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NEWSLETTER

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Harold Sobol, 1998 Microwave Career Award Honoree, pg. 27

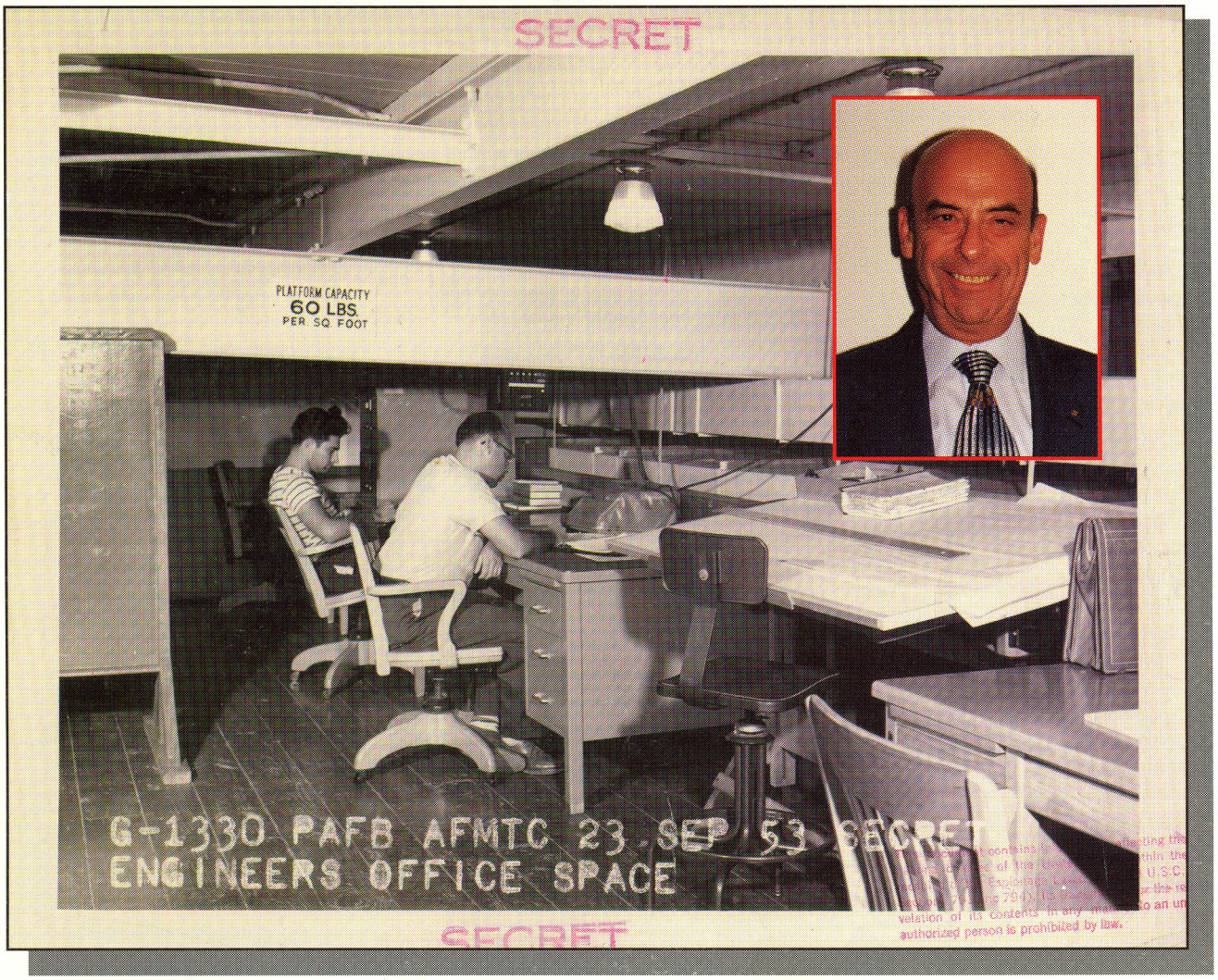

Figure 1. Patrick Air Force Base, 1953; the author (right) at work on the BOMARC program. Note the photograph was classified as secret.

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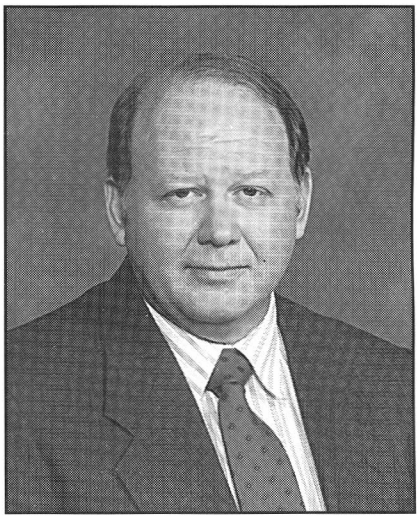

Editor's Message

Looking forward to Microwave week, June 7-12, in Baltimore. The TPC meeting in January was great, there were lots of good papers to review and Baltimore had unseasonally warm weather and so was beautiful in January. The Baltimore Aquarium is a don't miss, the shark tank was incredible. Hope to see you in Baltimore.

Regards,

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The MTT Digital Library Project Continues to Archive All MTT Publications

The MTT archive project continues on track. So far we have archived 5 CDROMS, up to 1972. We will start making the 1997 annual CDROM soon. A breif summary of the three projects follows:

Project 1, Complete Archive

- Complete Archive of all Publications Since 1953
- Expect 17 CDROM Set
- Target Cost to Members- 5$/CD, 100$ total
- First 5 CDROMs Completed, 1953-1975
- Thanks to Ted Saad for contributing all hardcopies
- Thanks to various people for RFIC Symposium Digests

Project 2, Cumulative Abstract Index

- Based on Complete Archive- Similar to 1997 Symposium Index
- Stand-Alone, but Offering Special Cross-CDROM Approach
- Plan to Update and Offer Every Year to All Members

Project 3, 1997 Annual CDROM

- Give to Journal Subscribers for 5$ (TBD)
- Offer to Non-Subscribers for $10 (TBD)
- Offer to Non-Members at non-member subscription rate
- Will Use Denver IMS and IEEE Pubs Material

Near Term Actions:

- Signed Contract
- Completed CDROM #5, from 1953-1975
- Create a 1997 annual CDROM
- Get CDROM Reviewers- need 20 to 60 people to review CDROMS
- Finalize IEEE Pubs Input
- Marketing and Distribution plan
- Decide on Costs to members, shooting for $120 for a 17 CDROM set

If you would like to help review a CDROM for quality of reproduction, including about 10 hours of time to "flip" through 1/3 of a CDROM, please contact Charlie Jackson at c.jackson@iee.org.

MTT Society

Ombudsman

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I have been selected by the Microwave Theory and Techniques Society Administrative Committee (ADCOM) to continue serving as your Ombudsman for 1998. It was a pleasure to serve in previous years and I look forward to continuing in 1998. The purpose of the Ombudsman is to receive complaints and assist members in solving problems encountered obtaining membership services from IEEE and MTT-S.

As your Ombudsman in 1998, I received 71 inquiries and suggestions (34 non-US) from MTT-S members. This is much higher than the 24 received in 1996. Seventy of the inquiries were made by e-mail, which is convenient for me to answer. Responses were made to all requests.

As in past years, members suggested that MTT-S periodicals be packaged for mailing in plastic wrappers instead of the traditional brown paper sleeve. This will cost more but will eliminate the possibility of the periodical falling out of the sleeve and provide a more rugged package to survive the mail without damage. ADCOM acted on this request at the January 1998 meeting and approved that future MTT-S periodicals be packaged in the plastic wrapper. Past suggestions requested that past and future MTT-S periodicals be put on CD ROM along with an index and be offered to members. This was approved at the January 1997 ADCOM meeting and this project is proceeding well. MTT-S periodicals are now in electronic form and are viewable to members who subscribed to them on the web by visiting http://www.opera.ieee.org/. Instructions on registering and obtaining your user ID are located on that web site.

Thirteen members wanted to receive the MTT-S Transactions and or MTT-S Microwave and Guided Wave Letters and were not receiving them. In checking with IEEE it was found that when they joined MTT-S they had chosen not to receive the publications. The basic MTT-S membership cost of $8/year includes the MTT-S newsletter and other member services. For an additional cost, members are given the choice of subscribing to the MTT-S Transactions ($13/year), the MTT-S Microwave and Guided Wave Letters for $8/year, or both ($21/year). This way members can choose what they want. I informed the members that they need to request the periodicals from IEEE. Members can call in their order using a credit card. Toll free in US (800) 678-4333 or (732) 981-0060. Members can also FAX in their order with credit card number, type and expiration date to the following number: (732) 562-6380 Attention Member Services. Members can e-mail their order using their credit card number, type, and expiration date. E-mail number is: member.services@ieee.org.

Eight members requested missing issues which were mailed to them. Eight members requested information on the 1998 International Microwave Symposium. To obtain this information, visit the MTT-S web page at http://www.mtt.org/ and to International Microwave Symposia then go to IMS 98 Baltimore, MD for information. Information is available for papers, technical session, workshops, panel sessions, focused sessions, hotels, travel, restaurants, etc.

I replied to six technical questions and responded to four paper requests. Four members requested membership status and three members complained about the lateness of the MTT-S Newsletter which was rectified. Three members wanted the MTT-S IMS Digest. Digests as well as any other periodicals can be ordered through IEEE by calling IEEE toll free in US (800) 678-4333 or (732) 981-0060, and asking for order department.

I received two requests in each of the following four areas: Transactions issues, becoming a senior member, exhibiting at 98 IMS, and needing a membership card. I received one request in the following 14 areas: how to become a MTT-S member, name of AP-S Ombudsman, how to obtain plastic Smith Chart, contact information of a member, award information, information on Education Society, correct address, student free membership information, filter topics for Ph.D. dissertation, European Microwave conference date, mailing list, IMS CD ROM, IMS travel information, and a request to put meeting notice on MTT-S web site.

If you have been involved in electrical engineering (engineer, teacher, etc.) for 10 years with significant experience for 5 years, you can apply for senior member of the IEEE. Call IEEE and ask for a senior member application toll free in US at (800) 678-4333 or (732) 981-0060.

All requests were acted upon. 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.

MTT-S Education Committee – Activities and Plans

by
K.C. Gupta, Chair

Role of the Education Committee: According to MTT-S bylaws responsibilities of the Education Committee include the following. a) Promotion and coordination of the activities furthering the cause of education as it relates to the Society, and b) Institution and administration of educational aid programs to be wholly and partially sponsored by the Society. The cause of education, as it relates to MTT-S, includes (a) Education of students about to join the profession and potentially become a member of MTT-S, and (b) Education (and educational renewal) of members themselves. Recent activities of the Committee had concentrated on educational aids program. However the Committee intends to play a broader role, and is seeking MTT-S membership response to questions of the following nature: Should the Committee look at and try to influence RF and microwave curriculum that our members go through? Do we need activities oriented towards curricula for microwave education, activities trying to influence what "microwaves" is taught to students etc? Should the Committee encourage workshops, symposia and seminars on microwave education? Should the Committee try to provide a forum for curricula inputs needed, and provide a platform for brainstorming among microwave educators on the future of microwave education? Should the Committee sponsor and coordinate tutorials/short-courses for continuing education and training of MTT-S members? Thoughtful responses to these issues and other suggestions for MTT-S Education Committee are most welcome. Please contact the Committee Chair at **Error! Bookmark not defined.**

RF/Microwave Education Forum: In order to provide a platform to address some of the above questions and to discuss microwave education related issues, the Committee is organizing an ***RF/Microwave Education Forum*** at the 1998 IMS Symposium in Baltimore. This event is planned to be a continuing feature of the future IMS Symposia.

The purpose of the ***Forum*** is to serve as a venue for discussion and constructive debate among practitioners in microwave education; a vehicle for the introduction and diffusion of new ideas in RF and microwave education; and a means for networking and interchange with others having similar interests. A list of attendees will be circulated to help initiate networking and continued dialog among them.

The ***Forum*** is scheduled on Thursday, June 11, 1998, during the afternoon from 12:00 noon to 1:30 p.m. Although the intent is to keep the ***Forum*** informal, in view of the limited time, the following agenda has been proposed:

- Very brief position papers or statements by three to four invited speakers
  12:00 p.m. — 12:25 p.m.
- Open discussion and brainstorming
  12:25 p.m. — 1:25 p.m.
- Recapitulation and summary
  1:25 p.m. — 1:30 p.m.

All IMS participants and MTT-S members with a serious interest in educational issues are invited to join other like-minded individuals during this ***Forum*** for a stimulating hour of discussion on issues of current importance, and to contribute, as well as hear about, new ideas in RF and microwave education. Members of the audience are invited to participate in the open discussion by asking questions, presenting alternative views, reporting their own experiences, and bringing up other issues of interest. If you would like to present some remarks to the assembled attendees, please feel free to bring one or two overhead transparencies in support of your comments, in the interest of making an effective use of the limited time available.

If you would like to propose topics for discussion, or make other suggestions concerning the ***Forum***, please let the Coordinator of the event, Professor Madhu S. Gupta know, preferably via e-mail (m.gupta@ieee.org). In the interest of saving time, box lunch will be available for all attendees. For this

purpose, it is necessary to have a head count in advance, and we would appreciate it if you could let us know if you plan to attend the ***Forum***. (Madhu S. Gupta, Dept. of Electrical Engineering; Florida State University; Tallahassee, FL 32310 Tel. (850) 487-6450; FAX (850) 487-6479; e-mail m.gupta@ieee.org.

Education Committee on WEB

Additional information on the activities and plans of MTT-S Education Committee is available on Society's home page at http://www.mtt.org. We welcome readers/members suggestions on the additional items that may be included in this portion of the home page.

MTT-S Graduate Fellowship Program

The Microwave Theory and Techniques Society offers financial assistance to graduate students pursuing research in the area of microwave technology. The assistance is in the amount of $5000 for use by the student and is in addition to any other stipend the student may be receiving. Four awards are made each year and the winners are selected on the basis of a competitive evaluation of the information they provide in an application form and the accompanying documents. Typically, the deadline for applying is November 30th of a given year and the winners are announced by the end of March of the following year. The students receive the award checks at a ceremony at the International Microwave Symposium in June. The odds of winning are quite high; in 1998 for instance the odds were 1 in 7! These awards are free of any citizenship restrictions but both the student and the faculty advisor must be members of MTT. Further information about this subject and an application form can be found on the MTT web page at org.

For further details of this program, please contact Dr. Aditya Gupta, Coordinator of the Fellowship Program at *gupta.a.k@postal.essd.northgrum.com*

Automatic RF Techniques Group

ARFTG Celebrates Silver Anniversary in Portland

by Roger Marks, ARFTG/MTT-S Liaison

After 25 years of semiannual conferences, the Automatic Radio Frequency Techniques Group (ARFTG) celebrated its Silver Anniversary with the 50th ARFTG Conference on December 4-5, 1997. The meeting was an occasion for reflection as well as for the usual exploration of the latest developments in microwave measurements. The charming and historic Benson Hotel in Portland, Oregon provided the perfect ambiance for the congenial interactions that are ARFTG's hallmark.

Conference Chair Ed Godshalk had his hands full in arranging the events for the 73 registrants while, as ARFTG's Publications Chair, pulling together the conference digest. At the same time, Ed served as Technical Program Co-Chair along with John Sevic. While the conference theme of "Measurement Techniques for Digital Wireless Applications" demonstrated that ARFTG remains at the cutting edge, a historical session provided interesting retrospectives of the challenges of the past. An additional highlight was an entertaining post-banquet historical review of ARFTG by Ed Stevens, who chaired the 2nd ARFTG Conference in 1973 and was a member of the first ARFTG Steering Committee. For the text of Ed's ARFTG history, see the ARFTG Web Site.

The conference Technical Agenda is attached. Conference attendees voted to present the Best Paper Award to Roger Marks for the talk "Formulations of the Basic Vector Network Analyzer Error Model Including Switch Terms." Gerry Reeve was chosen to receive an award for Best Historical Paper for

his "History of Microwave Metrology at NIST."

ARFTG Exhibition Chair Mike Fennelly once again organized a strong interactive Exhibition. The Best Exhibitor Award went to the University of South Florida for the display of its Wireless and Microwave Instruction (WAMI) Laboratory, which introduces students to the field with stimulating experiments.

At the Awards Banquet, ARFTG President Kevin Kerwin presented the Best Paper Award for the 49th Conference to Gary Alley (in *absentia*). He presented the Best Exhibitor Award from the same conference to Hewlett-Packard.

Before the conference, on December 2-3, ARFTG and the National Institute of Standards and Technology presented their fourth annual Microwave Measurements Short Course, this time addressing "RF and Microwave Measurements for Wireless Applications." Organizers Bob Judish and Larry Dunleavy again achieved success, attracting 69 people. The course agenda is attached.

The membership elected two new members to the ARFTG Executive Committee (ExCom): Chip Wilker and Greg Burns. Bob Judish and Mike Fennelly were re-elected. Bill Pastori and Harmon Banning did not stand for re-election.The ExCom elected the 1998 ARFTG Officers: Ken Wong as President, Bob Judish as Vice President, and Pat Nolan as Secretary.

The 51st ARFTG Conference will be held at the Hyatt Regency Hotel in Baltimore, MD on Friday, June 12, 1998 in conjunction with the 1998 IEEE MTT-S International Microwave Symposium (IMS). This year's meeting will continue ARFTG's leading-edge telecommunications focus, with the topic "Characterization of Spread Spectrum Components and Systems." For information, see the ARFTG Web site or contact Conference Chair Greg Burns at burns.john@postal. essd.northgrum.com. Abstracts are due to Technical Program Chair Paul Oesterle (paul_oesterle@hp.com) by March 6, 1998. Expanded versions of accepted papers will again be considered for the Special Symposium Issue of the *IEEE Transactions on Microwave Theory and Techniques*; John Sevic (j.sevic@ieee.org) will serve as Associate Guest Editor.

1997 ARFTG/NIST Microwave Measurements Short Course ("RF and Microwave Measurements for Wireless Applications")	
December 2, 1997	**December 3, 1997**
Microwave Circuit Theory , *Dylan Williams - NIST*	**Phase Noise Measurements**, *Fred Walls - NIST*
Network Analyzer Error Models and Calibration Methods , *Doug Rytting - Hewlett-Packard*	**Microwave Load-Pull Measurements** *Mike Fennelly - ATN Microwave*
VNA Uncertainty Issues *John Juroshek - NIST*	**Circuit Verification for Wireless Communications**, *Joel Dunsmore - Hewlett Packard*
On-Wafer Measurements *Dylan Williams - NIST*	**Modulation Theory for Digital Wireless Communications,** *John Sevic - QUALCOMM*
Power Measurements *Steve Reyes - Giga-tronics*	**Fixturing Issues in RFIC Test** *Leonard Hayden - Cascade Microtech*
Receiver Noise Measurements *Bill Pastori - Maury Microwave*	**Time Domain Measurements** *Sedki Riad - Virginia Polytechnic Institute*
Spectrum Analysis *Morris Engelson - JMS*	**Time Domain Network Analysis** *Don DeGroot - NIST*

The 51st Conference again offers an excellent opportunity to exhibit your product. For information, contact Exhibition Chair Mike Fennelly at mfennelly@atn-microwave.com.

