Sessions, in which 135 papers were presented. Interactive Forum organizers Alf Riddle and Cindy Yuen, as well as Convention Center Arrangements Chairman Dan Swanson and Catering specialist Kumiko Christopher clearly succeeded in making the physical setting as comfortable as possible. Panel sessions were well attended (1289 for five sessions), and the single evening "rump" session had 267 participants. Rump session organizer Bert Berson reported that the wine and discussions were appreciated by all. Speakers at technical sessions, workshops, panel sessions, and the Microwave Application and Product Seminars, as well as the organizers and Steering Committee members received a 1996 IMS plaque in appreciation for their contributions. These were planned, designed, and distributed by Alf Riddle and Guo-Chun Liang. Several of us will long remember the Saturday afternoon and early evening on the exhibition floor, where the Steering Committee equivalent of an assembly line attached nameplates to the plaques and separated them to correspond to the IMS sessions to facilitate later distribution. The plaque sorting system was indeed unique - the source of some humor that long afternoon!

The Publishing Challenge

The event most awaited by any Steering Committee is the arrival of the digests at the convention center.

This year, editor Richard Ranson was comfortably on schedule and the digests arrived with little suspense.

That was not the case, however, for CD-ROM Editor Roger Pollard. The CD-ROM was a new venture for the MTT-Society, and the preparatory effort was immense and not without considerable risk - virtually all of the procedures for submitting manuscripts had to be re-invented by Roger to accommodate current technology (The old "Instructions to Authors" assumed manuscript preparation on a typewriter!). The CD-ROMs didn't actually arrive until Saturday afternoon, and this definitely did create an air of suspense. The quality of both the hardcover digest and the electronic version is truly outstanding, and both editors can take great pride in their very significant contributions. By the way, Editors Richard Ranson and Roger Pollard report that the cooperation of the authors in submitting their manuscripts in electronic form was very good (82%), which certainly contributed to the quality of the final product. Our editors also received very strong professional support from Larry and Margaret Whicker of LRW Associates who serve as the coordinating center for manuscripts, provide administrative support at the Technical Program Committee Meeting, and who directly interface with the digest publishers.

Another major publishing activity associated with the Symposium is that of editing the special December issue of the MTT-S Transactions on Microwave Theory and Techniques. Jerry

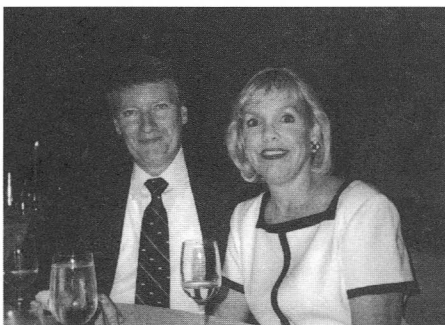


Local Arrangements Awards Banquet organizer Steve Kenney and Mrs. Cindy Kenney.

Fiedziuszko is this year's Editor, and he reports that over 500 separate paper reviews were solicited in support of this work. We all look forward to the result of this exhaustive and deliberative effort.

The Most Successful Exhibition Ever!

The Exhibition (the largest in the history of this event at 519 revenue booth spaces and 369 participating companies) was located in the Northwing of the ultra-modern Moscone Center in San Francisco. Upon registering, attendees proceeded down a large escalator that provided a dramatic entrance to the exhibition and technical session facilities, which are located in very close proximity - quite possibly the smallest separation ever. With over 7,000 people attending the Exhibition, there was no doubt that our industry is once again in a welcome period of growth and renewed optimism. Managing such a large exhibition is a very major undertaking, and it is contracted by the MTT-Society to Horizon House, publishers of the Microwave Journal. Exhibition managers Harlan Howe and Howard Ellowitz and the Horizon House staff work throughout the year signing up exhibiting companies and organizing the Exhibition. Horizon House also provides (via sub-contract) the registration services for Microwave Week. From the Steering Committee perspective, Horizon House is a very welcome and strongly contributing member of the symposium/exhibition team.



The Sign Team - Local Arrangements Contributors Scott Wetenkamp and Mrs. Jean Wetenkamp.

A highlighted new feature offered for the first time this year was the Microwave Applications and Products Seminars (Micro-APS '96) located on the Exhibition floor. There were 50 applications seminars in two parallel sessions, presented by engineers of the exhibiting companies, and coordinated by Technical Chair Martin Grace. One of the lessons of this new venture was that it is literally impossible to have too much publicity or too many signs for a new activity. The attendance was frankly lower on average than we expected it to be, although the assessment of those who did attend the sessions was overwhelmingly positive. Starting a new venture such as micro-APS '96 is a real challenge, and we are particularly indebted to Barry Bakner and Gary Koker of our Industry Relations Committee for up-front organizational work.

Publicity - Key to Symposium Success

Although the delivery of the digests is the activity with most anxiety for the Steering Committee, there is nothing that has more influence on the eventual success of the event than does the Symposium Program. In many regards, once the Program is published, the remaining activity is simply a matter of making it happen. This year's Publicity Chairman, John Barr, contributed in so many ways, it is difficult to give his work appropriate credit. John suggested our theme "Bridging the Spectrum" and led the creation of the logo artwork. He managed the collection and organization of information for the massive 64-page program, and, in a cooperative effort with Horizon House, created the several new features of the program layout and organization. Although there were numerous advertisements and articles about the '96 symposium, the program was considered our most influential tool for publicity. The full program was distributed to all MTT-Society members and recent Symposium attendees. Overseas (outside North America) mailing costs are very high for the full program, but it was



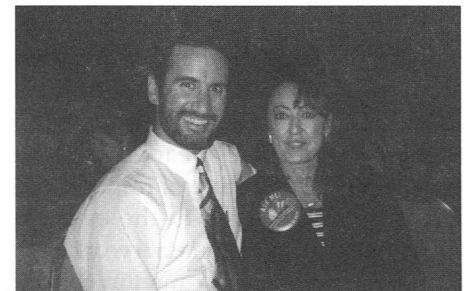
Mrs. Jane Brockman with Mrs. Rahat Khanna and Special Sessions Chairman Paul Khanna.

decided we should put service to the members above budget considerations.

A strong contributing factor to the record attendance at the Exhibition in particular was the superb work by our co-chairmen of the newly formed Industry Participation Committee, Gary Koker and Barry Bakner. Their publicity program for the Northern California area was particularly comprehensive. Barry Bakner is a principal in the local sales representation firm of Disman-Bakner, and he used his marketing expertise to be sure that every



Industry Participation Committee Co-Chairmen Gary Koker and Barry Bakner.



Chuck Christopher and Local Arrangements Catering organizer Kumiko Christopher.



Mrs. Cille Emery and Finance Chairman Frank Emery with Fort Worth IMS Chairman Karl Varian.

Northern California microwave engineer was informed several times about Microwave Week - often by personal contact. Since over 50% of the 7,000+ who attended the Exhibition were from California, it is clear that the Industry Participation Committee had a much appreciated impact.

Registration and Local Arrangements for 9,000+ People Was a Real Challenge!

As the Microwave Week activities grew and attendance broke records, the work of the registration and local arrangements functions increased proportionally. Although our registration function is managed by Horizon House and subcontracted to Convention Data Services, the workload of Registration Chairman Vernon Dunn was extremely heavy. Many registrants who experienced an anomaly in the registration process or who required some special consideration interfaced with Vernon. His patience, courtesy, and stamina were greatly appreciated by all. Our Local Arrangements Co-Chairmen, George Vendelin and Dan Swanson, and their respective teams performed admirably in their preparation for the many events. We departed from past organizations by forming a Local Arrangements - Convention Center Committee, headed by Dan Swanson. This splitting of responsibilities was in response to the ever increasing local arrangements workload. Dan Swanson was our man in control of all meeting room facilities and audio-visual at the Moscone Convention Center. This involved extensive prepara-

tion and interface with convention services, and many hours on the job during Microwave Week. One individual, our Catering Services Administrator Kumiko Christopher, interfaced expertly with all of the Local Arrangements Committee. Kumiko served as the coordinator of all "event order forms" that documented every meeting

that required catering (over 150 for the week!).

The person whose work was most visible at the Symposium was Scott Wetenkamp, who was in charge of all signs for the International Microwave Symposium and for the AdCom and Technical Committee meetings. Scott personally produced the distinctive color graphics and fabricated over 250 signs for the week! His commitment, his wonderfully supportive attitude, and his creativity were all greatly appreciated.

The extensive local arrangements for all the AdCom meetings and the Awards Banquet at the Hilton Hotel were coordinated by Steve Kenney. Steve was our very special "blessing from Atlanta", where he had also been active in local arrangements. Steve Kenney and Kumiko Christopher formed the highly successful team that brought us the outstanding Awards Banquet on Wednesday evening. Many of the spouses of our symposium registrants took part in one or more of the tours of our Guest Program, organized by Ibis Swanson. The hospitality suite in the Vista Room of the Hilton Hotel was a particularly popular function this year.

Of course, there were many other individuals who also contributed in critical ways to the 1996 International Microwave Symposium. Our liaisons with the MMWMC and ARFTG, Val Peterson and Ken Wong, were so cooperative and helpful that we often forgot they were "liaison" and instead accepted their contributions as full committee members. As the confer-

ence grows, so does the responsibility of financial management. Frank Emery, our Finance Chairman, has provided comprehensive leadership in this regard, and is diligently compiling exhaustive financial records which will support a final audit before we "close the books" on Microwave Week. Frank has a long history of contribution to the International Microwave Symposium. He was Digest Editor in Dallas in 1969.

There are, of course, a multitude of social activities associated with the awards ceremonies and with the AdCom meetings. Much of the preparation and communication regarding these events was the responsibility of our Chief of Protocol, Elaine Crescenzi. Elaine contributed in numerous ways, and was helpful to the entire Steering Committee in organizing their social activities. She only slowed down slightly after breaking her ankle two weeks before the symposium, and was certainly an inspiration to us all.

It simply isn't possible to acknowledge all of the contributors on the 1996 Steering Committee in this article. Many of these individuals have been part of our preparations since the initial San Francisco proposal to the AdCom in 1988, and we are most appreciative of their service! We speak for all of them in stating that it has been our pleasure and privilege to serve the MTT-Society as hosts and hostesses of the 1996 IEEE MTT-S International Microwave Symposium. Our heartfelt thanks to all who participated in the 1996 Microwave Week.



Chief of Protocol Elaine Crescenzi with '96 IMS Chairman Jim Crescenzi, prior to greeting guests.

I Left My Wealth in San Francisco

by Chuck Swift

In 1989, I wrote the "One Penny Opera," which was presented at the Awards Banquet. As Chairman, I was in a position to ensure that it would be the night's entertainment.

I'm still writing words to other people's songs, but I don't get any requests to perform them. Maybe there's a spot in the Newsletter for my San Francisco experience at this year's MTT.

I LEFT MY WEALTH IN SAN FRANCISCO

(As written)

THE LOV LI NESS OF PAR IS
SEEMS SOME HOW SAD LY GAY
THE GLO RY THAT WAS ROME
IS OF ANOTHER DAY
I'VE BEEN TER RIB LY A LONE
AND FOR GOT TEN IN MAN HAT TAN
I M GO ING HOME
TO MY C I TY BY THE BAY

I LEFT MY HEART
IN SAN FRAN CISCO
HIGH ON A HILL
IT CALLS TO ME

TO BE WHERE LITTLE CABLE CARS
CLIMB HALF WAY TO THE STARS
THE MORN ING FOG
MAY CHILL THE AIR
DON'T CARE

MY LOVE WAITS THERE
IN SAN FRAN CISCO
ABOVE THE BLUE
AND WIN DY SEA

WHEN I COME HOME TO YOU
SAN FRAN CISCO
YOUR GOL DEN SUN
WILL SHINE FOR ME

(As corrupted)

THE RES TAU RANTS OF PAR IS
HAVE LEFT ME DES TI TUTE
A PICK POCK ET IN ROME
RE LIEVED ME OF MY LOOT
I'VE BEEN OF TEN OV ER CHARGED
BY TAX I DRI VERS IN MAN HAT TAN
WHAT DID I FIND?
IN THE CI TY BY THE BAY

I LEFT MY WEALTH
IN SAN FRAN CISCO
THE M T T
WAS MEET ING THERE

I OVER DREW MY CRE DIT CARD
IT WAS N'T VERY HARD
FIVE GRAND WAS GONE
WHEN I GOT HOME
MY WIFE SWEARS

MY LOVE WAITS THERE
IN SAN FRAN CISCO
DRESSED LIKE A SHE
MIGHT BE A HE

SHOULD I RE TURN TO YOU
SAN FRAN CISCO
A MO TEL SIX
WILL SHEL TER ME

Master Calendar MTT-S Sponsored Conferences

1996

Name	Date/Location	Involvement	
• Advanced Technolgy Workshop on Wireless Communications	19-21 August Boulder, CO	Technical Co-Sponsor	Dr. Roger Marks NIST Mail Code 813.06 325 Broadway Boulder, CO 80303-3328 Tel.: 303 497-3037 Fax: 303 497-7828 email: r.b.marks@ieee.org
• Directions for the Next Generation of MMIC Devices and Systems	11-13 September New York City	Technical Co-Sponsor	Prof. Nirod Das Polytechnic University USA Route 110 Farmingdale, NY 11735 Tel.: 516 755-4228 Fax: 516 755-4404 email: ndas@prism.poly.edu
• 2nd High Frequency Postgraduate Student Colloquium	13 September Manchester England	Technical Co-Sponsor	Dr. Rob Sloan Dept. of Elect. Engineering UMIST P.O. Box 88 Manchester, M60 1QD England Tel.: +44 0161 200 4640 Fax: +44 0161 200 4820 email: sloan@umist.ac.uk
• Microwaves and RF Conference 1996	8-10 October London England	Cooperative	Terry Oxley "Tremont" Back Lane, Halam Newark Notts NG22 8AG England Tel. 44 636 815510 Fax. 44 636 815865 e-mail: t.oxley@ieee.org
• IEEE International Symposium on Phase Array Systems & Technology	15-18 October Boston, MA USA	Technical Co-Sponsor	Dr. Eli Brookner Raytheon Company Equipment Division 528 Boston Post Road Sudbury, MA 01776 USA Tel. 508-440-5636
• Topical Meeting on Electrical Performance of Electronic Packaging	28-30 October Napa, CA USA	Co-Sponsor	Vijai Tripathi, Cochair Phone: 503 737-2988 Fax: 503 737-1300 email: vkt@ece.orst.edu
• GaAs IC Symposium	3-6 Nov. Orlando, FL USA	Co-sponsor	Elissa Sobolewski ARPA/ESTO 3701 North FairFax Drive Arlington, VA 22203-1714 Tel.: 703-696-2254 Fax 703-696-2203 email: lsobolewski@arpa.mil

1996

Name	Date/Location	Involvement	
• International Topical Meeting on Microwave Photonics http://www.atr.co.jp/events.htm	3-5 Dec. Kyoto Japan	Technical Co-sponsor	Prof. Tsukasa Yoneyama Tohoku University Research Institute of Electronic Communications Katahiracho 2 Come 1-1 Sendai 980, Japan
• ARFTG Non-Linearity Measurements	5-6 Dec. Clearwater, FL USA	Affiliated	Michael Fennelly ATN Microwave Inc. 11 Executive Park Drive Billerica, MA 01862 Tel.: 508 667-4200 ext. 18 Fax: 508 667-8548

1997

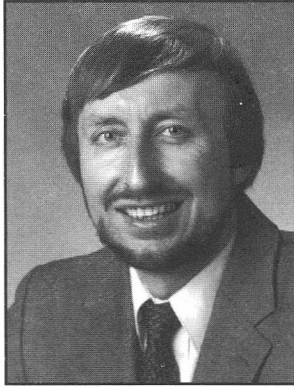
• International Topical Symposium on Technologies for Wireless Applications (WTS)	23-26 February Vancouver, BC Canada	Sponsor	Dr. Reynold Kagiwada TRW Space Electronics Group 3117 Malcolm Ave Los Angeles, CA 90034-3406 Tel.: 310 475-5255 Fax: 310 475-5483 email: r.kagiwada@ieee.org
• Radio Frequency Integrated Circuits Symposium	8-10 June Denver, CO USA	Co-Sponsor	Louis C.T. Liu TRW, Inc. Tel.: 310 812-8372 Fax: 310 814-4656 email: louis_liu@qmail.2.sp.trw.com
• MTT-S International Microwave Symposium	8-13 June Denver, CO USA		Claude M. Weil NIST 325 Broadway Boulder, CO 80303 Tel.: 303 497-5305 Fax: 303 497-6665 email: weil@boulder.nist.gov
• SBMO International Microwave and Optoelectronics Conference	11-14 August Natal Brazil	Co-Sponsor	Adaildo G. d'Assuncao UFRN, EE Dept. P.O. Box 168 Natal, RN Brazil 5 9072-970 Tel.: + 55 84 231 4254 Fax: + 55 84 231 4254 email: sbmo97@ct.ufrn.br
• International Topical Meeting on Microwave Photonics	Date TBD (Fall) Duisburg Germany	Technical Co-Sponsor	Prof. Dr. Dieter Jaeger Gerhard-Mercator-Universitaet Geshamthochschule Duisburg Kommandantenstrasse 60, KA D-47048 Duisburg, Germany Tel.: +49 02 03 379-2341 Fax: +49 02 03 379-2409 email: jaeger@optorisc.uni-duisburg.de

Name	Date/Location	Involvement
• Intelligent Transportation Systems Conference	9-11 November Boston, MA USA	Co-Sponsor Lyle Saxton 6108 Browning Lane Broadrun, VA 22014 Tel.: 540 347-9512 Fax.: 540 347-3311 email: l.saxton@ieee.org

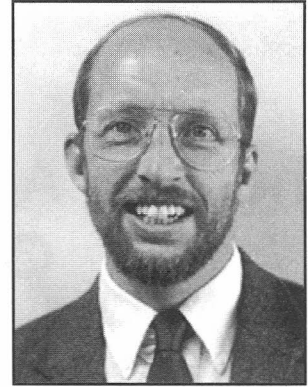
Notes: (1) Meetings listed are those that have been officially sponsored by MTT-S (i.e., AdCom approved). There are many other microwave related meetings (chapter sponsored, commercial, etc.) that are not listed.

MTT-S Continuously Sponsored Conferences

- MTT-S International Microwave Symposium (IMS)
Annual (Sponsor)
- IEEE Microwave & Millimeter-Wave Monolithic Circuits Symposium (MMWMC)
Annual (Co-Sponsor)
- Automatic RF Techniques Group (ARFTG)
Semi-annual (affiliated)
- European Microwave Conference (EuMC)
Annual (Cooperate)
- Asia Pacific Microwave Conference (APMC)
Annual (Cooperate)
- MIOP
Biennial—1993, etc. (Cooperate)
- MIKON
Biennial—1994, etc. (Cooperate)
- Combined Optical and Microwave Earth and Atmospheric Sensing
Biennial—1993, etc. (with GRSS-S, LEO-S)
- International Microwave Conference/Brazil (SMBO)
Biennial—1993, etc. (Cooperate; Co-Sponsor 1995)
- IEEE GaAs IC Symposium
Annual (Co-Sponsor)
- IEEE Conference on the Computation of Electromagnetic Fields
Biennial—1992, etc. (Cooperate)
- European GaAs Applications Symposium
Biennial—1992, etc. (Cooperate)
- Topical Meeting on Electrical Performance of Electronic Packaging
Annual (Sponsor)
- 19th International Conference on Infrared and Millimeter Waves
Annual (Cooperate)
- Microwaves in Medicine
Triennial—1993, etc. (Cooperate)
- National Radio Science Meeting
Annual (Cooperate) (with International Union of Radio Science)
- Int'l Workshop on High Perf. Electron Devices for Microwave and Optoelectronic Applications (EDMO)
Annual (Cooperate) (with UKRI MTT/AP/Leo Joint Chapter and King's College London)
- Cornell University Conference on Advanced Concepts in High Speed Semiconductor Devices and Circuits
Biennial (Technical Co-sponsor) (Sponsored by the IEEE Electron Device Society)



by Jerry Fiedziuszko
Technical Program Co-Chair



by Derry Hornbuckle
Technical Program Co-Chair

1996 IMS Technical Program

The 1996 International Microwave Symposium Technical Program was enormously successful. Records were set in a number of areas, including number of papers, workshops, technical attendees, and workshop attendees. Qualitative feedback was extremely positive as well. Innovations to better serve members included longer technical program hours in order to avoid additional parallel sessions, more Sunday workshops, the first ever ARFTG/IMS joint session, two daytime student-paper competition sessions, and post-workshop sales of extra workshop handouts. Thanks are due to the participants, authors, session chairs, Technical Program Committee, Steering Committee, Local Arrangements Steering Group, and Technical Steering Group for making the technical program such a success.

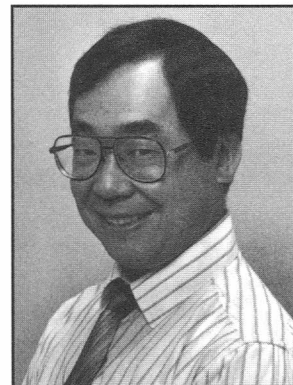
A record number of papers, 839 in all, were submitted for the Technical program. The acceptance rate of 56% was the lowest since 1991, but still resulted in an all-time high number of IMS papers, 466. The program was organized into 52 sessions, of which 8 were special Focused sessions, plus 2 open forums. Focused sessions included a retrospective on the history of microwaves in the San Francisco Bay Area, and a joint IMS/ARFTG session dedicated in memory of the late Mario Maury.

In addition to regular papers, the program included 26 workshops, the largest number ever, 5 panels, and an evening rump session. The Microwave and Millimeter-Wave Monolithic Circuits Symposium at the beginning of the week, and Automatic RF Techniques Group Conference at the end of the week rounded out the technical offerings for Microwave Week. IMS technical program attendance set a new record, 2299, as did workshop attendance of 2364.