In conjunction with the 51st ARFTG Conference, ARFTG will cosponsor two joint sessions of IMS'98 at the Baltimore Convention Center on Thursday, June 11, 1998. Registrants of the ARFTG Conference are invited to attend these sessions, the papers from which will be printed in both the IMS and ARFTG digests. The topics are "Commercial and Industrial Microwave Systems" and "Digital Interconnection Techniques and Characterization at GHz Frequencies."

For information on ARFTG and all of these upcoming events, please see the ARFTG Web Site, maintained by Roger Marks, at **http://www.arftg.org** .

50th ARFTG Conference: Technical Agenda

Intermodulation Distortion Measurements

- Nonlinear Characterization by Harmonic Generation: An Alternative Technique for Measuring Intermodulation Distortions, Charles Wilker & Charles F. Carter III (*DuPont Superconductivity, Wilmington, DE*)
- The Measurement of Intermodulation Products on Passive Components and Transmission Lines, Bernhard Rosenberger (*Rosenberger Hochfrequenztechnik GmbH & Co., Tittmoning, Germany*)
- Power Amplifier Intermodulation Distortion Measurements, Tom Ruttan (*Maxtek Components Corp., Beaverton, OR*)

Historical Session

- A History of Microwave Wafer Probing, Eric Strid (*Cascade Microtech, Inc., Beaverton, OR*)
- History of Microwave Metrology at NIST, Gerome R. Reeve (*NIST, Boulder, CO*)
- A Brief Look Back at Microwave Noise Generator Calibration, Bill Pastori (*Maury Microwave, Ontario, CA (retired)*
- Vector Network Analysis and ARFTG: A Historical Perspective, Gary Simpson (*Maury Microwave, Ontario, CA*)

Design and Testing of Wireless Components and Systems

- Characterization and Simulation of a 915 MHz Wireless Receiver, Lawrence P. Dunleavy, Paul G. Flikkema, & Anbuselvan Kuppusamy (*University of South Florida, Tampa, FL*)
- Designing a C-Band Downconverter for High Testability Edward Grimes, Thomas Weller, Lawrence P. Dunleavy (*University of South Florida, Tampa, FL*), James Culver (*Raytheon E-Systems, St. Petersburg, FL*)
- The Effects of Line Width and Slot Etching on Silicon-Based CPW at MM-Wave Frequencies, Thomas Weller, Michael Imparato, Lawrence P. Dunleavy (*University of South Florida, Tampa, FL*), Rashaunda Henderson, Steven Robertson, Linda Katehi (*University of Michigan, Ann Arbor, MI*)

Power Sensors

- High Speed Power Measurements for Digital Wireless Applications, Ken Harvey (*Anritsu*)
- Vector Corrections for an Automated Power Sensor Calibration System, John Gregory Burns (*Northrup Grumman Corp., Baltimore, MD*)

CDMA Measurements and Relevant Load Pull Techniques

- ACPR, IM3 and their Correlation for a PCS CDMA Power Amplifier, Wang Xinwei, Hiroshi Nakamura (*OKI Techno Center, Singapore*) and Rajinder Singh (*Institute of Microelectronics, Singapore*)
- CDMA Load Pull Measurements with Harmonic Tuning and Harmonic Behavioral Modeling, Michael Fennelly, David Kinzel (*ATN Microwave, Inc., N. Billerica, MA*)
- Measurement of Large Signal Device Input Impedance During Load Pull, Gary Simpson, Mike Majerus (*Maury Microwave, Ontario, CA*)

Vector Network Analyzer Characterization

- A Method for Comparing Vector Network Analyzers, Donald C. DeGroot, Roger B. Marks, Jeffrey A. Jargon (*NIST, Boulder, CO*)
- Formulations of the Basic Vector Network Analyzer Error Model Including
- Switch Terms, Roger B. Marks (*NIST, Boulder, CO*)
- Characteristics and Accuracy of a Fully Corrected Four-Port Vector Network Analyzer, Manfred Schindler, Peter Phillips, Michael Fennelly, Vahé Adamian, P. Enquist (*ATN Microwave, Inc., N. Billerica, MA*)

Calibration, Measurements and Testing

- Series-Resistor Calibration, Dylan F. Williams, David K. Walker*NIST, Boulder, CO*
- Data Assessment of the ARFTG Microwave Vector Network Analyzer Measurement Comparison Program, Ken Wong (*Hewlett-Packard Co., Santa Rosa, CA*)

- A High Throughput On-Wafer RFIC Tester K. J. Kerwin, F.L. Bugely, R. Chavez, J. Marroquin, R. Laurell, D. Veteran, D. Olney, D. McGinty, G. L. Madonna (*Hewlett-Packard Co., Santa Rosa, CA*)

Panel Session: Digital Wireless Communication Systems Measurement

Michael Fennelly (*ATN Microwave, Inc., N. Billerica, MA*), Edward M. Godshalk (*Maxim Integrated Products, Beaverton, OR*), Leonard A. Hayden (*Cascade Microtech, Inc., Beaverton, OR*), Roger B. Marks (*NIST, Boulder, CO*), John F. Sevic (*Spectrian Corp., Sunnyvale, CA*), Gary Simpson (*Maury Microwave, Ontario, CA*)

Region 8 - The Fastest Growing Region

from the Transnational Committee

by Jozef Modelski
Vice-Chairmain.

Following my reports in Spring and Summer 1997 Newsletters, here is a brief information about 1997 year main activities of the MTT-S Transnational Committee (TC) in Region 8 and some intentions for 1998. The Region 8 with 31 MTT Chapters (30 are joint chapters between societies, mostly with AP-S and ED-S) is the fastest growing region for MTT membership and the number of different events as conferences workshops, lectures technical meetings, educational activities, etc.

The most important conference is annual European Microwave Conference. The EuMC-97 was held in Jerusalem with Asher Madjar as a Chairman (who is also Chairman of the Israel Chapter). For two years Rolf Jansen (Past TC Co-Chairman) and Roberto Sorrentino (1998 TC Vice-Chairman) as well as other MITT Officers from Region 8 have been strongly involved in transformation of the EuMC in a new format as European Microwave Week. It seems that EuMW-98 in Amsterdam (October 5-9, 1998) will be first great success.

Region 8 MTT Chapters in 1997 have organized, supported or sponsored:

- over 200 technical meetings and lectures and
- over 50 local or regional conferences workshops and schools with the number of attendes from 50 to more than 300. Twelve events have been financially supported from the TC budget. Some local conferences have become well known ones like MTOP (Germany), TELSIKS (Yugoslavia), ICATT (Ukraina), MIA-ME (Novosibirsk), CriMiCo (Sevastopol), ICARSM (Voronezh), MITEKO (Czech Republic), SAITINI (Bulgaria), etc.

The biggest number of workshops, local conferences and technical meetings has been organized by German MTT/AP Chapter, and by United Kingdom and Republic of Ireland MTT/ED/AP/LEO Joint Chapter.

The main activities of the TC in 1997 were connected with:

- the Phase IT of the MTT/ED initiative for aiding Eastern Europe and the Former Soviet Union (EE/FSU), i.e. consolidation and further expantion of the new Chapters;
- the Divisions I and IV Region 8 Chapters Meeting in Ludwigsburg (Germany) on September 21, 1997.

The Joint MTT/ED Initiative for Aiding EE/FSU

The results of MTT/ED Region 8 Chapters development initiatives (started in 1993/94 and completed in 3/97) are shown below - the following new chapters have been established:

New Chapter	Date
MTT/ED Egypt	4/94
MTT/ED/AP West Ukraina*	1/95
MTT/ED St. Petersburg, Russia	4/95
MTT/ED/AP Lithuania*	5/95

MTT/ED	
Bulgaria*	6/95
MTT/ED	
Saratov-Penza, Russia	7/95
MTT/ED	
Moscow, Russia*	8/95
MTT/ED/AP	
Nizhny Novgorod, **Russia***	3/96
MTT/AES/AP/ED	
East Ukraina	4/96
MTT/ED	
Central Ukraina*	5/96
MTT/ED	
Minsk, Belarus*	5/96
MTT/ED	
Novosibirsk, Russia	5/96
MTT/ED	
Republic of Georgia*	3/97

*IEEE and society memberships and publication subscriptions being subsidized by MTT&ED approximately 14 members until the end or 1999.

Basic activities of the Transnational Committee in 1997 were concentrated on the consolidation and further expansion of the new chapters. With great pleasure I can again confirm that these purposes have been successfully realizing. That has been possible as a result of huge engagement, magnificent enthusiasm and unusual laboriousness of the new Chapters Chairmen and other Officers. Almost all chapters are conducting a wide variety of activities, such as organizing conferences, workshops, regular technical and administrative meetings. They try to be in current contact with societies but Usually it is very difficult to create good cooperation with national sections and sometimes also with local professional societies.

On the base of the current activities and dynamics of the membership development I suppose that almost all of the new chapters will survive, even when the societies will end to subsidize memberships and publication subscriptions. It seems to me that now the strongest and the fastest growing chapters are East Ukraina (Kharkov) and Novosibirsk (Russia) Chapters.

For further consolidation process societies should:

- provide greater support for improving distinguished Lecturers Program (up to now it has worked not at all or very poorly) and Eastern European Library Program;
- support student membership and create student branches;
- improve communication with different MTT Committees;
- create cooperation between FSU chapters and other European chapters and organize joint events e.g. workshops, meetings, etc. Good examples are workshops organized by Benelux and Nizhny Novgorod Chapters;
- continue organization of Division I and Division IV Chapters meetings as annual or biannal events

Divisions Iand TV Region 8 Chapters Meetings

The second joint Divisions I and IV Region 8 Chapters Meeting was held on September 21, 1997 in Ludwigsburg near Stuttgart, Germany. This meeting grew out of MTT/ED Initiative (the first one was in Prague in September 1996 joint with EuMC-96). This time the meeting was held in conjunction with the European Solid State Device Research Conference (ESSDERC).

The meeting purposes were:

- improve communication among Region 8 chapter representatives and between chapters and society representatives,
- facilitate growth of new chapters and chapters affiliations,
- provide opportunity for chapters to highlight best practices and issues,
- provide training for chapter representatives in holding technical meetings (tutorial).

Attending the meeting were 52 people representing 9 societies and 35 chapters, from 25 countries in Region 8. The meeting, which started at 8.30 AM and ended at 6.30 PK featured a series of addresses from the two Division Directors, the Region 8 Director, society presidents and representatives, and then reports from all of the chapters present, The chapter reports highlighted best practices from each chapter and issues and problems facing the chapters- The last hour of the meeting was devoted to a tutorial on holding technical meetings that was given by Bruce F. G. Duff, the current ED Vice President. MTT-S AdCom was represented **by Prof A. Beyer, MTT-S Region 8** Coordinator and by me.

The meeting was chaired by Michael S. Adler, Director of Division I, and William G. Duff, Director of Division TV. Division I includes the CAS, CPMT, ED, and LEO societies, and the new SSC society. Division IV includes AP, BT, CE, EMC, Mag, and NPS societies. A combined Division I and TV Chapters meeting was held since most of the chapters in Region 8 are joint chapters involving the two

divisions. For example, of the more than 30 ED and MTT chapters in Region 8, over two-thirds are joint chapters between the societies. Furthermore, 12 new chapter-, have been formed since 1995 in the former Soviet Union and all of these are joint MTT/ED chapters.

1997 Divisions I & TV Region 8 Chapters Meeting (similar like 1996 one in Prague) proved to be very successful with regards to learning and understanding the needs of the chapters and determining appropriate solutions. It also served as a unique forum for Region 8 Chapter Chair with diversial technical backgrounds to meet with one another (and IEEE Societies Officers) and exchange information and ideas.

The 3rd Divisions I & IV Region 8 Chapters Meeting is proposed to be held Amsterdam on October 4, 1998 in conjugation with European Microwave Week '98.

Main Purposes of TC in 1998

Transnational Committee should be one of the basic tools of the Society for **moving** MTT-S further ahead on the transnational track and realizing globalization process (policy). Basically, TC has been concentrated on the activities outside North America - in Regions 8, 9 and 10. Many statistics as well as experiences from other societies support the notion that the local chapter activities arc one of the most important key to membership growth and improvement of society image. So TC should look for the new chapters opportunities in **Regions** 8, 9 and 10.

Number of MTT existing chapters are as following: in Region 8 - 31 chapters, in Region 9 - 3 chapters and in Region 10 - 12 ones.

Below are shown countries where seems to be possible to form chapters (or joint chapters).

Societies without Chapters (Membership Count)

Region 8

Austria
MTT(27), AP(3I), ED(38), LEO(16)

Croatia
MTT(8), AP(20), ED(9), LEO(4)

Denmark
MTT(34), AP(46), ED(18), LEO(21)

Iran
MTT(11), AP(18), ED(10), LEO(8)

Norway
MTT(22), AP(26), ED(20), LEO(19)

Portugal
MTT(14), AP(17), ED(10), LEO(19)

Romania
MTT(18), AP(11), - LEO(10)

Saudi Arabia
MTT(13), AP(21), ED(8), LEO(12)

Slovenia
MTT(5). AP(3), FD(13), LEO(6)

Region 9

Argentina
MTT(48), AP(115), ED(35), LEO(30)

Bahia
MTT(13), AP(16), ED(6), LEO(11)

Malaysia
MTT(18), AP(22), , LEO(8)

New Zealand
MTT(11), AP(25), ED(5), LEO(8)

Pakistan
MTT(5), AP(7), ED(6), LEO(6)

Quensland, Austr.
MTT(21), AP(21), ED(9), LEO(6)

Victorian, Australia
MTT(33), AP(44), ED(7), LEO(43)

Western Australia
MTT(5), AP(6), FD(3), LEO(8)

Recently, we have started with a such initiative in Austria and Portugal.

Other important purpose for TC is support joint events of the few chapters,

The good examples are:

- "International Workshops on Terahertz Electronics" organized by French and German Chapters
- "International Travelling Summer School on Microwaves and Lightwaves" by Germany, Italy, Poland, Czech Republic and Slovakia.

The more than 30 - and MTT chapters in Region 8, over two-thirds are joint chapters between the societies. Furthermore, 12 new chapters have been formed since 1995 in

Brasilia
MTT(7), AP(8), ED(7), LEO(O)

Chile
MT7(6), AP(11), ED(l), LEO(0)

Colombia
MTT(6), AP(31), ED(5), LEO(12)

Costarica
MTT(5), AP(6), ED(l), LEO(12)

Mexico
MTT(23), AP(29), I LEO(21)

Peru
MTT(9), AP(16), ED(9), LEO(9)

Puerto R. & Caraib.
MTT(11), AP(17), ED(3), LEO(6)

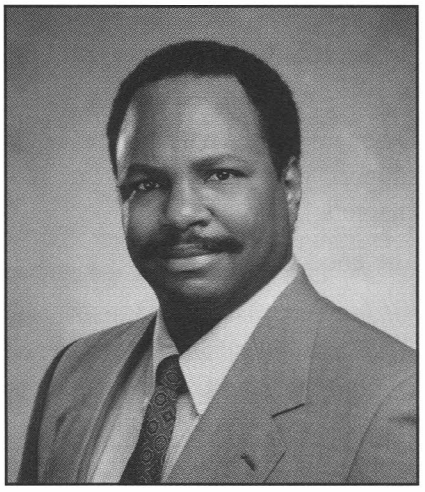
Region 10

Australian Cap, Terit.
MTT(8), AP(20),

Malaysia
MTT(18), AP(22), LEO(8)

New Zealand
MTT(11), AP(25), ED(5), LEO(8)

Chapter Records Around the World



Héctor J. De Los Santos

Beginning with this issue of the *IEEE MTT-S Newsletter* we start a new "chapter" on our quest to recognize the selfless, behind the scenes, hard work of our many Chapter Officer volunteers. Our immediate goal is to highlight 1997 Chapter activities by lifting up the officer names, their respective positions and terms of service, as well as a summary of the Chapter activities reflecting their efforts. Although Chapter response to our request for this information has been very enthusiastic, we would like to encourage those Chapters that still haven't done so to submit (*electronic mail* is preferred) the above information as soon as possible so they can be duly recognized in upcoming issues. In addition, we will also utilize this space to provide a rapid means for updating the roster of Chapter Officers.

Thanks for your efforts and we hope you will feel encouraged to continue submitting your reports to: *hjde1ossantos@ccgate.hac.com.*

New Chapter Officers for 1998

Atlanta: Dr. Joy Laskar, *Chair,* Mary Lynn Smith, *Secretary;* Rickey Cotton, *Program Chair.* Nanjing: Wen Xun Zhang, *Chair,* Dong Yi An, *Vice Chair.* **Switzerland:** Werner Baechtold, *Chair,* Rolf Huegli, *Vice-Chair,* Urs Lott, *Secretary.*

1997 Chapter Activities Summary

❖ **Atlanta:** Glenn D. Hopkins, *Chair*

(1) Dr. T. Itoh, "Active Integrated Antennas". (2) Dr. H. Morkoc, "Progree and Prospects of Wide Bandgap Nitrides". (3) Dr. A. Gasiewski, "Polarimetric Radiometry: From Laboratory to Satellite". (4) Dr. E. Brookner, "Phased Array Antennas for Radar, Communications, and ESM Sysrems-Undergoing a Revolution". (5) Dr. K Wakino, "Miniaturization of Microwave Components for Mobile Communications". (6) Dr. Y. Bar-Shalom, "Target Tracking: How to Get the Most Out of Your Sensors". (7) Dr. J. Shaeffer, "Computational Diagnostic Techniques for Electromagnetic Scattering: Analytical Imaging, Near Fields, and Surface Currents".

❖ **Central and South Italy:** Prof. P. Bernardi, *Chair* (3/96-3/99); Dr. S. Pisa, *Secretary* (3/96 - 3/99)

(1) Prof Raphael Kastner (Univ. of Tel-Aviv), "The Hybrid Ray — FDTD Moving Window Solution". (2) Prof. James C. Lin (Univ. of Illinois at Chicago), "Health Aspects of Mobile Communication Radiation". (3) Prof. James C. Lin (Univ. of Illinois at Chicago), "Transcatheter Microwave Ablation for Cardiac Arrythmias". (4) Prof. P. Excell (Univ. of Bradford, UK), "The British IBRETH Project-Interaction of the Body with Radiated Emission from Hand-Held Transceivers".