Selection of such a comprehensive program is a major undertaking. More than 200 dedicated volunteers on the Technical Program Committee reviewed an average of 30 papers each to select the top papers for inclusion in the Symposium. We would like to thank all of them. In addition, special thanks are due to the Steering Committee Technical Group. Paul Khanna headed the Special Sessions Committee, consisting of Edmar Camargo and Chuck Holmes, who handled workshops and panels, along with Alf Riddle and Cindy Yuen, who managed the open forums. Professors Rick Branner (U.C. Davis) and Bob Owens (U. of Santa Clara) organized the Student Paper Competition. Richard Ranson edited the largest *Symposium Digest* ever. Roger Pollard, with Richard Ranson's help, contributed a major innovation by arranging for publi-

cation of the *Digest* and other MTT material on CD-ROM. Alf Riddle and Guo-Chun Liang assembled and distributed over 800 engraved plaques, as recognition gifts for technical contributors. ARFTG Liaison/Conference Chairman Ken Wong initiated the joint MTT/ARFTG paper session, and Val Peterson served as MMWMC liaison. The Steering Local Arrangements group did an outstanding job; our thanks to George Vendelin, to Dan Swanson for managing the complex Moscone Center logistics, Kumiko Christopher for administration of local services/catering, Scott Wetenkamp for signs, and the rest of the Local Arrangements Steering group. Larry Whicker and LRW Associates handled numerous aspects of the technical paper selection, author communications, and digest printing, while Horizon House provided publicity services, in addition to managing the exhibits. John Barr's masterful management of publicity was essential to the success of the Symposium. Joe Barrera organized the appealing and inspiring Plenary Session. Our special thanks as well to all the other members of the '96 Steering Committee, who worked tirelessly to support bringing you an outstanding technical program, and to Symposium Chairman Jim Crescenzi for his leadership and personal dedication to the success of the 1996 Symposium.

The 47th ARFTG Conference Overview



by Ken Wong

Rapidly increasing interest in commercial applications for microwave technology plus the tourist appeal of San Francisco were key factors in attracting a record number of attendees to the 1996 MTT-S International Microwave Symposium (IMS) at the Moscone Convention Center. The symposium was held from June 17 to 21 with events of the 47th ARFTG Conference scheduled on the final two days. In addition to outstanding technical programs, attendees enjoyed clear weather and a friendly atmosphere along with the usual amenities of a major tourist city.

The large increase in conference registration to 163 was a nice reward for Ken Wong, Conference Chair and ARFTG Liaison to IMS Steering Committee.

Joint Session

A cooperative effort between ARFTG and MTT-S produced the Mario Maury Memorial session as part of IMS on June 20. Mr. George Oltman and Dr. Stephen Adam reviewed his life from the early days to his productive career at Maury Microwave. Many pleasant memories of our good friend Mario were brought back at this time. Papers on a variety of key subjects completed the session.

Technical Program

Theme of the conference was "High Power RF/Microwave Device Measurements". The technical pro-

gram was of exceptional quality and included a full day of 15 presented papers with 3 poster papers in the exhibit area. Technical Program Chair, Dr. Mohamed Sayed divided the program into four distinct sessions to allow attendees to focus on papers of interest. These sessions were organized as follows: 20 to 100 W Devices, Measurement Techniques A & B, and On-Wafer Measurements. Papers covered a wide variety of subjects from new devices and test systems to improved measurement techniques and better analysis. There were many exceptional papers. The winner of the Best Paper was Charles Wilker and co-authors for "Full Two-Port Calibrated S-Parameter Measurements up to 30 W of High Temperature Superconducting Filters".

Publications Chair, Edward Godshalk, had to put in extra effort to put together the digest for this conference. He had to add the joint session papers to the digest. Because of the record breaking registered attendees, he had to print a record number of digest as well. ARFTG Technical Committee Chair, Dr. Roger Marks worked out the copyright issues with IEEE on the joint session papers.

Exhibits

Exhibits Chair Michael Fennelly brought together a wide range of products and services that are available to support testing of circuits and components in environments ranging from test bench to wafer fabrication. Exhibitors included ATN Microwave, Automatic Test Solutions, Cascade Microtech, Hewlett-Packard EESOF,

Hewlett-Packard Santa Rosa Systems, Karl Suss, Lucas Weinschel, Maury Microwave and Weinschel Associates.

Best Exhibitor as selected by the attendees featured a Hewlett-Packard network analyzer with extended range to 120 GHz using 1.0 mm coaxial lines.

Awards Luncheon

Awards presented were limited to recognition of contributions to the 46th Conference as follows:

- Best Paper Award (tie)
Presenter: Saswata Basu—Cascade Microtech
Co-authors: John Pence, Eric Strid—Cascade Microtech
Title: "Impedance Matching Probes for Wireless Applications"
Presenter: Alan Kafton—Hewlett-Packard
Title: "Advance Technology Speeds Production of RF Integrated Circuit Testing"
 - Best Exhibitor—Cascade Microtech
 - Certificates of Appreciation were also given to the individuals responsible for the 47th Conference:
Mr. Ken Wong—Conference Chair
Dr. Mohamed Sayed—Technical Program Chair
- Recognitions were also given to two special guest of the luncheon:
Mr. Dan Swanson—IMS Steering Committee Moscone Center Arrangements
Ms. Kumiko Christopher—IMS Steering Committee, meals and services

Report on 1995 Microwave Workshops and Exhibition (MWE'95) Yokohama, Japan

by Yoichiro Takayama

Technical Program Committee Chairperson
Semiconductor Group, NEC Corporation
Shimonumabe, Nakahara-ku, Kawasaki, 211 Japan

The 1995 Microwave Workshops and Exhibition (MWE'95) was held December 12-14 at the Conference Center and Exhibition Hall in Pacifico Yokohama, Yokohama, Japan. MWE'95 was organized and sponsored by IEICE (the Institute of Electronics, Information and Communication Engineers of Japan) APMC (Asia-Pacific Microwave Conference) National Committee, and was co-sponsored by IEICE Technical Group on Microwave and IEEE MTT-S Tokyo Chapter. MWE is to be held annually in Japan as a joint event of workshops and an exhibition relating to microwaves.

This year, the theme, "New Microwave Technologies for Upcoming Multimedia Age," was chosen for the first time in MWE. It demonstrated the roles and responsibilities of the microwave engineers in the upcoming multimedia society.

At the opening ceremony, Prof. Norihiko Morinaga of Osaka University delivered a keynote address entitled "Advanced Wireless Communication System Technologies Towards Multimedia Age," and Dr. Masamitsu Matushiro, ex-professor of Nihon University, made an address entitled "Dawn of the Wireless Communication in Japan." In order to cover the broad range of technical themes, the Technical Program Committee arranged four parallel sessions comprising 13 workshops providing updates on microwaves, two panel sessions covering topical subjects, and one lunch session in which the theme of MWE'95 was discussed. And also five tutorial lectures on microwave basics were held to provide useful informa-

tion to young engineers and beginners in microwave fields.

In the exhibition, over 200 companies from Japan, USA and other countries displayed the latest products and services available. In addition to the commercial displays, historical panels of microwave semiconductor devices in Japan were displayed on the exhibition floor. Technical seminars on microwave applications and products were presented by the companies participating in the exhibition.

The number of attendees to MWE'95 was more than 4000, and 1900 of them participated in the workshops.

The technical program topics are shown below:

Tutorial Lectures

- Small, planar microwave antennas
- Mobile communication systems and related microwave technologies
- Nonlinear microwave circuits
- Microwave filter technology
- Microwave modulation-demodulation technology

Workshops

- Present status and perspective of microwave power devices
- Novel MMIC technologies and their applications
- Future technology prospect of microwave filters
- Microwave packaging and interconnect technologies
- Wireless LANs
- New development of satellite

broadcasting

- New application of microwaves
- Mobile communications 1—development status and future prospect of mobile satellite communications
- Mobile communications 2—fundamental technologies for cellular and PHS
- Mobile Communications 3—new device technology
- Millimeter-wave application system technology
- Technology trends of millimeter-wave semiconductor devices
- Optomicrowave techniques

Panel Sessions

- Disaster prevention radio communication systems
- Recent and future simulation technologies for microwave and millimeter-wave and circuits

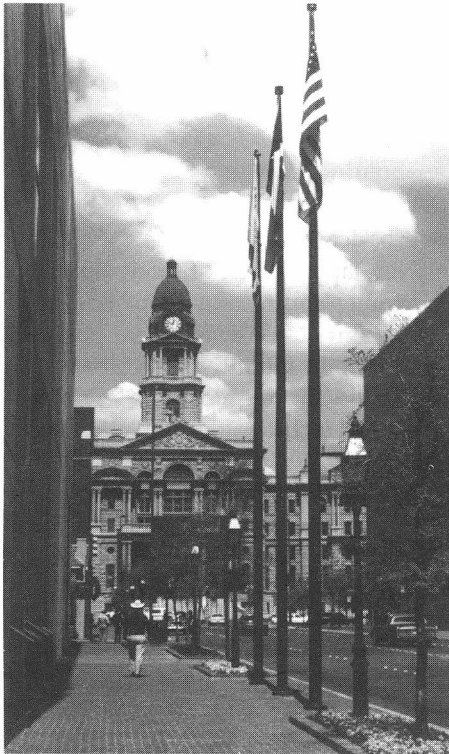
Lunch Session

- New microwave technologies for upcoming multimedia age

The *Workshop Digest* (in English except the tutorial lectures in Japanese) is available at the unit price of 14,000 Yen (including postage). Please contact REALIZE, Inc., MWE Secretariat, 4-1-4 Hongo, Bunkyo-ku, Tokyo 113, Japan (fax: +81-3-3815-8529). The next MWE'96 is scheduled to be held at the Pacifico Yokohama Convention Center on December 10-12, 1996.

IMS 2004 Fort Worth, Texas

by Karl Varian



On June 16, AdCom selected Fort Worth, Texas, as the site of the 2004 International Microwave Symposium. Microwave week 2004 will be June 5-12.

Fort Worth is renowned for preserving the feel and flavor of its western heritage, but if you think Fort Worth is just about cattle and cowboys...hang on to your hat.

The Dallas/Fort Worth Metroplex (DFW) is a national leader in the production of electronics and aviation products. We boast the third largest concentration of high technology in the country, with more than 800 electronic-related companies. Corporations with headquarters or major facilities in the DFW Metroplex include:

Bell Helicopter (commercial and military helicopters, and the V22 Osprey), Lockheed-Martin (home of the F-16 and a major facility for the F-22, the fighter of the future), Texas Instruments (supplier of components and subsystems), Tandy Corporation (leader in retail electronics and parent company of Radio Shack and Incredible Universe).

Fort Worth's cultural institutions offer everything from European masterpieces and modern art to interactive science exhibits. The area's museums are some of the country's best, including the Amon Carter and Kimbell Art Museums.

DFW International Airport is located in the center of the country, making it easily accessible from either coast. The airport is the second busiest in the world with over 2,200 flights daily, offering non-stop service to more than 200 cities worldwide.

Fort Worth is located 17 miles west of the airport, with a maximum 25 minute drive time. Several modes of ground transportation are available; shuttle, taxi, and bus services ranging in price from \$8-25. By the year 1998, TexRail (a commuter rail service) will be operational with connections between the airport and downtown Fort Worth.

Favorable ho-

tel rates and the close proximity of the city's hotels to the convention and entertainment facilities provide both value and convenience. Accommodations range from luxury to economical, providing a hotel pricing structure suitable to any budget, without sacrificing quality in rooms or service. 1400 guest rooms are within easy walking distance of the convention center. Members staying at hotels beyond the immediate downtown area will have access to complimentary bus transportation to and from the convention center. The average ride time is 10-15 minutes.

Downtown is the center of activity in Fort Worth. Hotels, the convention center, Sundance Square, over 40 dining and entertainment options are all within easy walking distance. The downtown area is the perfect blend between past and present. Victorian buildings now house restaurants, upscale night clubs, shopping, theaters, movie houses and in 1997 the magnificent Bass Performing Arts Hall.

The Convention Center offers everything we need to host the Symposium...and then some. It fully accommodates our requirements from exhibit space to meeting rooms.

The Dallas/Fort Worth Metroplex offers something for everyone - more shopping than New York, more music than Nashville and more thrills than Disneyland. And one thing is certain, Fort Worth is a great city for our Symposium.