❖ **College Station:** R.D. Nevels, *Chair, C.* Nguyen, *Vice-Chair, S.* Wright, *SecretarylTreasurer.*

(1) Dr. R. Nevels (Texas A&M Univ.), "Method of Moments with a Wavelet Basis". (2) J. Spadea (Texas A&M Univ.), "Planar Elements for NMR Microscopic Sensor Arrays Using Printed Circuit Tehniques". (3) A. Echeverria. Del Rio (Texas A&M Univ.), "Analysis and Design of a Linear Amplifier System Using the Feedforward Technique". (4) P. Zepeda (Texas A&M Univ.), "Study of an Adjustable Radiating Slot Waveguide". (5) C. Montiel (Texas A&M Univ.), "A Novel Active Antenna With Self-Mixing and Wideband Varactor-Tuning Capabilities for Communications and Vehicle Ident. Appl.". (6) D. Irawadi (Texas A&M Univ.), "Active Antennas". (7) Dr. H. Lirig (Univ. Texas-Austin), "Radar Image Simulation-Feature Extractiori and Phenomenology Interpretation". (8) Dr. B. Young (Motorola Austin), 'E-M Analysis in Circuit Packaging". (9) B. Hinson (Texas A&M Univ.), "Narrow BAnd Wireless Filter". (10) Dr. J. Williams (Univ. of Houston), "Surface Wave Antennas". (11) W. Liu (Texas A&M Univ.), "Focusing of Charged PArticles". (12) J. Nelson 9Texas A&M Univ.), "Wideband Lang Couplers".

❖ **Columbus**: Dr. Bob Burkholder, *Chair,* Dr. Joel Johnson, *Vice-Chair,* Dr. Brian Baertlein, *Sec.lTreasurer.*

(1) W. Lee, " Wireless communication: A personal view". (2) R. Abou-Jaoude, "An overview of the automotive antenna research at the ElectroScience Laboratory". (3) D. McElroy, "Key technologies for future satellite communication systems". (4) K. Wakino, "Miniaturization techniques of microwave components or mobile communication systems" (Distinguished Lecturer). (5) Y. Leviatan, "Wavelets in Electromagnetics". (6) R.-C. Chou, "A real-time millimeter wave imaging radiometer", (7)M. F. Iskander, "Multimedia modules for engineering education".

❖ **Egypt:** Prof. Ibrahim A. Salem, *Chair*

(1) "Active high power RT pulse compression using optically switched resonant delay fines". (2) "Analysis & design of passive MMIC packages interconnection7'. (3) "Millimeter wave power combining". (4) "Phase variation due to perturbed earth-ionosphere waveguide walls".

❖ **Finland**: Dr. Keijo Nikoskinen, Chair, Dr. Jussi Tuovinen, Vice-Chair.

(1) Dr. F. Olyslager, "Diaphanuous Wedge". (2) Prof. D. Rutledge, "Solid-State Radio Sources". (3) Dr. M. Sypniewski, "Quick Wave - FDTD Electromagnetic Simulator". (4) Prof S. Tretyakov, "Modelling of Thin Composite Layers". (5) Prof. V.J. Vokurka, "SinglePlane Collimating Test Ranges for Large test Zone Dimensions above 500 Mhz". (6) Dr. S. Rikte, "Transients and Pulses in Complex Media".

❖ **Nanjing:** W. X. Zhang, Chair, Z. Y. Hu, Vice-Chair

(1) X. G. Zhang (Nanjing MArine Radar Inst.), "Design of High Power Microwave Filters". (2) Z. Li (Inst. Comm. Eng.), "Synthesis & Analysis of Microwave Filter with Non-equiripple Frequency Response". (3) Prof. D.-X. Xu, Prof. S.-S.Chen, and Dr. Z.-Q. Yun (Southeast Univ.), Forum on "Microwave & Millimeter Wave Biological Effects". (4) S.-Z. Zhu (East China Normal Univ.), "Optimization of Multilayered Dielectric Structure Parameters Using Genetic Algorithms". (5) D.-Y. An (East China Normal Univ.) "Nondestructive Test of the Defaults inside a Layred Planar Dielectric Structure". (6) G. Y. Zhang (Nanjing Res. Inst. of Electron. Tech.), "The Application of Microwave Technology in Advanced Phased Array Radars". (7) Y. Chang (Nanjing Res. Inst. of Electron. Tech.), "Recent Development of Phased Array Radar Systems". (8) Prof. Z.-Z. Wu, Dr. Z.-Q. Yun, and Dr. H.-B. Zhu (Nanjing Univ. of Post & Telecomm. and Southeast Univ.), Forum on "Propagation Modeling of Mobile Communications". (9) Prof. P.-S. Kildal (Chalmers Univ. of Tech.), "Artificial Soft and Hard Surface in Electromagnetics and Their Applications". (10) Prof. P.-S. Kildal (Chalmers Univ. of Tech.), "Development of Dual-Reflector Feed for the Arecibo Radio Telescope". (11) Dr. K. Li (Communications Res. Lab.), "Microwave Integrated Circuit Analysis by Using Partial BEM". (12) Dr. K. Li (Communications Res. Lab.), "Green's Functions and Electromagnetic Fields in Multilayered Dielectric Structure". (13) Dr. K. Li (Communications Res. Lab.), "Recent Research on Microwave Photonics". (14) M. Li, et al- (Nanjing REs. Inst. of Electronic Equipment), "Microwave Techniques used in Electronic Warfare". (15) M.-H. Qian (Nanjing Res. Inst. of

Electronic Equipment), "Development of Electronic Intelligence Satellites". (16) X.-X. Shen (Nanjing Electronic Tube Factory), "Review of the Applications of Microwave Energy in China". (17) Z.Z. Zhang (Nanjing Res. Inst. of Electronic Tech.), "Synthetic Aperture Radar Remote Sensing Technology and Applications". (18) P, H. Wu (Nanjing Univ.) "Research Progree on Superconductive Electronics". (19) Wu, Ranting (55th Institute), 'V/X/Ku Three Frequency Bands Feeder for Parabolic Antennas". (20) Wang, Qian (57th Institute), "A Series of Miniaturized Down Converter from 1.2GHz to 11.45GHz". (21) National Sympisium on Microwave Power Applications (at East China Normal Univ., Shanghai) -30 speakers from 20 affiliations. (22) S.-Q. Li (Nanjing Electronic Devices Res. Inst.), "Review on Microwave Technology in 1997". (23) W. X. Zhang (Southeast Univ.), "Review on Antennas & Propagation in 1997". (24) Technical visit: Antenna Auto-Measuring Systems, at Nanjing Marine Radar Inst., (25) Prof. G. Rebeiz (Univ. of Michigan), "Planar Millimeter-Wave Front-End Technology" (Distinguished Lecture). (26) Prof. G. Rebeiz (Univ. of Michigan), "Micromachining for Microwave and Millimeter-Wave Systems" (Distinguished Lecture).

❖ **Ottawa:** Hugh Reekie, Chair; Yezdi Tarnboli, Vice-Chair.

(1) Malcolm Dunne, "Maritime Coastal Defence Vessel Combat System Integration (MCDV)". (2)Ralph Coppola (Canadian Coastguard), Lecture & visit to the Candian Coastguard Radio Beacon & Differential - GPS site at Cardinal, Ontario with associated visit to the Canadian Coastguard Despatch Radio Centre at Prescot, on the St. Laurence Seaway. (3) Doug George, "GNATs Air Navigation Control/Display System".

❖ **Philadelphia:** Eric Holzman, *Chair,* William Jernison, *Vice-Chair.*

(1) Arthur Paolefla (Lockheed Martin), "Photodectors for Microwave Lightwave Systems". (2) John Bandler (OSA, Inc.), " EM optimization of RF and Microwave Circuits". (3) 15th Annual Benjamin Franklin Symposium, 3 invited speakers, plus half day session of papers. (4) John Mulholland (Lockheed Martin), 'Thinning of Phased Arrays Using Neural Networks".

❖ **Santa Clara Valley:** Larry Bums, *Chair,* Edmar Camargo, *Vice-Chair;* Steve Kenney, *Secretary;* Steve Brozovitch, *Treasurer.*

(1) Dr. Steve Brozovitch (Fujitsu). Dr. Brozovitch spoke about the design of power amplifiers using some of Fujitsu's microwave transistors. Amplifiers, bias circuitry and thermal effects were covered. (2) Robert Scholtz (USQ. Professor Scholtz spoke about his research on impulse radio. Instead of modulating a signal to send information as in typical narrowband radios, very short impulses are used to send broadband, multipath-intolerant signals. (3) Dick True (Litton). Dr. True's talk centered on microwave tubes used in high power amplifiers. The talk focused on the merging of solid-state driver circuitry with TWTA's. (4) Annual MTT short-course at the Stanford Linear Accelerator Center. Our Keynote speaker was Professor Abidi of UCLA, who spoke about CMOS IC transceivers. Other speakers covered topics such as microwave breadboarding, A/D converters, simulating communication systems, LMDS systems, and antenna design. (5) Nader Gamini (consultant). Mr. Gamini spoke about the design of a plastic package for a MMIC power amplifier. Other similar packages were also discussed along with their inherent advantages and disadvantages. (6) Donald Benson (nCHIP). Mr. Benson's talk was about the design and development of low-cost passive ICs containing resistors, capacitors and inductors. These. ICs can be attached directly to the surface of standard active ICs. (7) Joe Jensen (Hughes Research Labs). Mr. Jenson's talk was a summary of the work his group has been doing in the development of InP ICs. Topics covered were 50 GHz prescalars and multi-GHz A/D's. (8) Dr. George Bechtel (Strategies Unlimited). Dr. Bechtel talked about past predictions, current status and future forecasts of the GaAs IC industry. A comparison was made to past predictions and actual market events. (9) Dr. Bruce Kendall (3Corn). Dr. Kendall presented a light-hearted treatment of the history and operation of microwave ovens. The technical discussion was followed by an actual demonstration of interesting effects that can be created inside a typical microwave oven,such as lighting fluorescent bulbs and shooting fireballs.

❖ **South Africa:** Prof David B Davidson, *Chair* (1995-7); Prof John H Cloete, *Vice-Chair* (1995-7)

(1) D. Didascalou (Univ. Karlsruhe, Germany), "Wave propagation models for radio network planning". (2) BA Austin (Univ.

Liverpool, UK), "Basil Schonland: a South African scientific collossus". (3) D. B. Davidson (Univ. Stellenbosch), "Six months at Trinity College, and the FEM for high-frequency electromagnetics". (4) 1. P. Theron (Univ. Stellenbosch), "Post-doctoral work at Ohio State University on a noise radar".

❖ **Toronto:** T. Emilie Van Deventer, Chair.

(1) J.1. Bell (President, MaxLink Communications, Inc.),"Work in Progress". (2) Dr. L. Martins-Camelo (Spar Space Systems), "Satellite Antenna Design at Spar Aerospace Ltd.". (3) Prof. G. Eleftheriades (Univ. of Toronto), "Towards Millimeter- Wave Integrated-Circuit Wireless Front-Ends". (4) Prof. T. Hubing (Univ. of Missouri-Rolla), EMC Distinguished Lecturer, "Tools and Techniques for EMC Troubleshooting". (5) Other co-sponsored events included THE GEORGE SINCLAIR LECTURE SERIES (cosponsored by the Sinclair family, Sinclair Radio Laboratories Ltd.,Dept. of Electrical and Computer Engineering at the University of Toronto, IEEE Canadian Foundation, IEEE Toronto section)

❖ **Venezuela**: Aldo Bianchi, SM, *Chair* (1985-Present, Chapter founder), Rafael Sanchez, *Vice-Chair* (1991-Present)

(1) Marcos Hernandez y Julio Delgado, "Red de Datos del Banco Mercantil con Frame Relay". (2) Enrique Delgado y Mario Oliveira, "Frame Relay en la Red del Banco Union". (3) Wilkins Gomez y Eloy Malav é,"Desarrollo de un Laboratorio de Pruebas de Radios Digitales Para INFOSAT"'. (4) Wilkins Gomez y Eloy Malavé,"Radios Digitales teorfa y mediciones"

❖ **West Ukraine:** Nikolai N. Voitovich, *Chair;* Doseslav B. Kuryliak, Vice-Chair; Mykhailo 1. Andriychuk, *Sec. lTreasurer.*

(1) V. F. Emets (Institute of Applied Problems of Mechanics & Mathematics of NASU), "The inverse boundary problems of elastic wave scattering by the local obstacles (asymptotic approach)". (2) Dr. A. M. Yatsun (Ukraine State University of Forestry and Wood Technologies, Lviv), "Quasi-stationary electrical field and parametrical responce of capacity probe". (3) Prof. N. N. Voitovich, Dr. 0. M. Gis, Dr. Yu. P. Topolyuk (Institute of Applied Problems of Mechanics & Mathematics of NASU, Lviv), 'The Mean-Square Approximation of the finite function with free phase by the function with the finite spectrum". (4) Dr. P. 0. Savenko, (Institute of Applied Problems of Mechanics & Mathematics of NASU, Lviv), "Nonlinear Problems of the Synthesis Theory of the Radiating Systems and the Method of their Solving". (5) Dr. G. E. Karvitsky (Institute of Radio Astronomy of NASU, Kharkiv), "Dielectric Slab Eigen-Value Diffraction by Periodic Grating of Rectangular Patches". (6) Yu. 1. Koval'chyk (Physico-Mcchanical Institute of NASU, Lviv), "The Continual Wieners Integral Method for the Parabolic Equations". (7) Ya. P_ Kulynych (Physico-Mechanical IrLititute of NASU, Lviv), "Mathematical Modelling of Signals and Electromagnetic Fields of Search Systems in the Sea".

❖ **Washington DC/Northern Virginia:** Eric Funk, *Chair* (July 97-present); Shyam N. Bajpai, *Chair* (July 96-June 97); John 1. Upshur, *Chair* (May 94-May 95); Saurabh F. Dalal, *Chair* (July 95-June 96); Ron Hooker, *Vice-Chair* (July 97-present); John Margosian, *Secretary* (July 97-Present); Roger Kaul, *Publicity Chair* (July 198 1 -Present).

(1) J. Shea (SIGTEK) "Spread-Spectrum Technology and Its Applications to Wireless LAN". (2) J. Neot (Lockheed-Martin), "Overview of the Globalstar Mobile Satellite System". (3) Dr. P. Karabinis (Ericson,lnc.) "Optimum Techniques and Architectures for Mobile Satellite Systems". (4) L. Boezi (NOAA), "Microwave Systems for Weather Applications". (5) Administrative Committee Meeting-1996-97 Series Wrap-up. (6) Planning and Administration for 97-98 Lecture Series. (7) M. Skolnik (Naval Res. Lab-Retired), "Review of Ultrawideband Radar". (8) J. McCorkle (Army Res. Lab.), 'The Architecture of a VWB SAR".

❖ **Yugoslavia:** Branka Jokanovic, *Chair,* Olga Boric, *Vice Chair*

(1) Prof. Aleksandar Nesic (Institute of Microwave Techniques and Electronics, Yugoslavia), Passive and Active Printed Antenna Structures-Trends in Research, Development and Application". (2) Prof. Zoran Petrovic (Institute of Physics, Yugoslavia), "Production, Reparation and Application of Microwave Tubes". (3) Vesna Radisic, M.S.(UCLA), "Active Antennas Integrated with Power Amplifiers".

IEEE Women In Engineering Committee Encourages Members to Support PBS Mathematics Series

PISCATAWAY, N.J., 19 March — The IEEE Women in Engineering (WIE) Committee is acting as an outreach partner for "Life by the Numbers,"a television series about mathematics coming to PBS in April 1998 from WQED Pittsburgh. WIE's goal is to encourage IEEE members to team up with local public television stations and other local groups to develop and participate in special math-oriented events that will stimulate young girls and boys' interest in careers related to mathematics, science, and engineering.

"Life by the Numbers" shows mathematics in daily use by people in all walks of life. The series reveals the important role that math plays in sports, work, education, exploration, chance, technology, and life in general. More information on this program can be found on the world wide web at LIFE.WQED.ORG OR *com/calc.*

IEEE members interested in volunteering to help with math-oriented activities related to the series should contact the education/outreach director of their local public television station.

"Life by the Numbers" complements the IEEE STAR Program that WIE began administering for the IEEE in January. This educational outreach program promotes involvement of IEEE members with local junior high and high schools to inspire a positive image of engineering careers. For more information on WIE activities, please contact the Committee at "women @ieee.org" and visit their website at *org/women/.*

1996-97 Activities of the Washington D.C./ Northern Virginia Chapter of the IEEE Microwave Theory and Techniques Society (MTT-S)

Shyam N. Bajpai, Chapter Chairman, 1996-97
Email: s.bajpai@ieee.org
http://www.ee.umd.edu/ -yag/mtt.html

The Washington D.C. /Northern Virginia Chapter was formed 40 years ago in the year 1957. Since then, it has been one of the most active chapters of the MTT-S. It has approximately 300 registered members. The chapter has been successfully organizing lecture series based on specific themes. The lecture series runs from October

through April, with one lecture per month. The lectures are held at the University of Maryland, University College. Our chapter has very unique team concept where attendees, guest speakers, local corporate sponsors and chapter officers work together to produce an excellent program which covers current and future systems and technologies.

The 1996-97 lecture series "Future RF/Microwave Wireless Systems and Technologies" attracted about 40 attendees at every lecture. The excellent topics, reputation of the guest speakers and increased publicity contributed to the success of this year's program. Our Vice-Chair Eric Funk created a chapter home page where the advance program was displayed. He also sent email reminders to the attendees, a week before the lecture. The abstract and speaker's biography for the following months's lecture was distributed to the participants in advance. An advance program together with the list of the officers and the corporate sponsors of the previous series was mailed to the members of the Washington and Baltimore Chapter members and other potential interested participants. Our publicity Chair Roger Kaul advertised the lecture (dates, topic, abstract, speaker's biography etc.) in the "SCANNEW' the news letter published by the IEEE National Capital Area Council. The news letter reaches about 15,000 IEEE members in the Washington metropolitan area. We also get suggestions from our members and long time supporting corporate sponsors. This year's corporate sponsors were: Hewlett-Packard, M/A COK Micro-Larnbda, M. Lader, Mid Atlantic Microwave Sales. Our colleague Ron Hooker helped with local arrangements, and interacted via phone and email with attendees to handle dinner reservations. The lecture sponsorship together with the funding from Washington D.C. section of the IEEE and the MTT-S significantly helps us. The following is the 1996-97 Program organized by the Washington D.C./Northern Virginia Chapter. The program includes lecture dates, topics, guest speakers and their affiliation.

FUTURE RFIMICROWAVE WIRELESS SYSTEMS & TECHNOLOGIES

1996-1997 Lecture Series - Advance Announcement

Organized by

IEEE MICROWAVE THEORY & TECHNIQUES SOCIETY

Washington DC/Northern VA Chapter

Date*	Tentative Speakers	Topics
October 08, 1996	Albert E. Williams COMSAT Laboratories, MD	*Personal Communications via Present and Future Satellite Systems*
November 20, 1996 (Wednesday)	William C. Y. Lee AirTouch Communications Inc, CA	*Spectrum and Technology of a Wireless Local Loop System*
December 10, 1996	Lamberto Raffaelli ARCOM, Inc, MA	*Millimeter-wave Commercial Opportunities and Required Technology*
January 14, 1997	James Shea SIGTEK Inc, MD	*Spread Spectrum Technology & its Application to Wireless Local Area Network*
February 11, 1997	Jerry Hoot Lockheed-Martin, MD *System*	*Overview of GLOBALSTAR Mobile Satellite*
March 11, 1997	Peter Karabinis ERICSSON, Inc, NC	*Cellular/Satellite Hand Held Phone Technology*
April 08, 1997	Louis Boezi NOAA/National Weather Service, MD	*Advanced Systems& Technologies for Weather Applications*
**All meetings are in the evenings on the 2nd Tuesday of each—month except November—which is on Wednesday*		

27th European Microwave Conference:

A Technical Review

The European Microwave Conference took place in Israel this year, in Jerusalem from 8th to 12th September. In this review Asher Madjar and Shmuel Auster, the Conference Chairman and Secretary, make a personal selection from the conference papers.

Visit and reception at the Israel Museum. Hosted by the Jerusalem Municipality. From left: A. Rosen, A. Madjar, S. Auster, L.P. Ligthart.

The 27th European Microwave Conference came for the first time to Israel, with Jerusalem being chosen as the host city. The beauty of Jerusalem and its many promises were for the conference delegates to experience.

Today, as in ancient times, Jerusalem is simultaneously the ultimate destination of countless pilgrims, the seat of government and vibrant urban center, which offers every activity from the mundane to the sublime.

The scientific program was of high standard, as is customary at EuMC. Following the decision of the Management Committee to encourage and increase industry participation, a new category of application-oriented papers was introduced. This new category has proved very successful, and comprised around 25% of the accepted papers. The theme of the 27th EuMC "Bridging the Gap Between Industry and Academia" was well established.

Due to donations from several sponsors, the event was complemented by many social activities (receptions, a tour to the old city, etc.), which are an important part of any conference.

This event was very successful and memorable both scientifically and culturally.

Exhibition

An exhibition of microwave devices, products and equipment ran in parallel to the conference, reflecting Israel's strong microwave industry, and the large number of microwave components imported to meet the needs for military and commercial systems. 60 booths (500 square meters) with 35 exhibitors introduced hundreds of RF and microwave companies.

Invited papers

Speaking were fourteen of the best microwave experts in the world, who had agreed to share their knowledge on a variety of topics. The invited presentations were scheduled in plenary sessions, so that all participants could attend them. In the opening session, Leo Young (Filtronic Comtek, USA), one of the founders of modern microwave, shared with us his views on " Microwaves in your future".

The subject of Satellite Communication takes more importance nowadays in the microwave field. The implementation of new technologies in improving satellite transponders described by A. Cazal,

Jean-Louis Cazaux and G. Floury (Alcatel Espace, Toulouse, France).

The use of SAW devices in sensor and communication techniques was the topic to be represented by two speakers from Austria, F. Seifert (Technische Universitat, Wien) and R. Weigel (Johannes Keppler Universitat, Linz).

In recent years, much work has been done on emerging microwave and optical techniques. A. Seeds (University College, London, UK) presented optical synthesis of microwave signals, and P. Herczfeld (Drexel University, Philadelphia, PA, USA) discussed the Millimeter Wave Fiber Optic Communication Links.

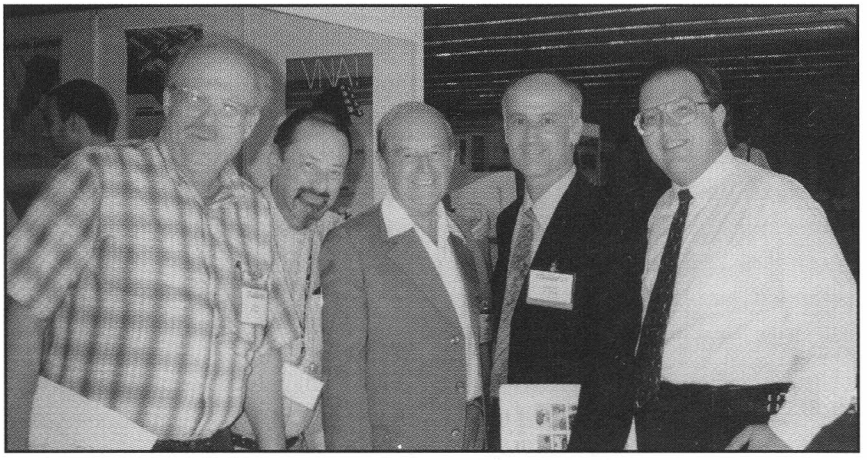
The MMIC developments take importance in the improvements to microwave technology and applications. MMIC technology offers advantages in: repeatability, reliability, size and price, and has increased the feasibility of many commercial applications. An overview of millimeter wave monolithic circuits was given by Y. Isota (Mitsubishi Electric Engineering, Kamakura, Kanagawa, Japan). The interconnects and packaging for MMICs were introduced by W. Menzel (Universitat ULM, Germany), and a presentation on the Israeli GaAs foundry was given by I. Lewin (Elta Ltd, Israel).

Microwaves influence biological effects by two aspects: The damage caused by microwave radiation to the human body, and also, the medical applications of microwave. These aspects were described by A. Rosen (David Sarnoff Research Center, Princeton, NJ, USA), H. Rosen (Division of Neonatology, St. Peter Medical Center, NJ, USA) and A. Vander Vorst (Microwaves U.C.L., Louvain-La-Neuve, Belgium).

N. Engheta (Univ. of Pennsylvania, Philadelphia, PA, USA) described the biologically inspired polarization-difference imaging.

Active antennas make summation of power in free space. Recent progress in active integrated antennas was given by Tatsuo Itoh (University of California, Los Angeles, CA, USA).

Non linear Analysis of Microwave circuits was covered by two invited speakers: M. Sobhy (University of Kent, Canterbury, Kent, UK) will examine the Chaos phenomena in microwave systems, and G. Leuzzi (Universita Degli Studi di Roma, Italy) introduced design techniques for non-linear microwave circuits.



At the exhibition: From left: A. Rosen, P. Heczfeld, T. Berceli, S. Auster (Conf. Secretary), and H. Rosen.

Focused sessions

In addition to the contributed papers there were five invited focused sessions which were organized by well known experts.

- "Millimeter Wave Automotive Radar" (Sessions C6, C7) organized by Holger Meinel (Daimler-Benz Aerospace AG, ULM, Germany).
- "Multilayer, MCM and Packaging Technology" (Session A1) organized by Rolf Jansen (RWTH Aachen Technical University, Germany).
- "Microwave Active Filters" (session C3) organized by Boris Kapilevich (Siberia State Academy of Telecommunication, Russia).
- "Commercial Microwave Sensor Systems" (session B8) organized by Patrik Heide (Siemens AG, Munich, Germany).
- "Wireless Market and Technology above 900 MHz" (session D9) organized by Paul Jackson (Microwave Engineering Europe, London, UK).

These sessions were an integral part of the conference program, and represent important issues of current interest to the microwave community.

Contributed papers

The main body of the Conference Technical Program highlights the most recent advances in microwave theory and techniques. Around 250 contributed presentations feature a wide variety of topics, ranging from Microwave and Millimeter Wave

Communications and Radar Systems, Antennas and Field Theory, to Active and Passive Devices and Circuits (including MMIC), Microwave and MM Wave Measurements, Packaging and Interconnects and Industrial Applications.

The contributed material included scientific papers and the new category of application-oriented papers, presented in four parallel sessions. These presentations were organized in 33 oral sessions and 3 poster sessions.

As usual, a rigorous selection process based on the evaluation of an international review board of about 180 experts assured the high technical standard of the conference.

Outlined below are some of the interesting and advanced papers representing some highlights of the conference. The papers are listed by topics:

Wireless and Satellite Communication: Scientists from UK and Spain described their work on "Modeling of propagation in outdoor microcells at 62.5 GHz". They characterized and modeled millimeter wave propagation in a line-of-sight and obstructed line-of-sight sub urban microcell. Experimental results were given and compared with theoretical predictions obtained from exhaustive ray tracing algorithms.

Among the most requested new services in the field of Intelligent Transport Systems (ITS) are Electronic Toll Collection (ETC) on highways and automatic access control to restricted areas. The majority of road operators in Europe demand interoperable 5.8 GHz Dedicated Short-Range Communications (DSRC) systems for these road traffic applications. Researchers from Germany presented the technical concept of 5.8 GHz DSRC and typical example of market-ready DSRC equipment, including On Board Units and beacons as well as experimental systems for advanced electronic toll collection with phased array antennas.

From left: Zvi Gelfend (Ortra), Peter Russer (Germany), Roberto Sorrentino (Italy), Mrs. and Dr. Asher Madjar, Shmuel Auster.

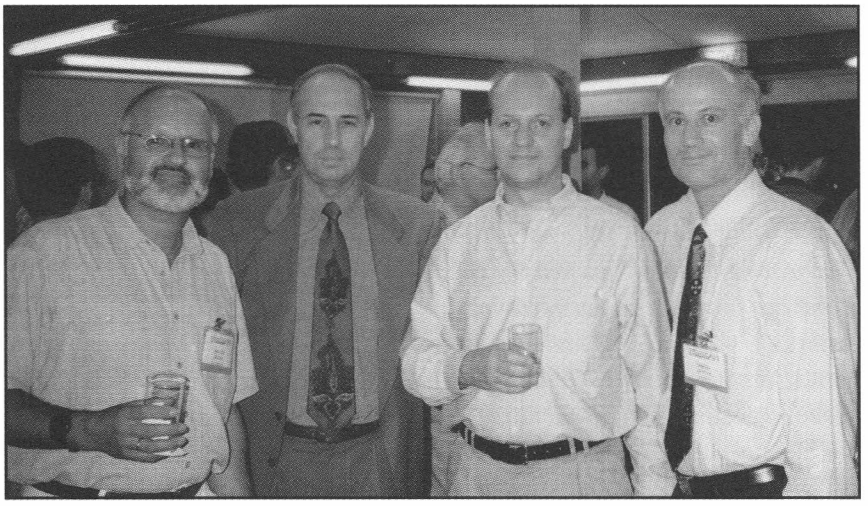
Three UTD (uniform geometrical theory of diffraction)based path-loss prediction models and their experimental validations for urban microcellular mobile radio communications were described by scientists from Finland. The three models apply to the base station and mobile antennas much lower than the buildings and wewritten in explicit forms for both vertical and horizontal co-polarization transmission and reception. Predictions and measurements at 900.5 and 1800 MHz were described. The Three models can be extended or modified to predict path loss for wireless personal communications.

From Japan, a compact novel C-band 580W SSPA for microwave satellite communication earthstation was realized by using a newly developed compact rectangular coaxial line combiner technique, cooling technique and high power 35W GaAs FETs. It has excellent performance, which is a match for 1.2 KW TWTAs, with high reliability. It is useful for microwave satellite communication earthstations, as a replacement of TWTA.

MMIC Technology: Scientists from Italy described the development and realization of two port devices for on-wafer network analyzer (NWA) calibration with a transfer standard technique. The new two-port NWA calibration uses a single two-port transfer standard plus a known reflectance to perform the calibration process. This technique uses less standards than any other calibration algorithm., which on the contrary, requires at least three different devices.

Co-authors from The Netherlands and Belgium described the design and measurements of novel silicon MMIC balanced oscillators using on-chip active resonators which have proven superior to on-chip passive resonators. The active

From left: Tatsuo Itoh (UCLA, USA), Leo Young (Filtronic-Comtek, USA), Asher Madjar (Conference Chairman, Israel), Gil Weiser (Managing Director, HP-CMS, Israel).



From left: H. Meinel (Daimler-Benz, Germany), Avner Raz (President, Elisra Electronic Systems, Israel), Peter Jackson (Editor, Microwave Engineering Europe, England), Shmuel Auster (Conference Secretary, Chief Scientist at Elisra, Microwave Division).

resonators contain active inductors. Good agreement between simulation and measurements for active inductors, resonators and oscillators was obtained. Output power levels of -12 dBm were achieved.

Researchers from Israel described the design and performance of a new compact and low cost transmitter for Ka band VSAT satellite communication ground terminals. The main features of the transmitter are: 32.5 dBm min. output power for - 16 dBm input power over 27.5-31 GHz. The transmitter consists of low, medium and high power MMIC amplifiers, BPF, a four way microstrip power divider, a four way waveguide power combiner and a DC supply unit.

Researchers from Japan describe CPW heterojunction FET (HJFET) down- and up-converter MMICs for millimeter wave wireless networks. These up/down converter MMICs incorporate source injection mixer and RF filters. In the circuit design, the FET was treated as a 3-port device in which the LO signal is applied to the source terminal with a LO power and frequency of 7 dBm and 60.4 GHz. Both converters can operate for any IF frequency within 0.5 to 2 GHz, with a corresponding conversion gain within -7 to -12 dB and chip size of 3.3mm x 2mm for the down-converter and 3.5mm x 1.8mm for the up-converter.

Engineers from Germany were reporting improvement of High-Speed Modules by an advanced Chip-on-Board assembly. For experimental optical fiber transmission systems working at 20 Gbits/s and 40 Gbits/s electronic transmitter, receiver and amplifier modules were developed. To guarantee reliable and error free operation unpackaged GaAs- and Si-chips on ceramic thin film substrates in combination with a sophisticated interconnection technique had to be used.

Scientists from Spain and France reported on the design of an ultra-low noise integrated GaInP/GaAs HBT-DRO with phase noise of -124 dBc/Hz at 10 KHz off-carrier working at 6.7 GHz.

Microwave/Lightwave Interaction: A new approach for the optical feed of radio nodes utilizing a new low noise high stability microchip solid state laser source was presented by scientists from USA and Hungary. Its application for cellular mobile and personal communications was described.

Solid State Modeling: A novel physics based large signal HEMT model which describes the signal properties and the low and high frequency noise behavior in the frequency range from 1 Hz to 40 GHz was presented by scientists from Germany. The modeling includes also dispersion and thermal effects on the active device. The model is used in amplifier and oscillator applications.

Superconducting: Russian scientists presented Simulation of linear and nonlinear characteristics of High-Tc Superconducting Resonators and filters. The phenomenological model of the microwave surface impedance is improved by a minimization of the number of fitting parameters.

Field Theory: A method developed by scientists from Italy for fast and rigorous analysis of complex waveguide networks of any topology was presented. A modal analysis, based on the generalized admittance matrix representation of discontinuities and components was employed, leading to a linear set of equations in the internal voltages. The high numerical efficiency of this approach was shown using a 4x4 Butler matrix example.

Radar: Motion monitoring with a millimeter wave radar sensor was introduced by scientists from Germany. An existing 94 GHz pulse radar system for autonomous mobile robots has been extended by a CW Doppler unit for fast motion monitoring. The extension is set up with low cost components and works independently from the pulse system.

Antennas: The design development and test activities performed on the Ku-band antenna subsystem for the Israeli communication satellite AMOS were presented by engineers from Israel and Germany.

Solid-state Technology: RF and microwave switching elements using silicon CMOS technology are being investigated by scientists from the USA and show promise as an alternative to the traditional PIN diode and GaAs MESFET devices. RF switching elements are attractive because of their potential in all-silicon monolithic CMOS solutions for completely integrated baseband and RF functions in low cost wireless mobile satellite service (MSS), and personal communications systems.

From France there was a paper on "7.12 W/mm (up to 1.7 W) CW X-band InGaP/GaAs HBTs: Top Heat Sink and Topology Influence", demonstrating that the parallel combining topology is more suitable for power amplification than the fishbone topology.

Microwave Measurements: The technical program includes several papers on microwave measurements, among them: "a membrane probe for testing high power amplifiers at mm-wave frequencies" from USA, "Wideband indoor radio channel measurements at 5.3 GHz" and "Measurement of a novel 40 GHz planar antenna using planar near-field scanning techniques and a hologram compact antenna test range (CATR)" from Finland, "A millimeter wave frequency extender for microwave network analyzers" from Germany.

Passive Components: A new microwave (10 GHz) transmitter-receiver switch (T/R switch) employing high-Tc superconductive (HTS) film elements was presented by scientists from Russia and Israel.

Scientists from Italy described design and realization of a dual mode circular waveguide filter for digital audio broadcasting (DAB) applications.

From Belgium, a new analysis method for integrated spiral and meander inductors on semiconductor substrates was presented.

Electromagnetic Compatibility: A new multiple probe nearfield scanning technique for EMC-investigations was proposed by scientists from Germany.

Workshops and short course

On the final day, Friday September 12th, four workshops and one short course were held in parallel.

The first workshop was on "Mobile and Personal Communication", organized by R. Meidan (Chief Scientist, Motorola Communication,

Management Committee and Technical Program Committee.

Israel) and B. Geller (David Sarnoff Research Center, Princeton, NJ, USA).

The second was on "Biological Effects and Medical Applications of Microwaves", organized by A. Rosen (David Sarnoff Research Center, Princeton, NJ, USA) and A. Vander Vorst (Microwaves U.C.L., Louvain-La-Neuve, Belgium).

The third workshop, entitled "Microwave Applications of Superconductivity" organized by A. Biran (Rafael, Israel) and M. Nisenoff (NRL, USA).

The fourth workshop devoted to "Microwave Nonlinear CAD" organized by M. Sobhy (Kent University, UK).

Prof. T. Weiland (Technische Hochschule, Darmstadt, Germany) gave **a Short Course** entitled **"CAD of Electromagnetic Fields".**

1997 EuMC Microwave Prize

Each year the EuMC Management Committee awards the EuMC Microwave Prize for the best paper presented at the Conference. Selection is based on originality, value and method and was judged othe quality of both written and oral presentation.