News from the St. Petersburg ED/MTT/AP Chapter

by Sergei Tretyalov

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Student competition for junior students studying radio engineering was organized by St. Petersburg Electrotechnical University, several other universities and higher-education institutions located in St. Petersburg, with support and cooperation from the IEEE St. Petersburg ED/MTT Chapter. Professor Ushakov, Vice Rector of the Electrotechnical University, was the Organizing Committee Chairman. The event was held at the Electrotechnical University premises on April 27, 1996.

The goal was to bring together the best students from different universities where electrical engineering is taught, and to give them a possibility to try solving more complicated problems than that from the standard study programs. The linear and non-linear circuit theory, basics of the signal theory, transmission-line theory and other related topics were included in the program.

90 students from six different institutions took part in the event. Both the best individual and the best university team were selected: the best team was that of the Electrotechnical University, and the best student in the competition was Mr Guzenlco from the St. Petersburg State Technical University.

On June 4, IEEE Executive Director T. Hissey visited St. Petersburg Chapter. At "Leninetz" holding company (mainly specialized in the radar technology) there was a meeting with several leading executives and scien-

tists from Leninetz, Svetlana holding (electron devices) "Ferrite" (ferrites and microwave ferrite devices) representatives of city universities (St. Petersburg State University, State Technical University, Electrotechnical University). The meeting was hosted by Mr N. Kocheshlcvov, Secretary of the Leninetz Scientific and Technical Council. Various aspects of IEEE developments in St. Petersburg area were discussed. Specifically, IEEE Entrepreneurial Skills Seminar (proposed for summer 1997), possible help from the IEEE for the School of Electromagnetic Waves Propagation (based on St. Petersburg State University), continuous education program of Leninetz holding were discussed. Prof. V. Sarychev (Leninetz holding company) informed about the directions of research and development in his company, and about its scientific and productive potentials, in view of possible contacts with the IEEE.

Interest in possible organizations of other IEEE chapters was clearly expressed. Prof. Mickerov (St. Petersburg Electrotechnical University) suggested that there was potential and increasing interest of specialists in power engineering, power electronics, robotics and automation, industrial applications, control system. Prof. Sarychev (Leninetz) spoke about his company interest in aerospace electronic systems, engineering in medicine biology, and signal processing. The problem of high (relative to the local salaries) IEEE fees was raised.

Mr Hissey visited also Svetlana

holding company. In the discussion with Mr O. Arshinov (Director of Marketing) and Dr V. Tsvetov (Advisor to the Board of Directors) current problems of electrical engineers in St. Petersburg were discussed. Generally low salaries, payments delays, massive lay-offs (Svetlana lost about 3/4 of its staff in the last few years). The best specialists flow from the industry, mainly into financial and commercial networks. The IEEE mission here can possibly help in improving the professional status of electrical engineers, although of course it is a hard time for the profession. Lack of information about the IEEE was discussed. To improve the situation, the Chapter will organize displays of IEEE materials in libraries of Universities and industrial companies of the city.

International Seminar "Day on Diffraction '96" was held in St. Petersburg from June 4 to June 6. The seminar was organized by the St. Petersburg Branch of the Mathematical Institute of the Russian Academy of Science and the State University of St. Petersburg (co-sponsored by the IEEE ED/MTT St. Petersburg Chapter) The seminar chairmen are Prof. V.M. Babich and Prof. V. S. Buldyrev. This is a traditional event, first established by Academicians V.A. Fock and V. I. Smirnov. Since 1991 it is an international venue. Over 30 reports were given, scientists from six countries participated.

Effective from June 7, the Chapter has changed its status to include the Antennas and Propagation Society.

Modeling Human Interactions

by Kaneyuki Kurokawa
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Introduction

It is a great pleasure for me to write this article at the suggestion of the Newsletter Editor.

For years, I have observed the following.

1. A committee meeting becomes unproductive when the number of participants exceeds 20. The meeting seems to be most productive when the number is somewhere between 5 to 10.
2. With the division of labor, a large number of people can work together towards a common goal.
3. A large group rarely invents something useful. An important invention or discovery is usually made by an individual or a small group of dedicated people.
4. The larger the corporation, the more difficult the technology transfer.

This article is intended to explain these observations.

A long time ago, I read a book, *Parkinson's Law*. It was not in the style of a textbook, but the author gave a glimpse of reality far more accurate than most textbooks. Among his acute observations, he studied the English

Cabinet over the past 200 years, and reported that when the number of Cabinet members exceeded 20 or 22, the Cabinet was in decline and an inner cabinet of 5, 7 or 9 members was readily formed. The author gave a dubious formula for the optimum number of committee members without derivation. So, I wanted to attain a more understandable formula but I couldn't at the time. After 20 years of experience in various managerial positions, I came back to this problem and obtained an explanation. Let me explain the model, and its extensions to other situations.

The Chemistry

When one meets another person, he brings with him not only his intelligence but also his personality. It is not possible for a person to leave his personality behind. His personality always comes with him. So, when two persons meet together, we have to expect the interaction of one personality with another. We call this interaction "chemistry," referring to the Random House Dictionary. Chemistry will be said to be good when friendship, mutual confidence, trust and understanding prevail. On the other hand, when hostility, distrust and doubt prevail, chemistry will be said to be bad or poor. Other expressions such as improve and deteriorate will be used ac-

ording to the traditional meanings associated with good and bad.

When two persons meet, there may be ambiguity, argument, conflict and disagreement. But, if the chemistry is good, the argument becomes useful. The ambiguity will be resolved and disagreement or conflict will disappear or at least they will remain within each other's comfort zone. When the chemistry is poor, suspicion and evasion become rampant, morale and hence the quality of work will deteriorate and any remaining confidence will evaporate.

Chemistry can improve or deteriorate with time, sometimes quickly and some times very slowly.

With this understanding of chemistry, let us now consider a committee meeting.

Committee Meetings

We would like to estimate the output of a meeting as a function of the number of participants. However, the output depends on the diversity of knowledge and experience the participants bring with them as well as their individual capabilities. So, instead of the output itself, we calculate the expected number of persons actively pursuing the goal of the meeting,

which we call the expected manpower. If the level of the diversity and capabilities of the participants remain the same, the output of the meeting is expected to be proportional to the expected manpower.

In a committee meeting, a chairperson presides over the entire proceedings. Direct discussion between the committee members may take place in the meeting. But the members anticipate intervention by the chairperson at any moment. So, interaction between the members' personalities remains of secondary importance. On the other hand, if the chemistry between the chairperson and a member deteriorates, the other members will notice the deterioration, and they either play the role of obedient subordinates to the chairperson or else rebel against the chairperson. In either case, they cease to pursue the goal of the meeting until the chemistry improves. Let n be the attendance including the chairperson and p be the probability of the chemistry being good between the chairperson and a member. Then, the probability of the chemistry being good between the chairperson and all the members is given by p^{n-1} . When the chemistry is good, the number of persons pursuing the goal of the meeting is given by n . Otherwise the number becomes zero. So, the expected manpower is given by np^{n-1} .

In order to obtain this formula for the expected manpower, we neglected details including the effect of direct interactions between the members' personalities. This allows us to focus on the essential features of committee meetings.

Figure 1 illustrates how the expected manpower varies with n when $p=0.86$. $p=0.86$ may be on the high side for ordinary meetings. But it may be appropriate for the Cabinet meetings since the Cabinet members tend to be experienced individuals. The expected manpower for $p=0.86$ becomes less than 1 beyond $n=22$. If the expected manpower is less than 1, everybody would notice how inefficient the meeting becomes by comparing the

progress of the meeting with his or her own potential contributions. Then, the formation of an inner cabinet becomes desirable. The maximum expected manpower is obtained at $n=7$. However, the decrease from the maximum is quite modest between $n=5$ and 9. So, the inner cabinet of 5 to 9 members will be formed. This is exactly what Parkinson observed in his study of the English Cabinet.

For ordinary meetings, p may be smaller than 0.86. Psychologists found that 5 was the magic number for most group activities. $n=5$ gives the maximum expected manpower when $0.8 < p < 0.833$. This is a more likely range of p we anticipate in everyday life.

The Division of Labor

Let us consider the division of labor. With the division of labor, each worker receives instructions from the leader, more or less independently of other workers. This is in contrast to committee meetings where the chem-

istry between the leader and a member critically influences the relation between the leader and the rest of the group as a whole.

Let p be the probability of the chemistry between a worker and the leader being good. The expected manpower of all the workers combined is given by p times the total number of the workers, $(n-1)$. Adding the manpower of the leader which is 1, the expected manpower of the group including the leader becomes

$$p(n-1)+1 = np+(1-p)$$

For a large n with ordinary p , the first term dominates the second on the right hand side of this equation. So, the expected manpower is essentially given by np . The expected manpower increases linearly with increasing n . In practice, the effect of the leader's span of control, n_c , sets in. As the size of the group approaches n_c , the expected manpower will tend to saturate. Beyond n_c , the expected manpower abruptly decreases in an erratic manner. This means that the expected man-

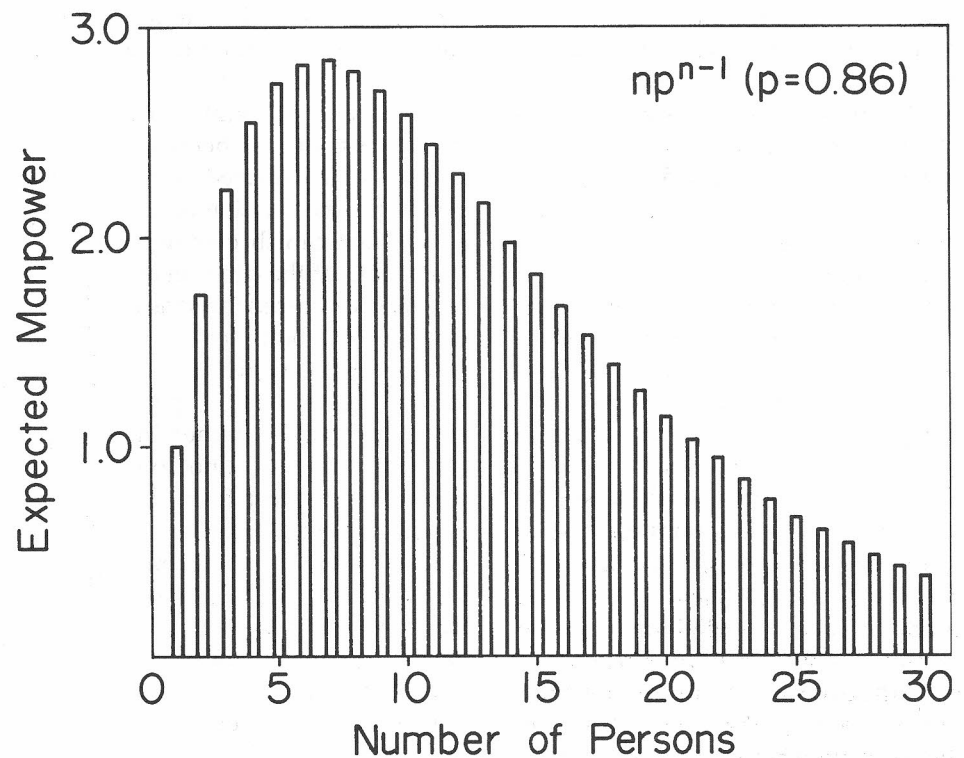


Figure 1. The Expected Manpower of Committee Meetings.

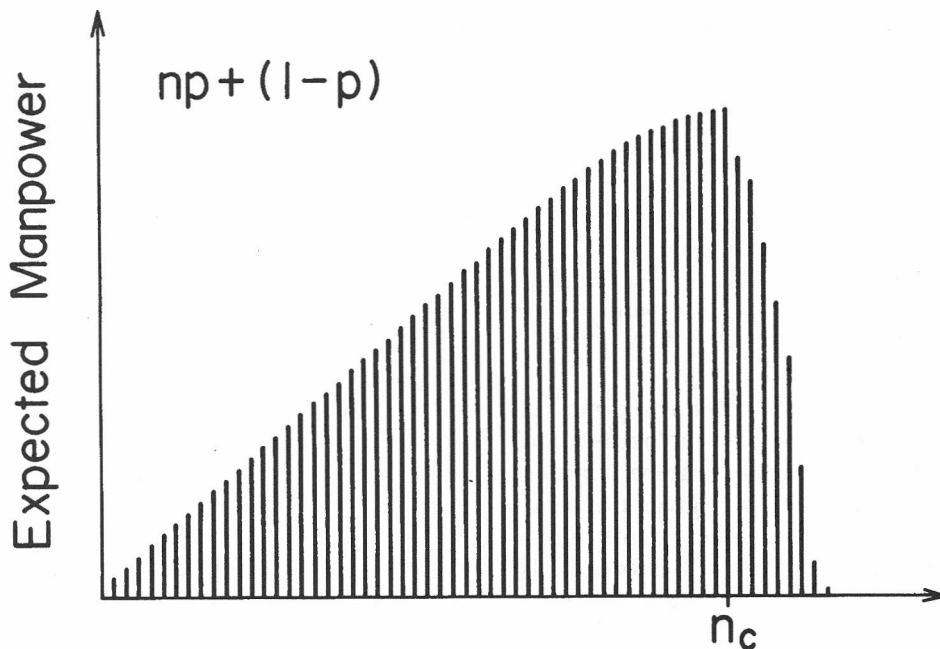


Figure 2. The Expected Manpower in the Division of Labor.

power in the division of labor varies as illustrated in Figure 2.

Now, let us consider a sales group. Each regional salesperson receives instructions from the leader and makes transactions with customers in his region, independent of other salespersons. Total sales is the sum of the sales each salesperson makes. The group output equals total sales. This is a parallel division of labor in which a task is divided into subtasks and each is carried out in parallel with and nearly independent of other subtasks. In this case, we can expect a good correlation between group output and the expected manpower. Next, let us consider an old process line for the fabrication of IC chips. Each operator receives instructions from the leader and performs one or two processes, nearly independent of other operators. This is a series division of labor, in which a task is divided into subtasks along the natural flow of operations necessary to complete the task. If one operator does careless work, the yield of the final product becomes negligible. So, group output is more nearly proportional to np^{n-1} , the expected manpower for committee meetings, than np . In this case, the correlation between the group output and the expected manpower would be poor. This is, however, due

to poor job design. Both the leader and operators were blindfolded. A modern process line gives high yield and the group output is nearly proportional to np . This is accomplished by introducing an appropriate monitor and feedback arrangement into each critical process, so that each process stops propagating defects to the next. In a traditional assembly line of cars, one can easily inspect the final product to determine who or what is responsible for defective assembly. In this case, group output has been in line with the expected manpower for the division of labor. Adam Smith clarified the benefit of the division of labor. He discussed the series division of labor. However, he did not discuss the reason why a large number of persons can work together in this arrangement. Our expected manpower formula indicates that it's because the adverse effect of poor chemistry does not propagate easily from one person to the next in the division of labor. In order for this arrangement to be effective, however, not only the psychological propagation but also physical propagation of ill-effects

such as contaminations must be stopped.

Exploratory Groups¹

Let us consider an exploratory group aiming at, for example, an invention or a discovery. In true exploratory works, no leader emerges and the members have to collaborate with each other on equal footing. Let n be the total number of members and q be the probability of the chemistry being good between a pair of members. A different letter, q , is used because we are now discussing lateral relations in contrast to vertical relations in committee meetings and the division of labor. If any one pair of members has poor chemistry, the whole group has to dissipate an enormous amount of energy to keep the group intact, and no one actively pursues the goal of the group anymore. Since the total number of pairs is given by ${}_nC_2 = n(n-1)/2$, the expected manpower becomes $nq^{n(n-1)/2}$.

Figure 3 illustrates the expected manpower for $q=0.86$. The expected manpower has a maximum at $n=3$. Beyond $n=3$, the expected manpower decreases very quickly with the increasing number of collaborators. A calculation shows that the expected

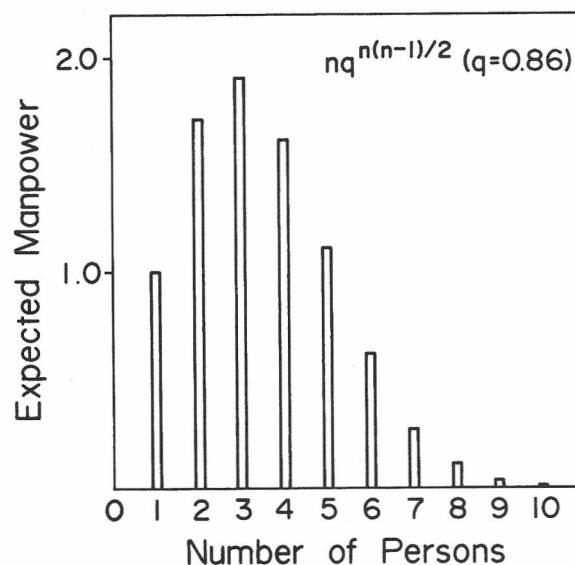


Figure 3. The Expected Manpower of Exploratory Groups.

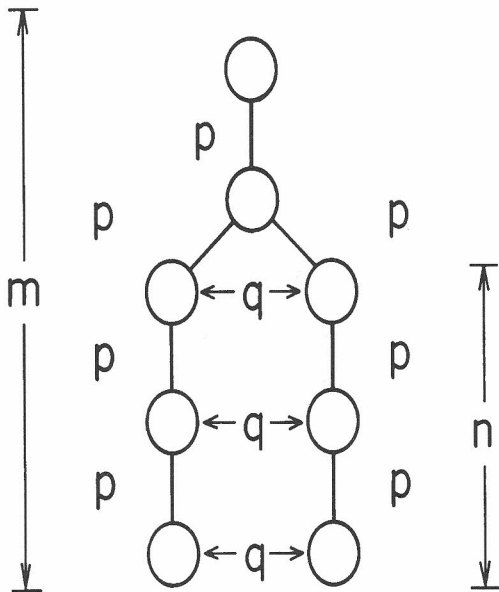


Figure 4. The Hierarchical Structure Relevant to a Technology Transfer.

manpower becomes maximum at $n=3$ when $0.816 < q < 0.909$, at $n=2$ when $0.5 < q < 0.816$ and at $n=1$ when $q < 0.5$. From our everyday experience, q rarely exceeds 0.9. So, in most cases, the number of collaborators should be less than or equal to 3. Beyond $n=3$, the manpower will be wasted. Note that no more than 3 collaborators have shared a Nobel Prize, whether it is in Physics, Chemistry, Medicine, or Economics. Furthermore, note that the number of cofounders of an innovative company rarely exceeds 3.

Economists argue that more input would produce more output. They assume that the unnecessary input factors can be left unused. Unfortunately, if a person is assigned to a project, he has to interact with other members of the project. He cannot be left unused. This is where economists' assumption breaks down. If the group is already on the right hand side of the expected manpower peak, the marginal contribution of the additional manpower is negative. The more he wants to contribute, the less productive the group becomes. This is certainly counter-intuitive and impossible to explain to higher-ups. Suppose an urgent problem cropped up in a project. The higher-ups expect a quick solution.

The project manager has to assign as much manpower to solving the problem as possible. Otherwise, he will not be considered doing his best. The appearance of solving the problem becomes more important than the actual solution. The more manpower that is put in, the further finding the solution is delayed. Eventually, the project fails because of too many persons involved. This kind of absurdity will be saved by disseminating the concept of expected manpower.

Technology Transfer^{1,2}

Let us consider technology transfer within a corporation. If the technology is sponsored by a major outside customer, or personally by the top of the corporation, disagreements among lower echelons can be overcome and successful transfer will be accomplished. Otherwise, the technology transfer fails because the chemistry between any pair of persons negotiating directly becomes bad. We will discuss only this latter case. Let m be the number of ranks in the hierarchy, and n be that of the receiving division. Referring to Figure 4, the probability of successful transfer is given by $p^{m-1}q^n$. Suppose p is very reasonable 0.86 and q is 0.8, $m=6$ and $n=4$. Then the probability of successful transfer becomes 10.5%. If $m=3$, $n=2$, the same probability becomes 35%. No wonder flat organizations are now in vogue. Unless special care is taken to make organizations flat, the larger the corporation, the more difficult the technology transfer.

Epilogue

I have introduced a new concept, expected manpower. The concept of ordinary manpower assumes that each person contributes one unit of power and the power is additive. In reality, capability is quite different from one person to the next. At the same time, there may be considerable overlap in the capabilities persons have. Nevertheless, manpower gives the first order

estimate of the group's combat capability. Similarly, expected manpower gives the first order estimate of the group's intellectual capability. It may give practical guidance about the number of participants when planning group activities.

Another concept, chemistry, is utilized throughout our discussions. Chemistry is a nebulous entity. We do not know its true origin. We do not know when and how chemistry turns to be good or bad. Nevertheless, our discussions in this article enable us to estimate the effects of chemistry in group activities. The situation is similar to physics. Note that we do not know the reason why gravity, mass and energy exist, or their true origins. Nevertheless, we use these concepts to understand our observations in physical world. Admittedly, our discussions of chemistry are crude compared with physics. But they may be the beginning of quantitative discussions on group activities, or at least an improvement over the proverb: Too many cooks spoil the broth.

Before closing, a word of caution is in order. This article may have given the readers the impression that the higher the p and q , the better. This is, however, not necessarily true because of the phenomenon called group think. Those who are interested in group think should consult with textbooks on social psychology^{3,4}.

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Miniaturization Techniques of Microwave Components for Mobile Communications Systems— Using Low Loss Dielectrics



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After utilization of the microwave as a communication media became popular, the miniaturization of the devices was seen as the important area to improve. The keyboard and display of the portable telephone terminal requires a proper size for ease of operation as a man/machine interface, but the other devices or components are expected to be as small as possible. Battery, antenna, antenna filter and earphone are representatives of the bulky devices in the hand-held terminal. A great deal of effort to reduce the size and weight of these devices has gone into the design of lightweight pocket size telephone terminals. The antenna filter of the base station for the micro cell system is also the urgent area to be miniaturized.

The big advantages of the use of a dielectric material are the remarkable miniaturization of a microwave device without a significant degradation of unloaded Q and the temperature stabilization of the resonant frequency without the use of expensive gold plated invar. These due to the phenomenon that the wavelength of electromagnetic wave is reduced to $1/\sqrt{K}$ in the dielectrics compared with that in the free space, (K is the relative dielectric constant) and largest portion of electromagnetic energy's concentrated in the temperature stable dielectric ceramics.

The word "dielectric resonator" was described on the paper by

Richtmyer¹ in 1939, where he showed theoretically that the ring shaped dielectrics could work as a resonator.