T1997 prize was awarded to the following two papers:

"Transmitter-Receiver Switch based on High-Tc Superconducting Film" by A. B. Kozyrev, V.N. Osadchy, M.M Gaidukov, A.S. Pavlov (St Petersburg Electrotechnical University, St. Petersburg, Russia), V. Meerovich, V. Sokolovsky (Ben-Gurion University, Beer-Sheva, Israel).

"2~3 GHz Silicon MMIC Balanced Oscillators using On-Chip Active Resonators", by Y. Sun, M. de Kok, J.L. Taurich (Delft University of Technology, Delft, The Netherlands) and R.G.F. Baets (University of Gent, Gent, Belgium).

Appendix

Biography of Asher Madjar

Asher Madjar, Fellow IEEE, received the B.Sc. and M.Sc. degrees from the Technion, Israel Institute of Technology, in 1967 and 1969, respectively., and a D.Sc. degree from Washington University, St. Louis, MO, USA, in 1979. Since 1969 he has been with Rafael, Haifa, Israel and with the Technion. In Rafael he performed research in the areas of passive and active microwave devices. He headed the MIC group from 1973 to 1976, served as a microwave Chief Engineer in the Communications Department from 1979 to 1982, and as Chief Scientist of the Microwave Department from 1982 to 1989 with direct responsibility of the MMIC group from 1987 to 1989. At Present he is a Research Fellow involved in microwave optoelectronics activity, MMIC, monolithic circuits combining microwave and optical devices and microwave modules.

At the Technion and at Ort Broude College, he teaches several courses on Microwave Devices and Techniques. From 1989 to 1991 he was visiting Professor at Drexel University in Philadelphia.

Dr. Madjar is an IEEE member since 1973, senior member since 1983 and Fellow since 1997. He served as the Israel S-AP/MTT chapter chairman for several years. Asher is amember of the management, the technical program and the steering committees of the European Microwave Conference and the chairman of the 27th EuMC.

Dr. Madjar is the author or co-author of over 70 papers in the areas of microwave components and devices, MIC, MMIC, linear and non-linear microwave circuits, microwave device modelling, optical links at microwave frequencies and more.

Biography of Shmuel Auster

Shmuel Auster is the Secretary of the 27th European Conference. Since 1980 he has been with ***Elisra*** *Electronic Systems Ltd*, Israel. Currently he is Chief Scientist of the Microwave Division and is also director of the Israeli GaAs/MMIC Consortium, serving as the Chairman of the technical and the packaging committees of the Consortium. Shmuel established the Millimeter Wave Technology and MMIC design activities in Elisra, was responsible for the developments in those fields and also for the development and design of Passive Components, Synthesizers, Microwave and Millimeter Wave Modules and Sub-Systems. He has served as a member of the management committee of the European Microwave Conference since 1997.

Shmuel received the B.Sc.EE and M.Sc.EE degrees from the Tel-Aviv university in 1980 and 1986, respectively, and graduated Engineering Management in 1993.

Shmuel has been the Israel IEEE S-AP/MTT chapter vice-chairman from 1992.

CONFERENCE HOUSING
1998 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM

June 7–12, 1998 •Baltimore, MD

MTT-S •RFIC •ARFTG

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2. Reservations will be processed on a first-come, first-served basis.
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4. Phone and Fax reservations must provide credit card information. Checks provided for mail reservations should be made out to BACVA Housing Bureau.
5. You will receive an acknowledgment of your reservation from the Housing Bureau 7–10 days after your reservation is received.
6. Changes and cancellations prior to May 11 must go through the Housing Bureau.
7. Changes after May 11 must be made with your hotel.
8. Hotel cancellation policies vary. Generally, cancellations received by hotels at least 72 hours prior to scheduled arrivals qualify for deposit refunds, but you should check with your hotel to verify its policy.

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Occupants (first name first)

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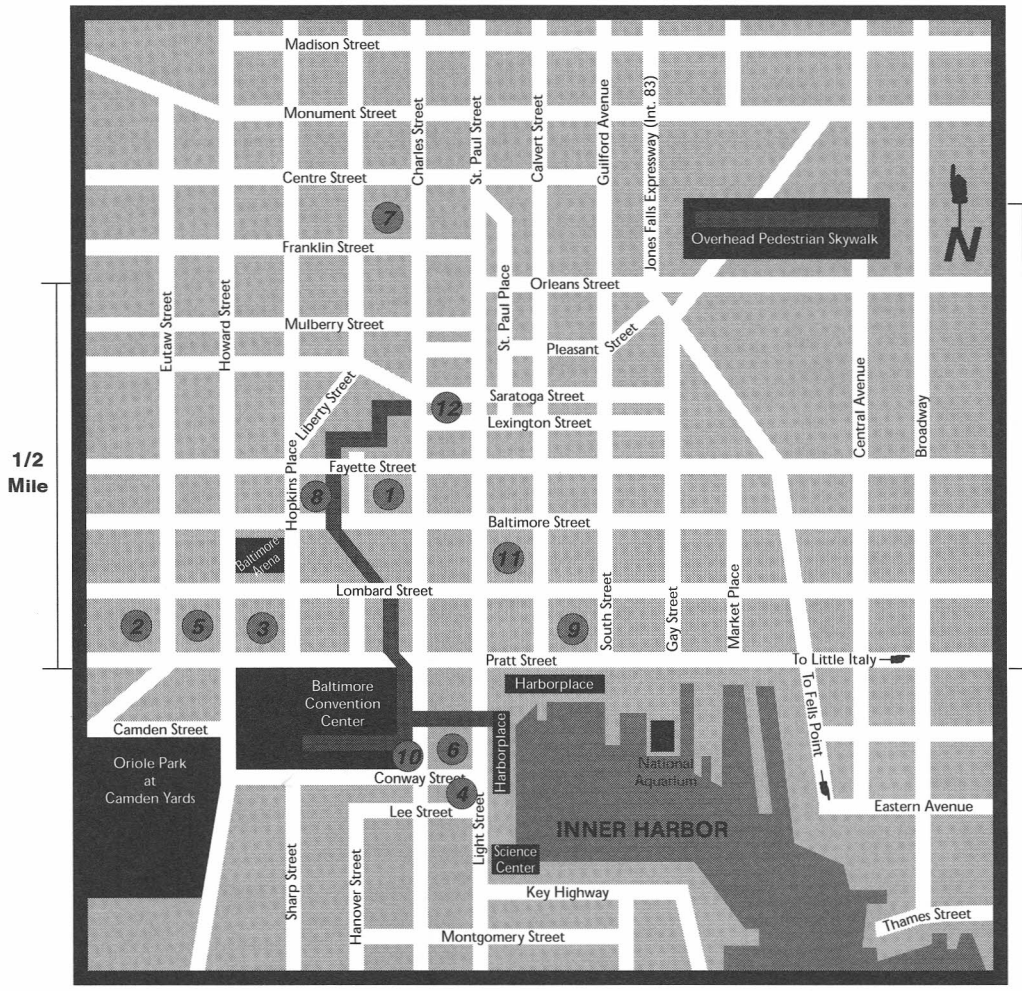
ROOM NO. 2	1. 2.	Check one: ☐ Single ☐ Double (1 bed) ☐ Dbl/Dbl (2 dbl beds) ☐ Govt. Arr. Date: _____ Dep. Date: _____ ***Requests:*** ☐ Smoking ☐ Non-Smoking ☐ Wheelchair Accessible ☐ King
ROOM NO. 3	1. 2.	Check one: ☐ Single ☐ Double (1 bed) ☐ Dbl/Dbl (2 dbl beds) ☐ Govt. Arr. Date: _____ Dep. Date: _____ ***Requests:*** ☐ Smoking ☐ Non-Smoking ☐ Wheelchair Accessible ☐ King



1998 IMS CONFERENCE HOTELS

Map No.	Hotel	Single	Double	Triple/Quad	
1	Baltimore Hilton & Towers	$134	$148	$168/$188	
2	Baltimore Marriott Inner Harbor	$149	$159	$169/$179	G
3	Days Inn Inner Harbor	$102	$112	$122/$132	G
4	Harbor Court Hotel	$160	$160	$175/$190	
5	Holiday Inn	$115	$125	$125/$125	G
6	Hyatt Regency Baltimore				
	(Headquarters)	$155	$170	$195/$220	G
7	Mount Vernon Hotel	$ 75	$ 85	$ 85	G
8	Omni Inner Harbor Hotel	$129	$129	$149/$169	G
9	Renaissance Harbor Place	$165/$205	$165/$205	$185/$225	
10	Sheraton Inner Harbor	$159	$159	$174/$189	
11	The Brookshire Suite Hotel	$159	$179	$199/$219	
12	Tremont Plaza	$125	$125	$145	

G Special rates available for US government employees with travel orders

Advance Conference Registration

1998 IEEE MTT-S MICROWAVE WEEK EVENTS

June 7–12, 1998 ✦ Baltimore, MD ✦ IMS ✦ RFIC ✦ ARFTG

Each Conference Attendee must submit a separate registration form. A copy of this form may be used.
The deadline for advanced registration is May 15, 1998. Afterwards, on-site fees apply.
On-site fees will be approximately 30% higher.

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IEEE MEMBER ☐ Yes ☐ No ☐ IEEE Membership No.* *Must be given to qualify for member discount **MTT-S MEMBER** ☐ Yes ☐ No

Name of Guest **ARFTG MEMBER** ☐ Yes ☐ No

To register, check ☑ the appropriate boxes and enter corresponding fees in the Remittance column.

INT. MICROWAVE SYMPOSIUM Tue., Wed. & Thur.	IEEE Member	Non Member	Remittance
All IMS Sessions (Includes IMS CD ROM and Digest.)	☐ $235	☐ $340	$
All IMS Sessions (Includes IMS CD ROM, *no* Digest.)	☐ $165	☐ $250	$
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RFIC Symposium ☐ $ 85 ☐ $110 $
Sun., Mon. & Tue. (Includes RFIC Reception and RFIC Digest.)

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Fri. (Includes breakfast, lunch, ARFTG Digest and ARFTG Exhibition.)

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IMS Digest	Qty. ___ @	☐ $ 70	☐ $ 90	$
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RFIC Digest	Qty. ___ @	☐ $ 35	☐ $ 50	$
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PMON1:	Levels of Integration for RFICs	☐ $15	$
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MONDAY			☐ WFD	(Full Day)	$
☐ WMA	(Full Day)	$	☐ WFE	(Full Day)	$
☐ WMB	(Full Day)	$	☐ WFF	(Full Day)	$
☐ WMC	(Full Day)	$	☐ WFG	(Morning)	$
☐ WMD	(Full Day)	$	☐ WFH	(Morning)	$
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☐ WMF	(Morning)	$	☐ WFJ	(Afternoon)	$
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☐ WMH	(Morning)	$			
☐ WMI	(Afternoon)	$			
☐ WMJ	(Afternoon)	$			
☐ WMK	(Afternoon)	$			

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Full-day workshops include continental breakfast, lunch and afternoon refreshments.
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All workshop registrations include a bound copy of the presenter's notes.

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An Adventure in Microwaves

Harold Sobol, 1998 CAREER AWARD

It is interesting as one approaches retirement to reflect on those key events and decisions that determined the directions of a lifetime career and to recall the major resultant outcomes. As might be expected the positive highlights are more easily recalled than the negative experiences. I have thoroughly enjoyed my more than 40 year adventure in microwave technology and have been most fortunate to have been positioned so that I was able to spend most of that time riding on the crest of the wave of new technology. I am grateful to my employers, the University of Michigan, RCA Laboratories, Rockwell International, and the University of Texas at Arlington for their support over the span of my career.

As an undergraduate senior at CCNY during 1951, I had a terrible course in field theory and was determined to do all I could in my professional career to avoid this area. I was successful in doing just that in my first job assignment at the University of Michigan's Willow Run Laboratory. My task was to program the intercept equations for the BOMARC missile on an analog computer since our early digital computer, MIDAC, was unable to perform reliably in the high humidity at Patrick Air Force Base in Florida. I also had to design and build a vacuum tube A/D and D/A pair to handle data communications from the computer to the launch site and communication center at Cape Canaveral. Figure 1 is a photograph of the author at work during the Florida experience. Note that the picture is classified secret, perhaps a reflection of the McCarthy era in the early 1950's.

My luck ran out on my next assignment. I had to design a waveguide network, a feedhorn, and a rotating waveguide short circuit to be used as a surface target simulator for studies on ground surveillance radars. Fortunately I was able to take graduate courses in field theory and waveguide engineering from Professors Stephen Atwood and Lou Holland at the University of Michigan. These courses as well as the great Rad Lab series of books not only allowed me to complete my design program but also turned me on to microwave technology, an area that I was to follow for the rest of my career. I remember being astounded in the field tests that we did in 1954 with the above gear to observe the complex statistical nature of both long term and short term fading of the signal for ground targets and the very large variances that each type of fading had. It was not unusual to move about one foot and to find a 30dB change in signal strength. It was not possible to use a deterministic expression for signal level at the target. I again ran into this problem 40 years later while investigating propagation issues for PCS wireless telecommunication systems. My student, Yuqiang (Richard) Tang, in his 1993 Ph.D. research carefully measured the fields and was able to find the appropriate distribution functions to characterize the statistics of the surface level propagation in indoor structures. Of course others over the years have also studied the statistics of this propagation and have set up various empirical expressions to characterize the fields.

My Ph.D. research in the late 50's under Professors Joe Rowe and Bill Dow at the University of Michigan was on the transport of modulated

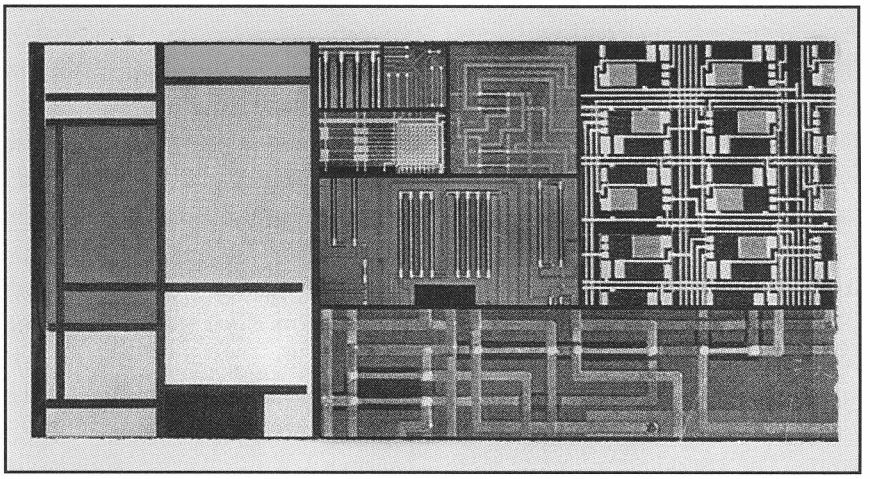

Figure 2. Collage of designs and IBM circuits, circa 1960. The author's cryotron circuit is in the lower right corner.

signals in electron beam devices. My experience in the U of M Electron Physics Laboratory expanded my interest in microwaves to include device physics and also gave me an opportunity to gain experience in building microwave tubes. It was in this Lab that I first met Cheng Wen and Bernie Hershenov, who were to become life long friends and colleagues of mine. Both received the Microwave Application Award for their work on the Co-Planar Waveguide, and Microstrip Circulators respectively.

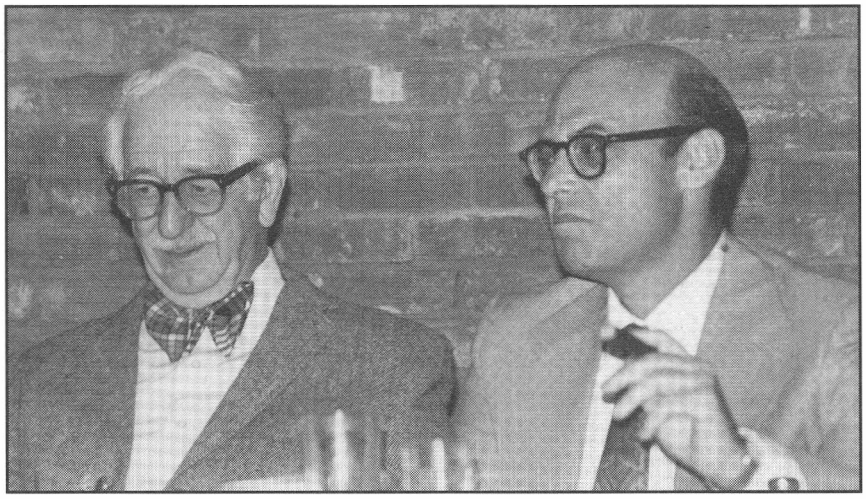

Figure 3. The author (right) and Dr. Leon Nergaard, 1972.

After graduating from Michigan I started my industrial career with a short but interesting stint at the IBM T.J.Watson Research Center to work on high speed superconducting thin film devices for new generations of high speed computers. In 1960 silicon devices were pretty well limited to the microsecond switching speed range. However a new superconducting device, the cryotron, had the possibility of switching many orders of magnitude faster but required operation at liquid helium temperatures. My role in the project was to address the high speed issues from a microwave viewpoint and also to design and test the devices. We did indeed demonstrate nanosecond switching. The project gave me an opportunity to learn about microwave strip conductors and thin film technology. I was able to learn this despite the fact that our films were lead and tin superconductors and we did not yet have the benefit of photolithography. We defined our structures using deposition of the metals on glass substrates by evaporation through metal masks in contact with the substrate. The conductor patterns were machined in the metal mask. Certainly a far cry from the technology that was to explode in the next few years. An interesting photograph of the one of my cryotron circuits is in the lower right corner of Figure 2. The figure is a collage of various IBM circuits and designs used in advertisements during the early 1960's.

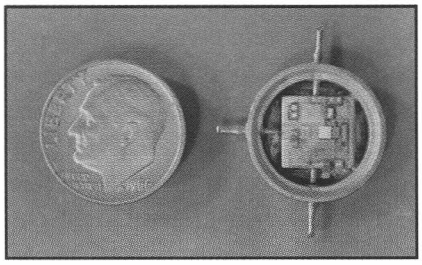

Figure 4. UHF thin film lumped element amplifier.

I left IBM after we found that we could not afford to buy a home in Westchester County, NY and there were no nearby universities that my wife could join for her professional career. We moved to Princeton NJ where I joined the Microwave Lab at RCA Laboratories.

My first assignments at RCA involved research on high power tubes. In 1963, recalling my IBM work, I proposed a program to our Director, Leon Nergaard, on the use of thin film planar circuits for integrating microwave functions. Leon picked up the ball on this and we established a corporate wide program to develop the technology and transfer the capability to the divisions. Figure 3 is photograph of the author and Dr. Nergaard, IEEE Mervyn J. Kelly Award recipient in 1973. We decided that the technology for monolithic microwave circuits was off in the future and as a consequence our early effort was on hybrid circuits. We concentrated on two circuit technologies, thin film microstrip circuits and thin film lumped element circuits. The microstrip was to serve as the primary circuit approach for frequencies above s-band. However, we saw an opportunity to reduce circuit size at s-band and below by using lumped elements that were a fraction of a wavelength. This small size held potential for increasing the number of circuits we could batch fabricate on a substrate and consequently lower the manufacturing cost. Another benefit of very small circuit size was that matching circuits could be included in packages of

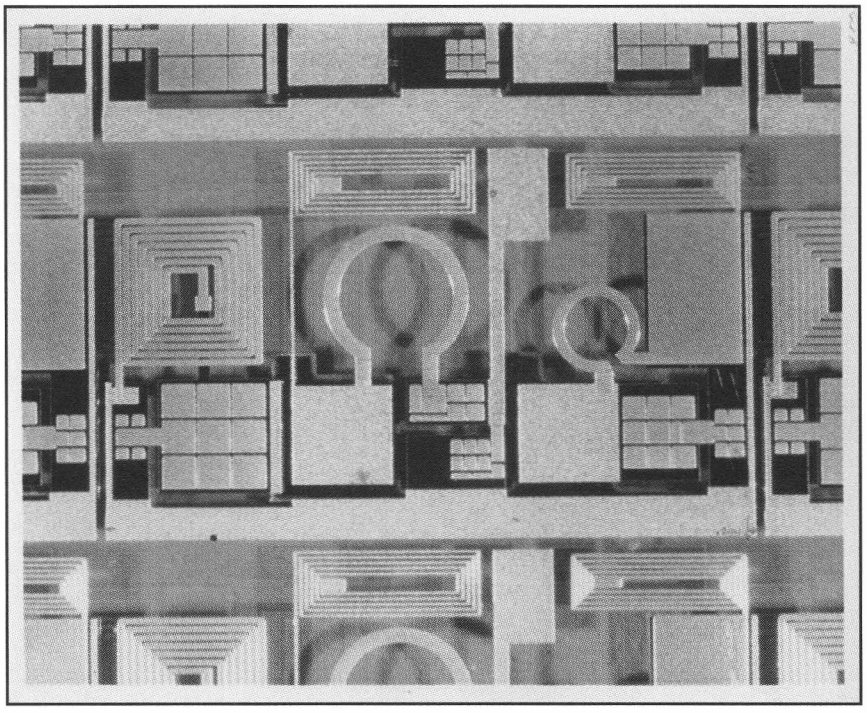

Figure 5. 2 GHz thin film lumped element power amplifier wafer

discrete UHF and microwave power transistors, a leading product line for RCA, to raise the impedance level to practical values at the package interface which facilitated the design of wide bandwidth circuits. Figure 4 is a 16 watt 225-400 MHz thin film lumped element amplifier, the RCA 7702, and Figure 5 is a wafer of substrates for lumped element 1 watt 2 GHz amplifiers.

The existing theoretical expressions for microstrip transmission line properties were not adequate for design purposes. However we found that by using a very clever quasi TEM analysis with a conformal mapping that Harold Wheeler published, we were able to get very good correlation between measured and calculated impedance and guide wavelength at frequencies below x-band. Marty Caulton, John Hughes and I published our results and we exhausted our reprints within a few weeks and had to reorder these several times.

We found that the theoretical values of impedance of inductors and capacitors published by Terman in his 1943 Radio Engineers Handbook were suitable with some minor corrections for design of our lumped element circuits. After finding the basic microwave properties we were able to study a wide range of parameters on substrates, conductors, and dielectrics that permitted us to gain a good handle on the technology for hybrid microwave integrated circuits and to apply these in functional circuits. We transferred the technology that we developed in the research lab to the RCA product divisions and through publications and presentations by our group, Texas Instruments and Microwave Associates convinced the world wide microwave industry that microwave integrated circuits were the technology of the future. Figure 6 is an X-band receiver with a tunnel diode front end.

After spending two years in the RCA Solid State Division transferring the technology, I returned to the RCA Labs to lead research efforts on GaAs FETs, IMPATT and TRAPATT diodes. Lou Napoli, a member of our Lab, received the MTT Applications Award for his work on the GaAs power FETs. Figure 7 is a photograph of a reunion of many former members of the RCA Microwave group taken at the 1992 IMS in Albuquerque.

In 1973, I received an offer from Collins Radio in Dallas to head up the Engineering for the Microwave Systems Division. Collins had undergone some very difficult times and was saved by an infusion of money from Rockwell International. The company was able to turn things around in 1972 and an area that was prime for growth was microwave radio as the new breed of telephone long distance carriers were coming on stream. I was offered the position of chief engineer to guide the technology and product development in this potentially explosive business. I made a very difficult decision to leave RCA and all the friends that I developed over the years and head to the Southwest to take this new challenge, one where I could apply the technologies I worked with for years in a new line of systems. I joined Collins in 1973 and the company was fully acquired by Rockwell in 1974.

At Rockwell, during the 1970's we developed high capacity analog heterodyne radio for the new long distance carriers including MCI and the fore runner of SPRINT (SPCC), and new generations of low cost remodulating radios for the industrial and video markets. During the late 1970's the major development of

analog radios included a 5400 voice-circuit single sideband radio and a radio for the largest microwave system installed at one time for long distance service in Saudi Arabia. An AT&T and Rockwell team performed the Saudi program. The state of the art of 6 GHz GaAs power FETs was insufficient to permit the use of these devices in the analog radios of the 1970's. The remodulating radios used 2 GHz silicon amplifiers and multipliers, the single sideband and wideband heterodyne radios used travelling wave tubes with appropriate linearizing predistorters, where required, and the Saudi heterodyne radio used a 2 GHz power amplifier, a multiplier and a deviation divider in the receiver. It was indeed frustrating after leading an effort on the development of GaAs FETs to find that commercial devices at the time were not available or did not meet our requirements. The Saudi program was very successful and the Kingdom issued the commemorative stamp shown in Figure 8 recognizing the accomplishment.

We were finally successful in incorporating 6 GHz power FETS in the final analog radio we developed in the early 1980's. Figure 9 shows an early model of a 5-stage, 5 watt, 5.9 – 6.4 GHz power amplifier The last of the analog radios was designed using approaches recommended by Dr. W. Edward Deming for reliabilty, manufacturability, and cost. The technologies incorporated maximum use of silicon ICs, SMT circuit boards and hybrid integrated microwave circuits. The radio was indeed one of the most successful and profitable that we produced and further captured a very large share of market.

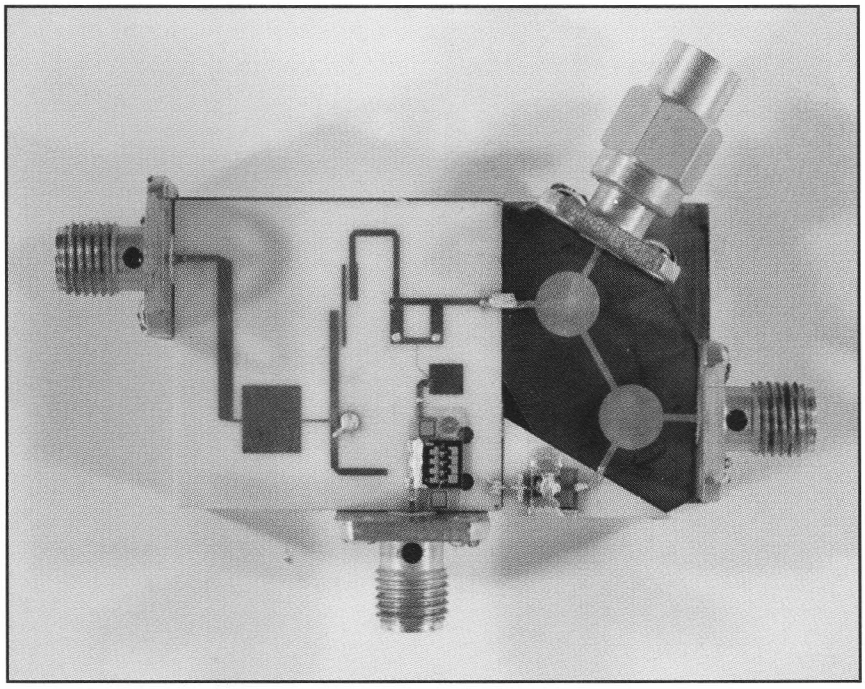

Figure 6. X – Band low noise receiver with tunnel diode LNA.

Figure 7. RCA Reunion at IMS 1992, Albuquerque; L to R, Lou Napoli, Barry Perlman, Mrs. and Dr. Fred Sterzer, Dr. and Mrs. Walt Curtice, Dr. and Mrs. Arye Rosen, Dr. and Mrs Bernie Hershenov, Marion Sobol, Cheng Wen, Hal Sobol, Ed Denlinger

A second major activity during my early years at Rockwell was the development of microwave digital radio. The FCC issued the regulatory notices on digital radio performance in the mid 1970's. These included a minimum capacity of 1152 digital voice circuits in the 4, 6, and 11 GHz common carrier bands and a specific spectrum mask that was a compromise to allow adjacent channel operation of the digital radio with an analog FM radio. The spectral densities to meet the

Figure 8. Commemorative stamp for Saudi Arabia long distance microwave network.

minimum capacity requirements were approximately 4, 2.7, and 2 Bits/second per Hz in the 4, 6, and 11 GHz bands respectively. The first frequency band that digital radio was aimed at was the 10.7 to 11.7 GHz band since it was not heavily occupied by the common carriers and had the simplest requirement on spectral density. Several suppliers including AT&T, Microwave Associates and NEC were first to market the 11 GHz equipment. The early radios used either QPSK modulation with two orthogonal cross-polarized radio channels in a single bandwidth assignment, or a form of QPR modulation that resulted in the minimum required spectral density. The cross polarization radio was highly susceptible to fading problems since cross polarization discrimination decreased during multipath fades. Both of these schemes met with lack of enthusiasm from the marketplace.

We elected to enter the digital market with a solid state singly polarized radio and one that had a capacity of 1344 digital voice circuits which met a standard digital interface of two DS3 signals rather than the minimum requirement which was not a standard interface. The radio to meet these specifications had to operate at 90 MB/s. The only practical solid state amplifier for the 11 GHz band during the 1970's was an IMPATT device. Taking into account the difficulty in achieving amplitude linearity with an IMPATT amplifier, and the required spectral density of 2.25 Bits/second per Hz, 8PSK modulation which has a Nyquist limit for eliminating intersymbol interference of 3 Bits/second per Hz, and has minimal amplitude linearity requirements, was selected. The modulation was applied directly at the carrier frequency using an 11 GHz diode switched line length modulator, shown in Figure 10. The circulator coupled 2 watt IMPATT amplifier, shown in Figure 11, utilized 3 IMPATT stages and a Gunn diode preamplifier.

In order to minimize spectral distortion in the IMPATT, final transmitter filtering was accomplished after amplification using a low loss 5-section invar coupled cylindrical cavity filter. Further, to meet compliance with the FCC, the filter was hermetically sealed so it would be useable at sea level as well as on high mountain peaks. This radio captured the major share of the 11 GHz digital radio market in the US. Unfortunately after several years, our suppliers of IMPATT diodes, HP and NEC, both stopped manufacturing the diodes and we were forced to switch to TWT amplifiers, another frustration with solid state amplification. A 6 GHz model of this radio that operated with a spectral density of 3 Bits/second per Hz and used a TWT power amplifier was developed and also was very successful in the marketplace.

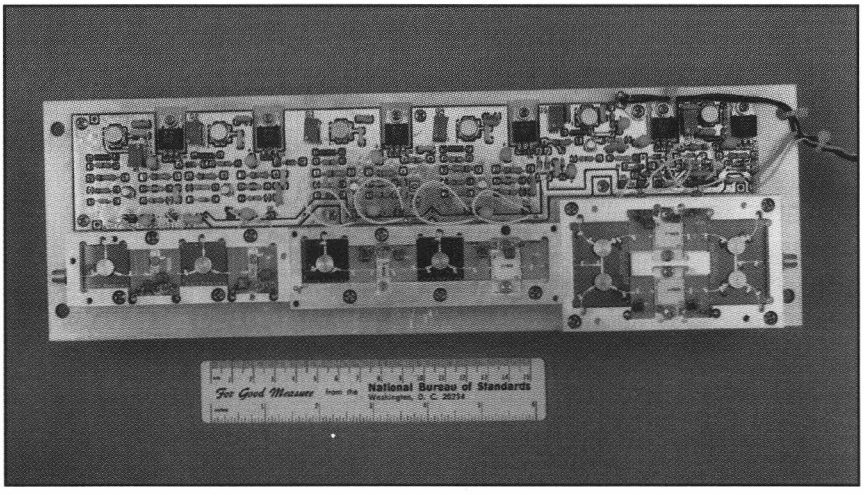

Figure 9. Five stage, 5 watt, 5.9 – 6.4 GHz circulator coupled GaAs FET power amplifier, circa 1980

The capacity of the 8PSK radios became an issue as the population of these radios grew. The 6GHz analog FM radios had capacities of more than 2000 voice circuits and as a consequence, the marketplace demanded comparable capacity with digital radio. Thus again using standard digital interface a three DS3 radio with a capacity of 2016 digital voice circuits was required. Since the 6 GHz 8PSK radio was already at the Nyquist limit, it was clear that a high level M-Ary modulation system was required. Our competition had elected to pursue

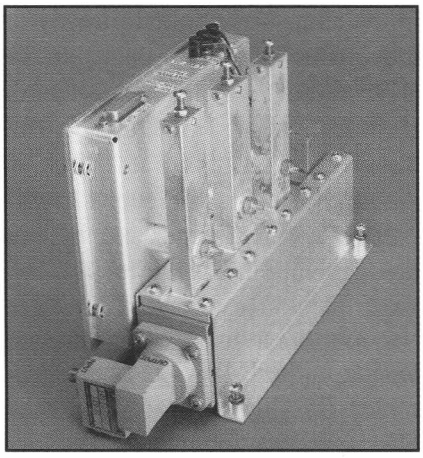

Figure 10. X – band 8 PSK digital radio modulator.

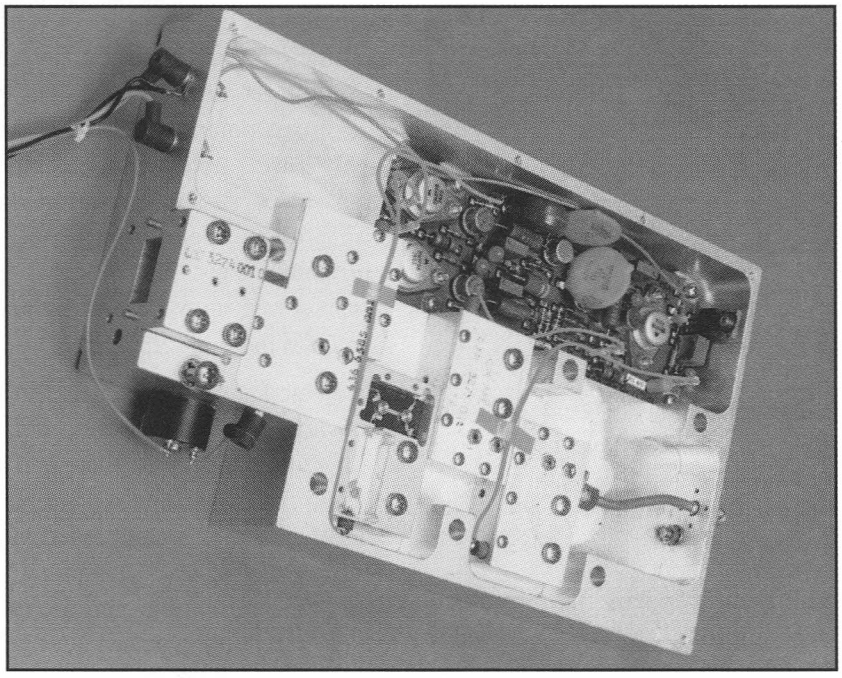

Figure 11. Four stage X – band, 2 watt IMPATT diode amplifier.

Figure 12. Visit to Xian, China, Microwave Radio Works, 1978

the 90 MB/s two DS3 radio for the 6 GHZ band using a 16QAM modulation system. Our approach for the three DS3 radio, which was later adopted by all successful participants in this business, was to use 64QAM modulation in a radio that operated at 135MB/s. M-Ary 64QAM 6 GHz radios that operate over 25 mile paths rather than the 15 mile paths of 11 GHz radios are considerably more susceptible to multipath fading than the earlier radios. As a consequence considerable more sophistication was required in these systems in the form of amplitude and time domain adaptive equalizers, and the use of forward error correcting codes. The 64-state modulation was applied to a 70 MHz carrier that was subsequently up-converted to 6 GHz. The transmitter chain required extremely good linearity, approaching that of the SSB radio. Thus TWTs with predistorter linearizers and backed-off operation were used for these radios. The equipment was introduced to commercial service in 1984. In the late 1980's and early 1990's, after I retired, suitable GaAs FET amplifiers with the required linearity and at competitive cost finally became available for use in the high level M-Ary modulation radios.

During the late 1970's, it became clear that fiber optics systems were going to be a significant threat to microwave transmission systems. As a consequence, we started a program to also develop fiber optic digital transmission equipment. Our first product was a short wavelength (820nm) multimode 90 MB/s system that was basically our 90 MB/s digital radio with the microwave front end replaced by a lightwave front end. By 1984 our technology advanced to the point that we were able to deliver a state wide, single mode, 139 MB/s (3 DS3), 1300nm fiber optic system to Indiana Bell, one of the first single mode systems deployed in the US. By 1986 we were the first to have a 565 MB/s system in commercial service, and by 1987 placed a 1.1

Figure 13. Visit to Xian, China, Microwave Radio Works, 1978

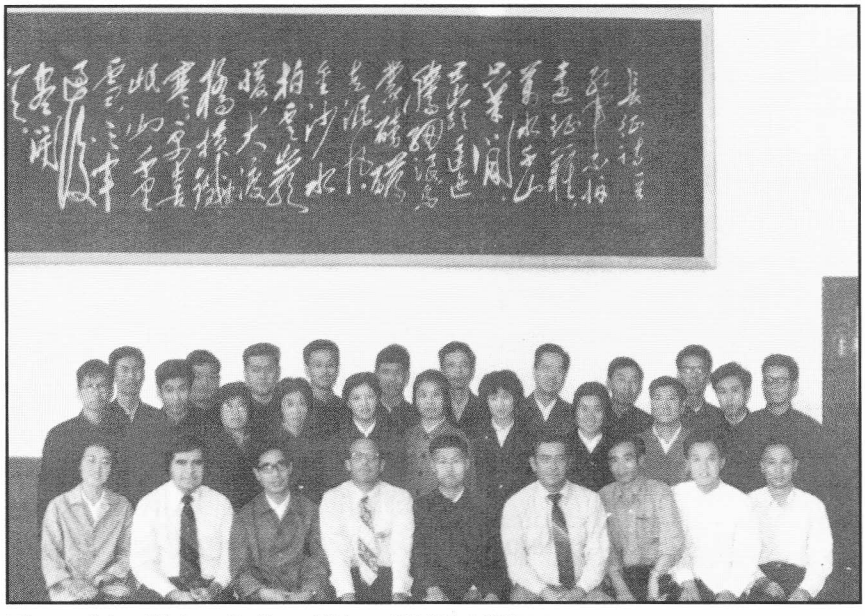

Figure 14. Visit to Bejing, China, PT&T, 1978

GB/s placed in service. Key to the success of the GB/s fiber systems was the use of an integrated GaAs multiplexer and demultiplexer fabricated using GaAs gate array chips. SMT technology and the use of semiautomatic assembly of the hybrid circuit optical transmitters and receivers were key to the reliability and manufacturability of our products. We again were fortunate in capturing a major share of the market in the mid 80's. In addition to the microwave and lightwave equipment, it was necessary to also have a full line of multiplex, protection switching, alarm and control, and other ancillary products to support the transmission equipment.