In the 1960s, several pioneers investigated the behavior of dielectrics at microwave frequencies and tried to apply them to the microwave device. For example, the dielectric loss at microwave frequency of SrTiO_3 was measured and its mechanism discussed by Silverman et al.², and far infrared dispersion was investigated by Spitzer et al.³

A. Okaya and L. F. Barash measured the dielectric constant and Q of TiO_2 and SrTiO_3 single crystals from room temperature down to 50 K at GHz range, using the commensurate transmission line method in 1962.⁴ The simple but accurate measurement method for dielectric characteristics at microwave frequency was proposed by Hakki and Coleman using the parallel metal plate sample holder⁵, and this method was improved by Y. Kobayashi⁶. This invention accelerated the progress of material research.

The first microwave filter using TiO_2 ceramics was reported by S. B. Colm⁷ in 1968. But this filter was not put into practical use because its large temperature variation of pass band frequency of about 450 ppm/ $^\circ\text{C}$. Y. Konishi⁸ developed the stacked resonator using two opposite signed temperature characteristic dielectric disks.

Meanwhile, in the low frequency area, the temperature compensating ceramic capacitor were developed in Germany at the beginning of 1930 and widely used for the stabilization of a electronic circuits such as the LC resonance circuit, CR timing circuit etc. Since 1940s, the composition of ceramic capacitor, $\text{MgTiO}_3 - \text{CaTiO}_3$, $\text{BaO} - \text{TiO}_2$ systems have been well known as well as TiO_2 ceramics, these compositions could be used it delays as a starting material for microwave application. Fortunately, temperature compensating ceramic capacitor (so called Class I ceramic capacitor) showed enough high Q (2000 - 10000) compared with that of inductor (200 - 700, 1000 at most), and for this reason, special attention to improve the Q value of class I ceramic capacitor was not considered until at the end of the 1960s when the application to microwave equipment was considered.

The research and development work of a temperature stable dielectric materials for the microwave application started at beginning of 1970. In the present decade, the Q values of these materials have been remarkably improved. Table 1 summarizes the dielectric characteristics of the representative materials. Along with the development of the improved microwave materials, new designing and manufacturing techniques of microwave passive devices have been proposed and applied to realize the miniaturization of the dielectric filters, hybrid circuits

Table 1. Representative Materials for Microwave Application

Materials	K	Q · f GHz	τ_f ppm/°C
MgTiO ₃ -CaTiO ₃	21	55,000	+10 ~ -10
Ba(Sn,Mg,Ta)O ₃	25	200,000	+5 ~ -5
Ba(Zn,Ta)O ₃	30	168,000	+5 ~ -5
Ba(Zr,Zn,Ta)O ₃	30	100,000	+5 ~ -5
(Zr,Sn)TiO ₄	38	50,000	+5 ~ -5
Ba ₂ Ti ₉ O ₂₀	40	32,000	+10 ~ +2
BaO-PbO-Nd ₂ O ₃ -TiO ₂	90	5,000	+10 ~ -10

oscillators and others. We have reported the paper of the temperature stable 6.8 GHz microwave filter using (Zr,Sn)TiO₄ ceramic resonators in 1975 on MTT-S meeting at Palo Alto.⁹

The typical modes of the dielectric resonators which are most commonly used are TE_{01d}, TM₀₁₀ and TEM. Table 2 shows the comparison of distinctive characteristics among these three modes.

A distinctive feature of the TEM mode is the tremendous miniaturization capability of the resonator, but it carries with it the downside of a remarkable degradation of Q with miniaturization (still far better than an inductor). The Q value of this type resonator is approximately proportional to V^{1/3}, hence the designer should decide the adequate size compromising the contradictory relation between the size and unloaded Q for his application.

The size and weight of antenna duplexer for mobile telephone terminals were reduced to about 1/10 in the last 7 years. Fig. 1 shows the size trend of the filter and duplexer for a cellular mobile radio terminal.

Table 2. Comparison of the Distinctive Character Between Modes

Mode	Distinctive Characteristics
TE _{01d}	highest Q, largest size
TM ₀₁₀	medium Q, medium size
TEM	lowest Q, smallest size

The significant miniaturization of the microwave filter and duplexer has been a driving force in the popularization of mobile and portable communication systems.

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⁸Y. Konishi, "Microwave Dielectric Resonator," *Tech. Report of NHK* (Nippon Hoshoh Kyoukai), pp. 111-117 (1971) (in Japanese).

⁹K. Wakino, T. Nishikawa, S. Tamura and Y. Ishikawa, "Microwave Bandpass Filters Containing Dielectric Resonator with Improved Temperature Stability and Spurious Response," *IEEE MTT-S Int. Microwave Symp. Dig.*, pp. 63-65 (1975).

Miniaturization of Duplexer (E-AMPS)

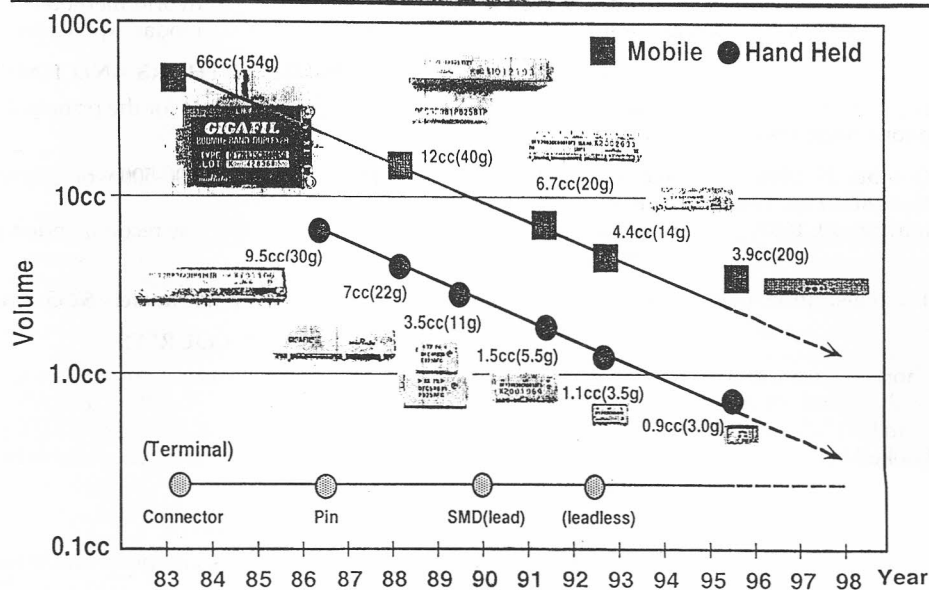


Figure 1. Size Trend of Filter and Duplexer for Terminal

Microwave Components Group
© December 1995

THE APPLIED COMPUTATIONAL ELECTROMAGNETICS SOCIETY

1997

CALL FOR PAPERS

1997

The 13th Annual Review of Progress
in Applied Computational Electromagnetics
March 17-21, 1997
Naval Postgraduate School, Monterey, California

"Share Your Knowledge and Expertise with Your Colleagues"

The annual ACES Symposium is an ideal opportunity to participate in a large gathering of electromagnetic analysis enthusiasts. The purpose of the Symposium is to bring analysts together to share information and experience about the practical application of EM analysis using computational methods. The Symposium offerings include technical presentations, demonstrations, vendor booths and short courses. All aspects of EM computational analysis are represented. Contact Eric Michielssen for details.

Technical Program Chairman

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Papers may address general issues in applied computational electromagnetics or address specific applications, techniques, codes, or computational issues of potential interest to the ACES membership. Areas and topics include:

- Code validation
- Code performance analysis
- Computational studies of basic physics
- Examples of practical code application
- New codes, algorithms, code enhancements, and code fixes
- Computer hardware issues
- Partial list of applications:
 - antennas and arrays
 - bioelectromagnetics
 - communications systems
 - dielectric & magnetic materials
 - eddy currents
 - EMP, EMI/EMC
 - fiber optics
 - inverse scattering
 - microwave components
 - MIMIC technology
 - non-destructive evaluation
 - propagation through plasmas
 - radar cross section
 - remote sensing & geophysics
 - visualization
 - wave propagation
- Partial list of techniques:
 - finite difference & finite element analysis
 - frequency-domain & time-domain techniques
 - integral equation & differential equation techniques
 - diffraction theories
 - hybrid methods
 - modal expansions
 - perturbation methods
 - physical optics
 - wavelet and multipole techniques

INSTRUCTIONS FOR AUTHORS AND TIMETABLE

For both the summary and final paper, please supply the following data for the principal author: name, address, E-mail address, fax, and phone numbers for both work and home.

October 25, 1996: Submission deadline. Submit four copies of a 300-500 word summary to the Technical Program Chairman
November 25, 1996: Authors notified of acceptance.
January 10, 1997: Submission deadline for camera-ready copy. The recommended paper length is 6 pages, with 8 pages as a maximum, including figures.

The registration fee per person for the ACES Symposium will be approximately \$235. The exact fee will be announced later.

SHORT COURSES

Short courses will be offered in conjunction with the Symposium covering numerical techniques, computational methods, surveys of EM analysis and code usage instruction. It is anticipated that short courses will be conducted principally on Monday, March 17 and Friday, March 21. The fee for a short course is expected to be approximately \$90 per person for a half-day course and \$140 for a full-day course, if booked before March 3, 1997. Full details of the 1997 ACES Symposium will be available by November 1996. Short course attendance is not covered by the Symposium Registration Fee!

EXHIBITS

Vendor booths and demonstrations will feature commercial products, computer hardware and software demonstrations, and small company capabilities.

The 1997 ACES Symposium is sponsored by ACES, NPS, DOE, U of KY, U of IL, DOD, SIAM and AMTA in cooperation with the IEEE Antennas and Propagation Society, the IEEE Electromagnetic Compatibility Society and USNC/URSI.



1997 IEEE RADIO FREQUENCY INTEGRATED CIRCUITS (RFIC) SYMPOSIUM

Denver, CO—June 9-10, 1997

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Members at Large

Mahesh Kumar
Val Peterson
Eric Strut
Eliot Cohen
Reynold Kagiwada
Tsuneo Tokumitsu

FIRST CALL FOR PAPERS for a New & Exciting Symposium on RFICS



Got a hot chip or module for wireless systems? Does it have an antenna at one end and a Digital Signal Processor at the other end? Looking for folks that talk high frequency as well as low cost? Developed a highly integrated IC or a nifty package? Then send your paper to the 1997 IEEE RFIC Symposium! This Symposium will be held in Denver Colorado, 8-10 June 1997 in conjunction with the IEEE MTT-S International Microwave Symposium and it opens the 'Microwave Week', the biggest RF/Microwave get together of the year.

This RFIC Symposium expands from the previous Microwave and Millimeter Wave Monolithic Circuit (MMWMC) Symposium. In the time since the MMWMC began (1982), high frequency IC technology has rapidly developed and its applications have become wide spread in the RF, microwave and millimeter wave spectrum. The symposium will now shift to being a premiere conference announcing highly integrated ICs or subsystems that include RF functions at any frequency.

Papers are solicited describing original work on IC design, fabrication, testing and packaging that supports RF, microwave and millimeter-wave applications, including analog, mixed signal, and mixed-mode ICs and subsystems for commercial or military applications including wireless communications, broadband communications, analog and digital mobile communications, intelligent transportation systems, broadband access modems, high speed optical links and radar systems.

Additional information is available at <http://www.ieee.org/mtt.html>

PAPER SUBMISSION DEADLINE: DECEMBER 2, 1996

Technical areas of interest and topics suitable for this NEW symposium are listed below.