After serving as Director of Engineering for 12 years and as Vice president of Engineering for all of Rockwell Telecommunications for three years, I decided that the time was right for me to join a university for the last few years of my career. My goal was to once again participate in research but also to work with new engineers to try to pass on to them some of what I learned over the span of my career. I retired from Rockwell at the end of 1988. I look back with a feeling of great satisfaction, knowing that I played a role in significantly advancing the technology and developing products that grossed more than $2B during my time with the corporation. We also succeeded in supplying equipment in a great many countries and in some brought long distance service to the area for the first time. Figures 11, 12 and 13 were taken during a visit to The People's Republic of China in 1978, to help that nation in growing their telecommunications infrastructure.

I am grateful to the hundreds of engineers who I had the privilege in directing during these efforts and I want to share this honor bestowed on me with them. A few of the key individuals were Bob Hicks who was my Director of Radio Development, Paul Hartmann, Eddie Allen and Drew Crossett who led the digital radio development, Bill Conner and Phil Salas, who played lead roles in the analog development, Ben Hallford, Bob Livingston, Bill Thompson, Dick Nichols, Charlie Hogge, and Bob Fekete who were some of our top design engineers, and Joe Cook who hand-fed each of our radio products on their journey from engineering to manufacturing. Nevin Karlovak, Dale Trent, Mike Dugan, and Dennis Offut were some of the key players in our lightwave development.

I became Professor of EE and Associate Dean of Engineering for Research at the University of Texas at Arlington in the fall of 1988 and started a telecommunications graduate track in EE. I enjoyed the return to the campus and particularly the opportunity to work with new engineers and to once again get personally involved with research. My student's dissertations covered a wide range of fields including M-Ary modulation in coherent detection fiber optic systems, architectures for fiber optic distribution of wide bandwidth multimedia information in subscriber loops, filters for dispersion compensation of optical fibers, in-building propagation for PCS, integrated voice/data mobile radio, and low bit rate voice. Our program at the university was considerably strengthened when Vasant Prabhu retired from Bell Labs and joined me in the graduate telecom activities. Our Ph.D. and MSE students are not only populating many of the companies in the Telecom Corridor of the Dallas Fort Worth Metroplex but are working in many nations of the world. I officially retired in 1995 from the university, but have not been able to break away from my career yet as I continue to consult, lecture and serve on too many national, local and IEEE committees.

My career followed many paths and took many turns but there has been one constant, the strong support of my wife, Professor Marion Sobol of SMU, who put up with me for all these years. I am eternally grateful to her.

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RF/Microwaves in Medical Applications, and Future Research

RF/MICROWAVES APPLICATIONS IN MEDICINE

Arye Rosen, Ph.D.* and Har'el D. Rosen, M.D.**

Abstract

The applications of RF/microwave in medicine, particularly in cardiology, urology, otolaryngology and surgery are described. A few of the applications have gained worldwide acceptance and are currently used to treat human subjects, while others are currently being researched and developed.

Introduction

The use of RF/microwaves in therapeutic medicine has increased dramatically in the last few years. RF and microwave therapies for cancer in humans are well documented, and are presently used in many cancer centers. RF treatments for supraventricular arrhythmias, and more recently for ventricular tachycardia (VT) are currently employed by major hospitals. RF/microwaves are also used in human subjects for the treatment of benign prostatic hyperplasia (BPH), and have gained international approval, including approval by the United States Food and Drug Administration (FDA).In the last year, several otolaryngological centers in the United States have been utilizing RF to treat upper airway obstruction and alleviate sleep apnea. Despite these advances, considerable efforts are being expended on the improvement of such medical device technology. Furthermore, new modalities such as microwave enhanced liposuction, microwave ablation, RF/microwaves for the enhancement of drug absorption and microwave septic wound treatment are continually being researched. In this paper we specifically address the advances in the area of RF/microwave ablation, RF/microwave treatment of benign prostatic hyperplasia, microwave balloon angioplasty, RF in the treatment of sleep apnea, and two new areas of investigation: microwave enhanced liposuction and microwave anastomoses.

RF/Microwave Ablation for the Treatment of Cardiac Arrhythmias [1-15]

Cardiac arrhythmias can result from a variety of clinical conditions, but at their root is an abnormal focus, or pathway, of electrical activity. Abnormal sources of electrical activity most commonly occur at or above the AV-node, and are thus deemed supraventricular tachyarrhythmias. Alternatively, abnormal ventricular foci cause ventricular tachycardia. The presence of abnormal conduction pathways can also result in an uncontrolled cycling of electrical activity resulting from retrograde signal conduction through the myocardium (re-entry tachy-arrhythmias). Re-entry can occur within the AV-node (AVNRT), or via accessory conduction pathways (AP). Regardless of the specific etiology, once the source of the arrhythmia has been identified, destruction of the abnormal cardiac tissue is curative. The goal of ablation is to modify the electrical system of the heart by converting electrically-active cardiac tissue to electrically-inactive scar tissue. The scar or lesion that forms then blocks the focus or accessory pathway and prevents the

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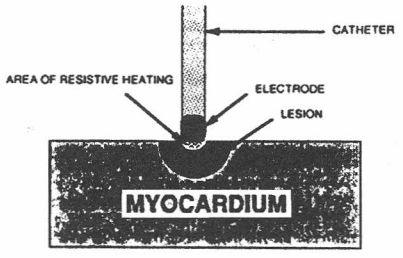


Figure 1. Mechanism of RF ablation. When RF current is delivered to the tip of a catheter electrode, resistive heating occurs along a small rim of tissue in direct contact with the electrode. A lesion is created as heat conducts passively away from this zone and the surrounding myocardium is heated to a temperature where cell death occurs (~50°C). Lesion size is therefore a function of the size of the electrode and the resulting temperature at the electrode-tissue interface.

tachycardia. Various energy forms have been used to create such localized tissue injury, including direct current (DC), radio-frequency (RF), and microwave energy.

The clinical use of DC ablation dates back to 1982. An electrode catheter is placed at the desired location, and a DC shock is applied. Although complete ablation occurs in up to 65% of patients, DC ablation is fraught with complications. Hypotension, perforation, cardiac tamponade, embolization, pericarditis, and ventricular tachyarrhythmias have been reported in as many as 10% of patients. Mortality associated with DC ablation may be as high as 5% in some patient groups. RF ablation was developed with the hope of decreasing the risks associated with DC application. In RF ablation, lesion formation results from resistive tissue heating at the point of contact with the RF electrode (Figure 1). This heating is thought to lead to coagulation necrosis and permanent tissue damage. If there is poor tissue contact, RF current can not be coupled to the underlying tissue, and the desired effect of tissue heating is lost. Overall success rate for RF ablation have been reported to be as high as 85% for AV junction ablation, and as high as 95% when applied to re-entry mediated tachycardia. Furthermore, RF ablation has not been reported to result in serious side effects. Recently, encouraging results in the treatment of ventricular arrhythmias occurring as a consequence of diffuse processes such as myocardial ischemia or infarction have been published. The search for ablation modalities capable of safely generating even larger lesions has spawned an interest in microwave ablation (Figure 2). Unlike DC and RF techniques which generate lesions of relatively limited size and penetration, microwave energy might allow for greater tissue penetration, and thus a greater volume of heating. Microwave ablation systems are currently being developed.

RF/Microwave Treatment of BPH [16-33]

Benign prostatic hypertrophy (BPH) represents an enlargement of the prostate gland which can lead to compression of the urethra, and thus cause urinary tract obstruction. The prostate gland is an organ at the base of he male bladder which surrounds the urethra and produces seminal fluid. Overgrowth of prostatic tissue leads to compression of the urethra. BPH is among the most common medical conditions affecting men over the age of 50. In fact, over 50% of men older than 50 years old have enlarged prostates. Symptoms of urinary tract obstruction (frequent urination, decreased urine flow, nocturia, dribbling, discomfort, pain) most commonly begin at 65 -70 years of age.

Although drug therapy may be effective for patients with early stages of BPH, many men will need invasive intervention for relief of

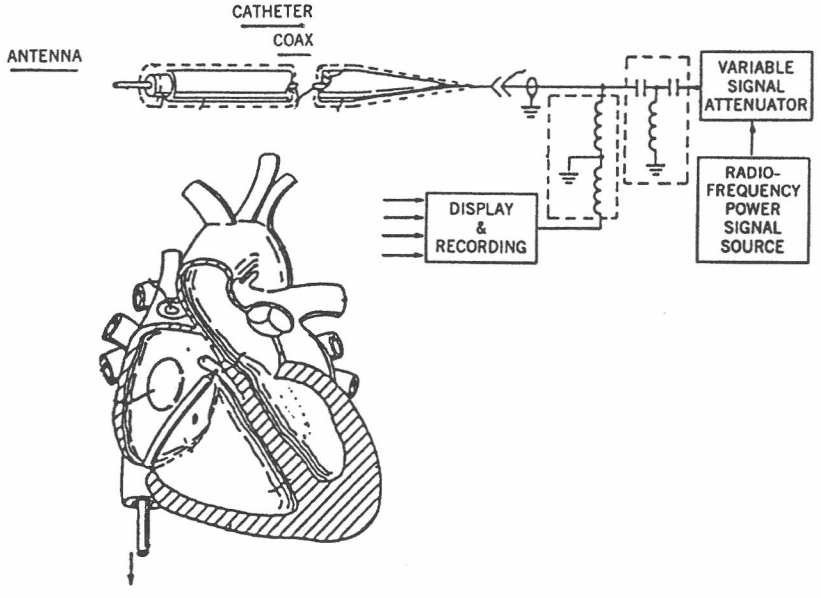


Figure 2. Microwave system used for myocardial tissue ablation

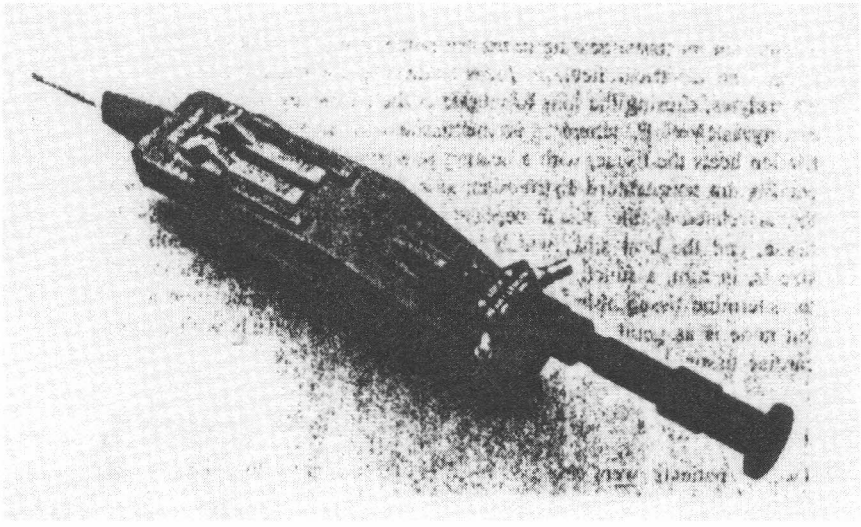


Figure 3. TUNA catheter with handle incorporating direct fiberoptic vision(with permission of VidaMed, Inc.)

symptoms. Surgical excision of prostatic tissue has been the standard care for more advanced forms of BPH. Procedures such as prostatectomy and transurethral resection of the prostate, however, carry with them significant risks. To minimize such hazards as hemorrhage, coagulopathies, pulmonary emboli, bladder perforation, incontinence, infection, urethral stricture, retention of prostatic chips, infertility, and retrograde ejaculation, minimally invasive alternatives have been developed and are being investigated. Transurethral RF and microwave procedures are becoming promising alternatives to surgical intervention. The goal of therapy is to decrease the volume of prostatic tissue. RF Transurethral Needle Ablation (TUNA) (Figure 3) involves the introduction of interstitial needle electrodes directly into prostatic tissue. One such system uses a catheter harboring electrode-needles within its tip. These needles, when deployed, pass into the prostatic tissue. RF current flows through the tissue from the active to the dispersive electrode, and ablation occurs as the intervening tissue is heated. Alternatively, single needle electrodes can be passed via a cystoscope, into the prostate. RF energy is then used to create two or more localized lesions. Both methods have been effective as therapy for symptomatic BPH.

Transurethral Microwave Thermotherapy (TUMT) (Figure 4a,b,c) has also shown promise as a therapeutic modality for the treatment of BPH. This technique uses a microwave delivery system housed within a transurethral catheter (Figure 4). Its goal is to selectively destroy prostatic tissue without damaging the urethral mucosa or structures surrounding the treatment area. At microwave frequencies, temperatures in the target tissue can be raised to as high as 45 - 70°C without damaging periprostatic tissue. TUMT has been used routinely outside the United States, and has recently received approval by the U.S. Food and Drug Administration.

Microwave Balloon Angioplasty [13, 34-44]

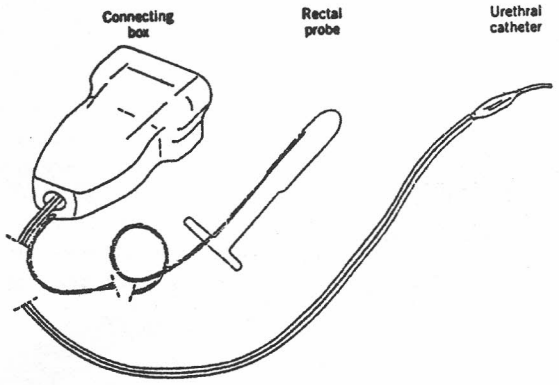
Atherosclerosis, with its resultant occlusion of coronary blood flow, remains a leading cause of morbidity and mortality. For many patients with advanced disease, or in whom pharmacologic management has failed, percutaneous transluminal balloon angioplasty (PTCA) has offered an effective alternative to coronary bypass surgery. The efficacy of PTCA, however, has been limited by restenosis rates ranging from 17% to 47%, as well as by a risk of arterial dissection and/or thrombus formation. Furthermore, acute occlusion, resulting from elastic recoil at the angioplasty site, can occur in as many as 5% of patients undergoing PTCA. Such patients require emergency heart surgery. Microwave Balloon Angioplasty (MBA), the first microwave application in cardiology, was developed with the ultimate goal of decreasing both acute and long term restenosis risks.

MBA, like PTCA, employs a balloon catheter which is advanced to the site of arterial stenosis. While PTCA uses only the pressure generated by balloon inflation to dilate the affected artery, MBA takes advantage of the volume heating properties of microwave emitters. In MBA, a microwave cable-antenna assembly is threaded through the catheter, with the antenna centered in the balloon portion of the catheter. By heating the tissue as the balloon is inflated, it was hoped that a patent vessel would be created that would be resistant to both acute and chronic reocclusion. Early *in vivo* studies, at 2.45 GHz, were conducted to assess the effects of various energy levels upon normal and atherosclerotic rabbit iliac arteries.

Research on the therapeutic potential was subsequently conducted on atherosclerotic rabbit iliac arteries using microwave energy to raise the balloon surface temperature to 70 - 85°C. When compared to simultaneously performed conventional angioplasty, MBA at 85°C produced significantly wider luminal diameters both immediately after angioplasty and 4 weeks after the procedure (Figure 5). Further work, utilizing mongrel dogs with thrombin induced coronary occlusion, has demonstrated the feasibility of MBA as a treatment modality for coronary thrombosis. MBA of such coronary thrombi in dogs resulted in patent vasculature with the added benefit of an organized and stabilized thrombus. Although the technique described was successful in animal studies, it has not yet found its way into clinical use. However, microwave balloon angioplasty has recently been suggested for applications in carotid stenosis and arterial occlusion.

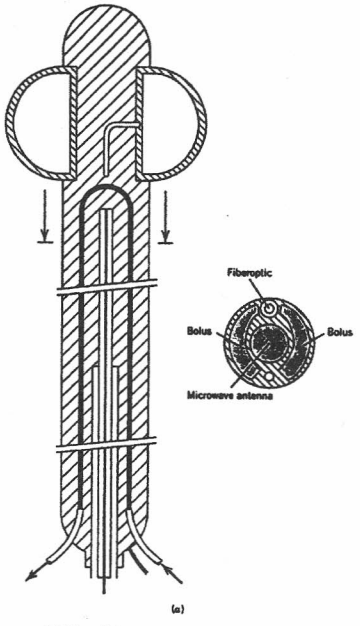
RF in the Treatment of Obstructive Sleep Apnea

Obstructive Sleep Apnea (OSA) is a disorder diagnosed when an individual's upper airway becomes intermittently blocked during sleep and breathing becomes interrupted. Approximately 20 million Americans are estimated to suffer from OSA, and over half of these are between the ages of 30 and 60 years. During sleep, there Is a relaxation of the structures surrounding the pharynx/throat. Breathing becomes interrupted (apnea) when these anatomical structures relax in a position which occludes airflow. The most commonly involved structures include the soft palate, the base of the tongue, and the tonsils/



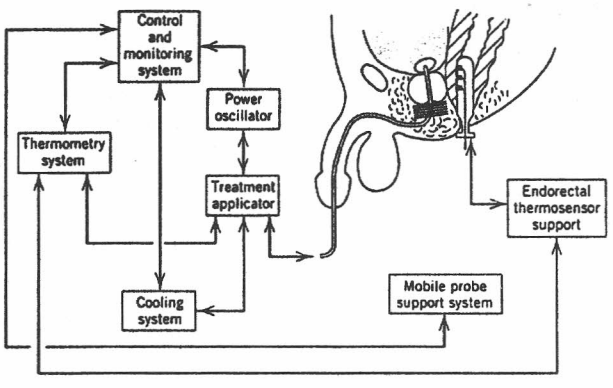
Schematic representation of the treatment catheter (with permission of Technomed Medical Systems).