Highly integrated RFICs in any semiconductor technology:

- Si, SiGe, SOI, GaAs, InP, SiC, etc.
- Circuit implementations in:
 - CMOS, BiCMOS, SiBipolar, MOSFET, JFETS
 - MESFET, HEMTs, PHEMT or HBT
- Front-end of a transceiver, "Radio on A Chip"
- Receivers, transmitters, control circuits, portable communication circuits
- Radio Frequency Identification (RFID)
- T/R Modules
- Analog subsystems, Mixed-Technology ICs, A/D, D/A and mixed Mode ICs
- Integrated filters and Integrated Antennas
- High speed optical fiber/cable communication ICs

Low cost RF subsystems realization such as:

- Chip area compaction
- Design for testability
- Low cost packaging
- Low cost technologies at high frequencies

Innovative RFIC design, testing or characterization techniques for:

- High efficiency
- Low standby power
- Low cost

Packaging for RF monolithic ICs:

- Flip-chip on hybrid or Si
- Chip scale packaging
- 3-D or multi level designs
- Multi-chip modules

Intelligent Transportation Systems (ITS)
Millimeter wave communication ICs
Microwave and millimeter monolithic ICs.

RFIC Symposium Paper Evaluation Criteria

All submissions are reviewed by the Technical Program Committee based on a scoring criteria giving equal weighting of the following four factors:

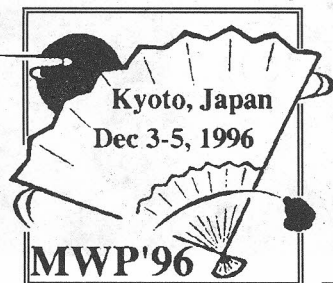
1. Originality—How is the contribution unique and significant?
2. Quantitative Content—The summary should give an explicit description of the work with complete supporting data and adequate references to the existing literature.
3. Quality—The writing and figures must clearly communicate the author's purpose and results.
4. Interest to RFIC symposium participants—Why should this symposium support this work??

Authors are required to submit 20 copies of a 500-1000 word summary which includes a 30-50 word abstract and the complete mailing address of the author(s). **Please indicate Technical Areas of Interest and Topic at the top page of the paper.** The summary should not exceed four pages of the text and figures; only the first four pages of longer summaries will be reviewed. Authors should clearly explain, what has been achieved, how the results were accomplished, how this effort compares with other work in the field and what is the significance of their work. **The paper summary and abstract must be in English and be received before December 2, 1996. Late submissions will not be considered.** Submissions should be sent to:

Vijay Nair
1997 RFIC TPC Chairman
C/O LRW Associates/Chesapeake Mailing Services
707 E. Ordnance Road, Suite 401
Baltimore, Maryland 21226-1741
USA
Tel: (410) 768-8757



Microwave Photonics



December 3-5, 1996, ATRI, Kyoto, Japan
The Institute of Electronics, Information
and Communication Engineers (IEICE)



The Topical Meeting on Microwave Photonics in Kyoto, December 1996 is the first international conference planned in Japan as the sixth of a series on this subject following ones in France (November 1994) and in USA (August 1995).

Microwave photonics is growing from the interdisciplinary research area between microwave technology and optoelectronics. It is a promising new concept for opening up novel information and communication technologies. Examples are the rapidly developing field of fiber-optic microwave and millimeter-wave subcarrier transmission link technologies for microcell or picocell mobile systems, as well as radio local area networks, phased array antennas, and various measurement systems. Microwave/millimeter-wave signal processing techniques composed of photonic devices will play an important role in realizing these systems.

The objective of the Meeting is to provide a forum for the technical communities representing device development and fabrication, system design and architectures, and their users, in which to explore the future direction of this held.

The meeting is sponsored by IEICE, in corporation with the IEEE Lasers and Electro-Optics Society (LEOS), the IEEE Microwave Theory and Techniques Society (MTT-S), IEEE LEOS Tokyo Chapter and IEEE MTT-S Tokyo Chapter.

The working language of the meeting will be English.

Scope

Relevant topics of interest include, but are not limited to, the following:

1. Microwave Signal Transmission and Distribution by Light,
2. Microwave Fiber-Optic Links,
3. Optically Fed Wireless Communication Systems,
4. Chip-to-Chip Optical Interconnects for Gigabit Circuits,
5. Microwave Signal Processing by Photonic Technology,
6. Optically Controlled Phased Array Antennas,
7. Microwave Photonics for Measurements,
8. On-Chip Optical Characterization of MMICs,
9. Optical Control of Microwave Devices and Circuits,
10. Optical Generation and Control of Fast Electric Signals,
11. Ultrashort Light Pulse Technologies for Millimeter-Wave Applications,
12. Ultrafast Optoelectronics, Devices and Applications,
13. High-Speed Light Modulation and Detection,
14. Heterodyning and Mixing of Light and Microwave Signals, and
15. Material and Device Technologies for Microwave Photonics.

The meeting will offer a limited number of invited papers presented by experts of international repute and a special symposium in which to discuss the impact and role of microwave photonics in information and communication technologies of the next generation. A session for post-deadline papers is planned that will discuss the newest evolution and the latest results.

Please note that papers exceeding the 4-page limit will not be accepted for review. Authors will be notified by mid September, 1996 whether their papers have been accepted. Receipt and notification will be sent to the first author, unless otherwise instructed. No submitted paper will be returned to authors. Post-deadline papers will also be solicited. Details on the submission of post-deadline papers will be announced in the final call for papers.

Conference Site

The conference site, Advanced Telecommunication Research Institute International (ATRI), is in a newly developed Kansai Science City located at the intersection of Kyoto, Nara and Osaka Prefectures. It takes around one hour by train or car from either the center of Kyoto or Nara and also from the downtown of Osaka. Join us at MWP '96 and enjoy Japan in late autumn. The region is in rich history, culture and beautiful nature including mountain trees in their brilliant crimson tints.

Information

A special workshop focused on a hot topical subject will be held in the following day after the meeting on the same site. Details will be fixed by next spring.

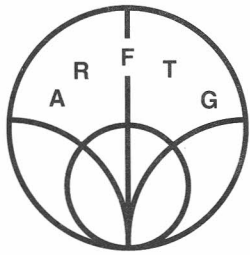
The registration fee for the meeting will be 35,000 yen for all members of the science and technological community, which includes admission to all technical sessions, get-together party, conference reception, lunches and dinners during the meeting, refreshments in the morning and breaks, transportation between conference site and the nearby railway station, and a copy of the technical digest. A student rate will also be set.

Further information about meeting registration together with hotel accommodation and transportation will be announced in the final call for papers available in April, 1996. A www (world wide web) home page for the meeting will also be opened by next spring. The advance program will appear in October, 1996.

For more information about the meeting, including paper submission, please contact the following address.

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Short Course on RF and Microwave Measurements for Wireless Applications

December 3-4, 1996
Clearwater, Florida

NIST

Preliminary Announcement

The Automated Radio Frequency Techniques Group (ARFTG), in cooperation with the National Institute of Standards and Technology (NIST), will offer its 1996 Short Course on RF and Microwave Measurements for Wireless Applications in Clearwater, FL on December 3 and 4. This course, held in conjunction with the 48th ARFTG conference (Dec. 5-6), is designed for engineers and scientists concerned with accurate measurement of RF and microwave quantities. The curriculum will specifically support the conference theme of "RF Nonlinearity Measurements."

The first day of the course will cover microwave measurement fundamentals, including microwave circuit theory, vector network analyzers, scattering parameters, time domain, power, and noise. It will include a discussion of cables, connectors, fixtures, probes and on-wafer measurements. This will provide an excellent introduction for newcomers to the field or a good review for those familiar with RF and microwave measurements.

The second day will highlight topics specifically related to RF nonlinear measurements. Topics to be covered include spectrum analysis, phase noise, load-pull, adjacent channel power, and amplifier nonlinearity characterization. This will help build a good base of common understanding to set the stage for the advanced topics to be presented at the conference.

All sessions will be held in the Radisson Sand Key Resort in Clearwater, Florida, site of the ARFTG Conference. The course registration fee is \$300 and includes lunch on both days. For those who wish to attend only the second day, the fee will be \$175. In either case, notes for both days' lectures will be provided. Class size is strictly limited, with preference to those attending both days.

For more information contact:

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First World Congress on Microwave Processing

Microwave and RF Technology—
From Science to Application

5-9 January 1997

Hilton Hotel at Walt Disney Village
Lake Buena Vista, Florida, U.S.A.

A major international Congress of invited lectures and contributed platform and poster papers covering the field of microwave and radiofrequency processing for both scientists and users:

- Focused on the science and applications of microwave and radiofrequency processing technologies.
- Organized by members and leaders of the ten endorsing societies and committed to technology transfer through world class speakers and programs.
- Emphasizing the latest emerging microwave and radiofrequency processing technologies.
- Bridging science to applications to users and electric utility companies.

There are world class plenary and invited speakers, a limited number of submitted platform reports and two high profile poster sessions.

Who Should Attend

Scientists, engineers and researchers developing new applications involving microwave and RF heating.

Utility company marketing and technical representatives interested in as-

sisting industrial companies to become more productive through the use of microwave and RF electrotechnologies.

Managers and engineers of industrial companies seeking new techniques and competitive advantages in process heat operations.

Suppliers of microwave and RF heating equipment, accessories and instrumentation desiring broad international exposure and contacts.

Technology Applications Program

Geared specifically to users and their utility representatives and covering the essentials for successful applications in the processing of: rubber, meat, pharmaceuticals, engineering, lumber, textiles, baking, drying and joining.

Special Events

European Roundtable Organized by AMPERE. Japanese Tea - A Technology Transfer Session by IEAJ. Wednesday evening informal family activity.

Industrial Exhibits

Equipment and services exhibits are planned as part of the Congress. A special information package for ex-

hibitors can be obtained by contacting the Congress Executive Offices.

How to Register

Early Registration Forms for the Congress are included with this brochure and can also be obtained from the Congress Executive Office at 7519 Ridge Road, Frederick, MD 21702-3519, U.S.A. (Voice: 301-663-1915; Fax 301-371-8955; e-mail 75230,1222@compuserve.com)

Payment

Registration fees can be paid via VISA/ MasterCard/Diners Club, by a check in U.S. dollars, drawn on a U.S. bank and made payable to W/L Associates, Ltd. for the Microwave World Congress, or by wire transfer to: Fredericktown Bank & Trust Company, Frederick, Maryland, USA; Account Name - W/L Associates, Ltd.; Account Number-131431; Routing No. 055000288. Specifically note for Microwave World Congress.

Cancellation Policy

Written cancellation must be received at the Congress office no later than 1 December, 1996, for a full refund. No refunds will be given after 1 December, 1996. There are no refunds for no-shows other than a documented medical emergency.

CALL FOR PAPERS MICROWAVE TECHNOLOGY SYMPOSIUM (ISRAMT '97)

The 6th International Symposium on Recent Advances in Microwave Technology (ISRAMT '97) sponsored by the University of Nevada, Reno, and the Chinese Institute of Electronics is scheduled from August 4-7, 1997 in Beijing, China. The Symposium will cover all the topics in Microwave Technology and its Applications including: Components, Solid State Devices, Antenna and Radar Technology, MICs and mm-ICs, Microwave On-board Equipment, Communication Systems, Remote Sensing, Electro-Optics, Biological Effects and Applications, CAD Techniques, Propagation and Measurement, Microwave/mm-wave Optical Technology, Microwave Superconductivity, Industry and Environment, and Microwave Education.

Exhibits of Industrial Products and Workshops are also planned. One original and 3 copies of the 4-page manuscript prepared according to the instructions (sent on request) are required by January 31, 1997. The working language of the symposium will be English. For additional information regarding manuscripts, industrial exhibits and workshops, please contact:

Banmali Rawat Technical Program Co-Chair Dept. of Electrical Engineering/MS 260 University of Nevada Reno, Nevada 89557-0153, U.S.A. Phone: (702) 784-6927 Fax: (702) 784-6627 e-mail: rawat@moriah.ee.unr.edu

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Call for Papers I T S C '97 IEEE Conference on Intelligent Transportation Systems

**Boston, Massachusetts
November 9-12, 1997**

<http://www.ieee.org/itsc/itsc97>
IEEE Boston Section Tel: 617-890-5290
255 Bear Hill Road Fax: 617-890-5294
Waltham, MA 02154 Email: sec.boston@ieee.org

The IEEE Intelligent Transportation Systems Committee (ITSC) is sponsoring a conference on basic research and present and future applications of leading-edge advances in communications, computers, control and related electronics-based technologies to Intelligent Transportation Systems. The conference incorporates the VNIS Conference and the Intelligent Vehicles Symposium.

Program Topics

- Communications
- Computers
- Control
- Decision Systems
- Imaging and Image Analysis
- Information Systems
- Man-Machine Interfaces
- Reliability & Quality Assurance
- Sensors
- Signal Processing
- Simulation
- Standards
- Systems
- Technology Forecasting & Transfer

IEEE Sponsoring Societies

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- Control Systems
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- Robotics & Automation
- Signal Processing
- Systems, Man & Cybernetics
- Vehicular Technology

Supporting Organizations

The following organizations are participating:

- DGON
- IEE
- ION
- ITE
- ITS America
- ITS Mass.
- PATH
- RIN
- US DOT
- VERTIS

To submit:

Submit a letter of intent by November 15, 1996 with the

- Author's affiliation, return address, phone number, and email address
- Title and topic of the proposed paper
- For tutorial/special sessions, also submit speaker names

Draft papers, to be submitted by April 1, 1997, will be reviewed for technical content, originality, completeness and clarity.

Submit to:

Professor U. Ozgüner — ITSC '97
The Ohio State University
Center for Intelligent Transportation Research
2015 Neil Avenue
Columbus, OH 43210 USA

Deadlines

Letter of intent	November 15, 1996
Tutorial/special session organizers contacted	January 1, 1997
Draft papers due for peer review	April 1, 1997
Notification of acceptance	June 30, 1997
Camera-ready copy for proceedings due	August 1, 1997

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**1997 SBMO/IEEE MTT-S INTERNATIONAL
MICROWAVE AND OPTOELECTRONICS
CONFERENCE**

Natal, Brazil, August 11-14, 1997

**FINAL CALL FOR PAPERS**

The 1997 SBMO/IEEE MTT-S International Microwave and Optoelectronics Conference, organized by the Brazilian Microwave and Optoelectronics Society (SBMO), and co-sponsored by the IEEE Microwave Theory and Techniques Society (IEEE MTT-S), will be held in August 11-14, 1997, in Natal, Brazil.

This Conference will provide a major international forum for the exchange of information on research and recent developments in the field of RF, Microwaves, Millimeter Waves, Antennas, Radio Propagation, Optics and Optoelectronics.

General information about the Conference may be obtained from Dr. A. G. d'Assunção, Steering Committee Chair, fax: +55 84 231 4254 / 9048, E-mail: adaildo@ncc.ufrn.br.

Technical program inquiries may be directed to Dr. H. C. C. Fernandes, Technical Program Chair, fax: +55 84 231 4254 / 9048, E-mail: humbecf@ncc.ufrn.br.

Papers are invited for consideration by the Technical Program Committee describing original work on the suggested topics listed below.

- | | |
|------------------------------------------------------|-------------------------------------------|
| 1. Medical and Industrial Applications | 13. Field Theory and Guided Waves |
| 2. Microwave and Optical Materials | 14. Numerical Methods in Electromagnetics |
| 3. Microwave and Millimeter Wave Integrated Circuits | 15. Antennas and Arrays |
| 4. Monolithic Integrated Circuits | 16. Scattering and Diffraction |
| 5. Optical and SAW Devices and Techniques | 17. Radio Propagation and Remote Sensing |
| 6. Active and Passive Devices and Components | 18. Radio and Radar Meteorology |
| 7. Microwave/Optical Integration | 19. Wireless and Mobile Communications |
| 8. Packaging Techniques | 20. Digital Radio Systems |
| 9. Computer Aided Design and Modeling | 21. Optical and Satellite Communications |
| 10. Microwave and Optical Measurements | 22. Superconductivity Technology |
| 11. Microwave Techniques in Radar and ECM | 23. Microwave and Optoelectronics Systems |
| 12. Microwave and Optical Education | 24. Others |

A selection of invited speakers will highlight important and developing areas.

Authors are asked to submit five copies of their summaries, which should be typed single-spaced and occupy two A4 pages (including graphs, diagrams, and references). The summary should include an abstract, and should emphasize what is new in the area. The summary should also include a brief conclusion.

DEADLINE FOR SUMMARY SUBMISSION: November 8, 1996.

The title of the paper, author's name, affiliation, full address, telephone/fax numbers, and E-mail address should be given in a separate A4 page, together with the topic reference number that seems most appropriate to the work. Number 24 should be used for topics not listed above.

Authors will be notified of the decision of the Technical Program Committee by early February 1997. Authors of selected summaries will be asked to provide a full typescript, in camera ready form, of no more than six A4 pages. Instructions for the preparation of papers will be mailed with the notification letter.

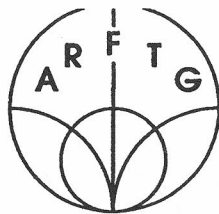
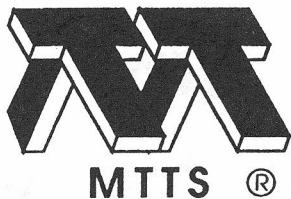
The paper will be assessed by an international review board. Acceptance for inclusion in the Book of Proceedings and presentation at the Conference will be based on the full typescripts. English will be the official language of the Conference.

Authors of some selected papers accepted for presentation in this Conference will be invited to submit an extended version of their work, for publication in the MTT Transactions.

Address correspondence and papers to:

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CALL FOR PAPERS

48th Conference

Clearwater, Florida, Dec 5-6, 1996

Non-Linearity Measurements

The Automatic RF Techniques group will hold its 48th Conference at the Radisson Sand Key Resort in Clearwater Florida on Thursday December 5th and Friday December 6th. The conference technical theme is Non-Linearity Measurements.

Communications is the growth area in the electronics industry, and the trend in communications is toward digital systems. In commercial applications areas such as mobile telephony or CATV and in military applications for surveillance or radar, digital methods are providing significant performance improvements. The non-linear characteristics of these digital systems are creating substantial simulation and measurement challenges.

Papers are solicited relating to test requirements, methods and techniques, test equipment design, performance results and environmental considerations. Both transmitter and receiver non-linear phenomena are requested. Measurement topics such as Adjacent Channel Power, Noise Power Ratio, Load Pull, Bit-Error Rate, Noise, Noise Parameters and Power are of concern.

Papers are also invited in other areas of automated microwave and RF testing including calibration issues, MMIC related measurements and other topics of interest to the RF/Microwave community.

Presentations should be informal, 20 minute talks using view graphs or 35mm slides. Authors are requested to submit two copies each of a one page abstract and a 500 to 1000 word summary including illustrations, to allow evaluation with regard to the interests of the attendees and for advance publicity. This submittal should be made to the Technical Program Chair no later than **September 1, 1996**. Final deadline for full camera ready papers is October 7, 1996. Additional information can be obtained from the Conference Chair. Manufacturers interested in exhibiting should contact the Exhibits Chair.



First Annual



Wireless Communications Conference



Regal Harvest House
Boulder, Colorado
August 19-21, 1996



With the pace of the wireless revolution threatening to overwhelm engineers as well as consumers, we struggle to keep abreast with critical developments in fields which seem increasingly distant from our own specialty. The WCC offers a broad and integrated perspective, consistent with the wide interests of its cosponsors:

- ISHM – The Microelectronics Society
- IEEE Components, Packaging, and Manufacturing Technology Society
- IEEE Microwave Theory and Techniques Society
- National Institute of Standards and Technology (U.S.A.)

The 49 presentations will provide detailed insight into developments at the world's leading companies working in wireless technologies such as systems, active and passive components, measurements, packaging, antennas, and propagation. In addition, a special session will focus on roadmapping the wireless future and prioritizing technical needs for industry, academia, and government. Another session, held at the National Institute of Standards and Technology, offers on-site presentations in four laboratories developing measurements for wireless communications. Tabletop exhibits will be on display at a Tuesday night reception (contact organizers to arrange participation).

Please join us in beautiful Boulder, at the foot of the Rocky Mountains, for a fun and lively meeting and the opportunity for outstanding technical interactions.

The full program and registration forms are available at:

<http://www.ishm.ee.vt.edu/wcc.html>

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— Scenes from IMS '96 —

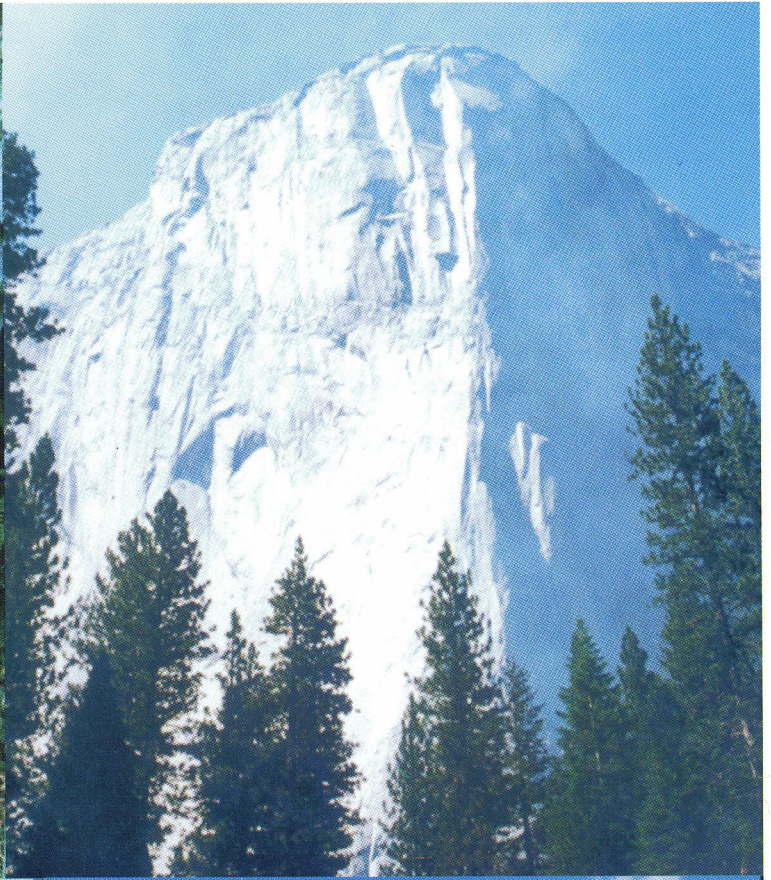


— Scenes from IMS '96 —



/MTT-S Membershi

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