(a)



(a) The catheter;

(b)



Prostatron treatment functional diagram (with permission of Technomed Medical Systems).

(c)

Figure 4

adenoids. Enlarged turbinates within the nose can serve to further impede airflow.

OSA and its resultant interruption of normal sleep patterns have a wide range of clinical effects. Patients may experience daytime sleepiness, most hazardous while driving or during work. They may also exhibit personality changes, difficulty concentrating, memory difficulties, headaches, or sexual dysfunction. Sleep apnea Is also associated with increased rates of systemic and pulmonary hypertension, stroke, heart failure, and myocardial infarction.

Treatment depends on severity and frequency of symptoms. Some mild cases may be managed with weight loss alone. Often, however, further intervention is needed. conventional management has relied upon dental appliances to maintain an open airway, ventilators to provide Continuous Positive Airway Pressure (CAP), and attempts at surgical correction of the airway obstruction. Though effective, dental appliances and CPAP are both uncomfortable, and suffer from relatively low patient compliance rates (40 -70%)[68,69]. Surgical correction may involve either excision of 'excess tissue' (uvulopalatopharyngoplasty) or more involved maxillofacial surgery. Surgical cure rates have been reported to range between 30 and 75 %. [70, 71]

Recently, Somnus Medical Technologies has developed an RF system (Somnoplasty™) which uses needle electrodes to create precise regions of submucosal tissue coagulation. Thus, both the tissue volume and its resulting airway obstruction are reduced. Applicator probes have been developed to target specific tissues including the base of the tongue (6a), the uvula (6b) and soft palate (6c), arid nasal turbinates (6d). Somnoplasty is designed to be performed on an outpatient basis, under local anesthesia, and is expected to boast such benefits as immediate results, little post-operative edema or discomfort, and no permanent scarring.

In the paper entitled "Radiofrequency Volumetric Reduction of the Tongue - A Porcine Pilot Study for the Treatment of Obstructive Sleep Apnea Syndrome" Powell, et al, reported on the use of RF for the volumetric reduction of the tongue [72]. Powell's three stage pilot study investigated both the *in vitro* and *in vivo* effects of RF, delivered via a customized needle electrode. Volumetric measurements were performed using implanted ultrasonic crystals positioned around the treatment site. Changes in tissue volume could then he assessed both before and after the delivery of RF energy. To establish the feasibility of the technique, the initial stage of the project used two bovine tongues (in vitro). A single 0.05" diameter needle electrode delivered 30 kj over a 20 minute period at two sites per tongue. Volume reductions of between 12.8 and 26.7 % were noted immediately after the procedure, with an additional 4% reduction noted after 4 hours. The second stage was conducted using pigs, *in vivo*, and demonstrated that volume reduction increases as the amount of energy delivered is increased from 6.8 to 40 kj. Finally, in the third stage, an *in vivo* porcine model was again used, this time assessing clinical efficacy of the procedure by measuring both tissue volume changes, and histological changes. RF tissue reduction was performed on 9 pigs, with 3 additional pigs serving as controls. An 0.035" diameter needle electrode was used to deliver 2.4 kj over 6+1.29 minutes. Immediately after the procedure, a

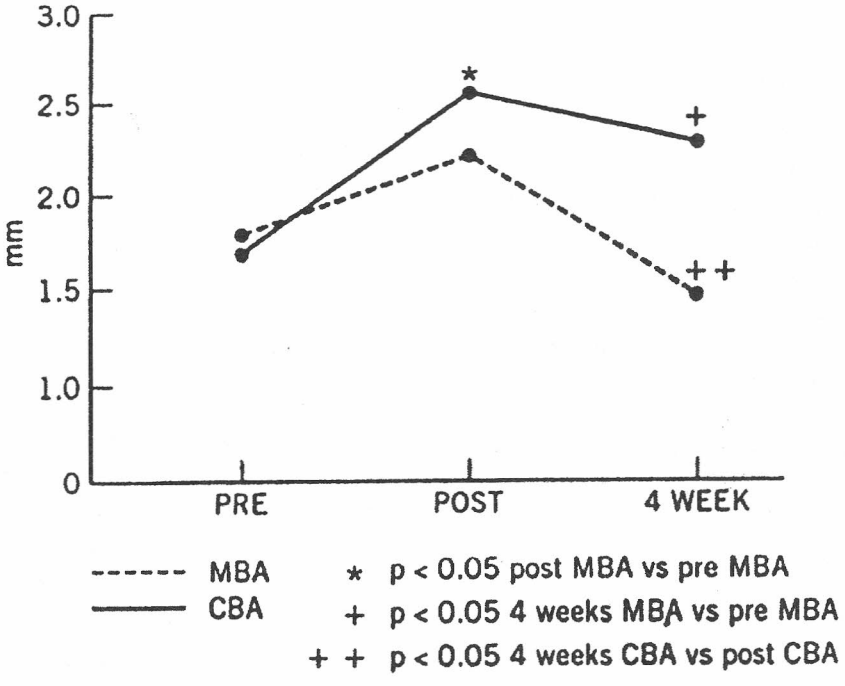


Figure 5. Microwave thermal angioplasty (85°C)

mean volume shrinkage of 7.02% was described. By 24 hours after the procedure, edema resulted in a 4 to 6 % increase in tissue volume, thus returning nearly to baseline volumes. Subsequently, however, a progressive volume reduction of up to 26.3% was identified over the following 10 days. Animals were sacrificed at between 1 hour and 5 weeks after the procedure. Lesions were described as spherical, well defined regions of tissue destruction, initially demonstrating edema and hemorrhage. As the lesion healed, scar formation occurred, along with neovascularization. Tissue and vessels surrounding the lesion remained intact and viable. Given the seeming success of this technique in the animal model, RF tissue reduction may offer a promising alternative to the conventional management of obstructive sleep apnea.

FUTURE RESEARCH IN RF/MICROWAVES

Microwave Enhanced Liposuction [45-53]

Liposuction is used for aesthetic and reconstructive surgery. Its uses include the undermining of large flaps while preserving vascular attachments, removing lipomas, treating gynecomastia, and improving axillary hyperhydrosis. The application of RF/microwave for enhanced liposuction may reduce some problems associated with standard mechanical liposuction, including blood loss, fluid shifts and systemic effects.

Dry-technique liposuction vs. microwave-enhanced dry-technique liposuction - Preliminary work has been conducted, in swine, to compare the effects of the dry-technique liposuction vs. microwave-enhanced dry-technique liposuction. The "non-microwave" dry-technique liposuction performed at the two cephlad sites yielded typical fat debris which grossly appeared to be mixed with a noticeable amount of blood. The "microwave" liposuction performed at the two caudal sites yielded fat which differed considerably in quality and texture from tissue extracted using the dry-technique. The duration of microwave enhanced suctioning appeared to be related to the histologic changes observed in the subcutaneous fat derived from the caudal sites. The fat initially removed during the first 30 seconds grossly appeared similar to conventionally suctioned fat. However, the fat removed as the duration of microwave enhanced liposuction increased from 30 seconds to 2 minutes appeared increasingly softened. The longest duration of microwave suctioning, from 2 to 4 minutes, yielded fat which grossly appeared to be fused into an opaque, amorphous melted state.

The Tumescent-Technique for Liposuction Surgery - The "tumescent technique" of liposuction was introduced in 1986. Use of the Klein needle has allowed the anesthetic solution to be rapidly injected through the same incision used for liposuction, efficiently anesthetizing large subcutaneous areas, thus eliminating the need and risks of general anesthesia. Injection of a large volume of dilute lidocaine produces a swelling and firmness of the site to be aspirated which greatly facilitates fat removal. The small (3-4 mm) cannulas produce less trauma, therefore result in less

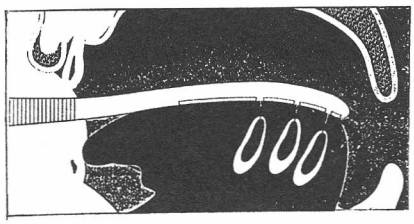


Figure 6a. Tongue Somnoplasty

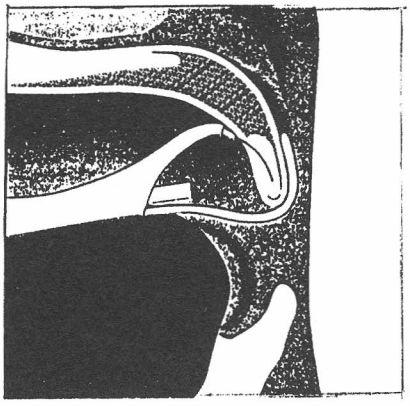


Figure 6b. Uvula Somnoplasty

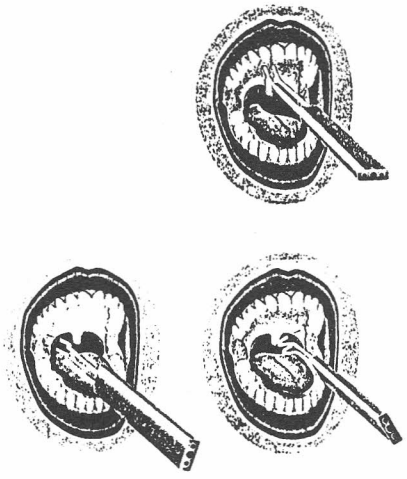


Figure 6c. Palatal Somnoplasty

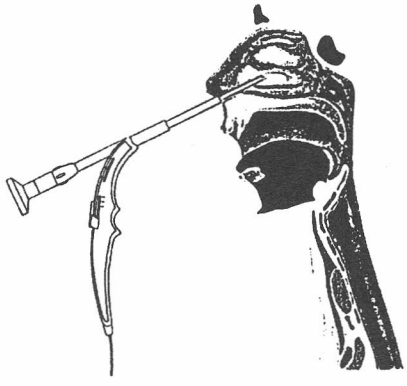


Figure 6d. Turbinate Somnoplasty

blood loss, bruising, and discomfort. The basic technique was later expanded, and much larger volumes of lidocaine were administered, resulting in the capability of aspirating significantly greater volumes of tissue with a minimum increase in blood loss. This was achieved with serum lidocaine levels well below the toxicity range. We believe that using microwave volume heating will further enhance and benefit the tumescent technique.

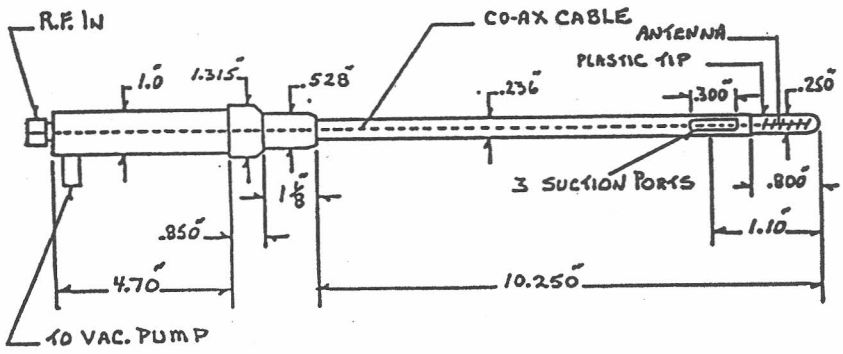


Figure 7. Microwave enhanced liposuction cannula

Tumescent-technique liposuction vs microwave-enhanced tumescent - liposuction - A similar protocol was followed at corresponding sites on the left side of the swine. The only modification was to employ tumescent liposuction instead of the dry technique that was used for sites on the right side. The solution used for tumescence consisted of lOOOcc of normal saline, combined with 6Occ of 1 % lidocaine with epinephrine. Approximately 250cc of this solution was infiltrated into each of the four sites prior to liposuction. The conventional "non-microwave" tumescent liposuction performed at the two cephlad sites yielded fat typically seen in such procedure; there was also less bleeding than seen with the dry technique.

Tumescent liposuction combined with microwaves between 30 and 40 Watts yielded a transformation in the fat suctioned, enabling easier fat removal with less bleeding in comparison to both conventional dry and tumescent liposuction without microwaves.

Cannula Design

The cannula utilized was a Byron Accelerator III type cannula, which was modified to hold a microwave semirigid coaxial cable having a whip antenna at the distal end, Figure 7. The tip of each cannula distal of the suction port was modified by removal of its metal tip, which was replaced with a dome made of plastic in order to facilitate microwave radiation. The suction port in the proximal end of the cannula handle was converted to accept the semirigid coaxial cable/antenna structure. Suction was effectuated through a new port installed in the cannula handle.

The system used in our preliminary experiments was designed for use at 2.45GHz while immersed in a tissue phantom. With the modified liposuction cannula and antenna, we have measured return losses as low as -37db.

Tissue Anastomoses Utilizing Biological Solder in Conjunction with Microwave Irradiation [54] in Future Endoscopic Surgery

Endoscopic surgery is revolutionizing many surgical procedures. For example, laparoscopic surgical procedures, particularly laparoscopic cholecystectomy, have gained widespread acceptance. Further expansion of the endoscopic approach is inevitable. Although minimal access surgery is advantageous to patients, the technical problems imposed by the limited access are pushing existing tissue closure technologies (mechanical stapling devices and hand-sewn sutures) to their limits. The laparoscopic closure of an incision made in the bile duct for removal of stones is an example of the shortcomings of current technologies. Closure of this incision with laparoscopically placed sutures is difficult and postoperative bile leakage may result. Mechanical stapling devices for this purpose are beyond currently available technology.

To enhance a tissue anastomosis with microwaves, the tissue temperature must be kept below the threshold for damage, while the biological solder is heated above 60°C. Microwave anastomosis may also prove useful for vascular repairs, for example. A microwave antenna can be positioned inside an artery, and solder (albumin) is then placed on the outside of the vessel and in any small gaps between the arterial segments undergoing repair. The successful results in vitro have encouraged the preliminary investigation in a rabbit model. Early results

in vivo, however, have indicated the need for a dry environment. More research is needed to evaluate the full potential of the microwave anastomoses technique.

Conclusions

In this paper we have reviewed a few of the existing applications of RF/microwaves in medicine. We have indicated with some detail the new applications currently under investigation. A more detailed discussion of some of the topics can be found in the book entitled New Frontiers in Medical Device Technology edited by Arye Rosen and Harel D. Rosen, published by John Wiley and Sons, 1995 as part of the Wiley Series in Microwave and Optical Engineering/Kai Chang, Series Editor.

Acknowledgements

We wish to thank Mr. Stuart Edwards, President and CEO of Somnus Medical Technologies, who furnished some of the information and figures presented in this paper. Somnus has recently received FDA 510(k) clearance to market its Somnoplasty System for some of the procedures described. We also wish to thank Mr. John Hendrick, COO of VidaMed for his support in presenting VidaMed's story. Finally, Danielle Rosen's contribution in editing and typing this manuscript is gratefully acknowledged.

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Great Success of the TELSIKS'97 Conference

The 3rd Conference on Telecommunications in Modern Satellite, Cable and Broadcasting Services - TELSIKS'97 was held from October 8 through 10, 1997, at the Faculty of Electronic Engineering, University of Niš, Yugoslavia.

The series of the biennial conferences TELSIKS intended to be a highly competent scientific and professional meeting, which offered an opportunity for researchers, scientists and engineers to present their recent achievements in this area. The first two well-organized conferences allowed organizers to provide an international character and high quality of this year conference. TELSIKS'97 was organized by the Faculty of Electronic Engineering - Niš, Ei HOLDING Co. - Niš and Radio-Television of Serbia – Belgrade. It is very significant for organizers that, this year, a technical sponsorship is obtained from IEEE Microwave Theory and Techniques Society. Also, IEEE Yugoslavia Section, Yugoslav Society for Microwave Techniques and Technology, Yugoslav Society for Telecommunications and others helped very much the organization of the Conference.

The Conference topics were: Satellite communications, Cable communication systems, Radio communications, Satellite and terrestrial broadcast systems, Television technique, Applied electromagnetics, Antennas and propagation, RF and microwave technique, Optical communication systems, Telecommunication and DSP integrated circuits, Modulations and Coding, Signal processing, Multimedia, Telecommunication networks, etc. The Conference focused on modern broadcasting technologies as MMDS.

Faculty of Electronic Engineering in Niš - the location of the TELSIKS'97

All submitted scientific and application oriented contributed papers have been reviewed by the International Review Board. On the basis of that, 175 papers (which authors are from 21 countries) have been accepted for oral or poster presentation. All papers were presented in English and published in the Conference Proceedings.

A number of invited speakers provided the first hand information on the state in focused fields and helped in maintaining a general view. For instance, B. Evans from U.K. talked about the recent developments in UHF and microwave terrestrial television, D. Draji} from Yugoslavia talked about the development of information theory, N. Uzunoglu from Greece gave a speech of the field theory techniques in MIC and MMIC design, C. Christopoulos from U.K. presented the applications of TLM method, etc. A number of selected high-quality papers will be published in a special issue of the international journal "Facta Universitatis."

In addition, the technical program included two workshops (*Cable Television* and *MMDS*) and two round tables. The Conference was accompanied by an exhibition of

Executive Council of the Opening Session (from left to right): Prof. A. Marin~I}, Prof. C. Christopoulos, Chaimen of the Conference Prof. B.Milovanovi}, Prof. I. Stojanovi}, Prof. V. Vladimirov and Prof. J. Surutka

The Chairman, Prof. B. Milovanovi}, opened the Workshop

The Exhibition

research results and industrial products related to the Conference topics. During the exhibition, two presentations were performed. The first one was the installation and presentation of an experimental MMDS system, and the second one was the demonstration of some satellite solutions for high-speed Internet access.

It is important to mention a detail from the Conference Opening. Namely, according to the suggestion of Mrs. Margaret Chini, president of Memorial Society "Nikola Tesla" from the USA, the conference participants accepted that the birthday of Nikola Tesla, July 10, be pronounced as "World Nikola Tesla Day".

General impressions were excellent. Most of participants put a special emphasis on the high professional level of the Conference and on the traditional hospitality of organizers. The social program was rich in events. The University choir and a folkdancing group took part in the performance arranged for all conference participants. Also, a sightseeing was organized for all interested conference participants. It should be emphasized that the Conference gala dinner made a strong impression on conference participants who enjoyed fine cuisine, good beverages and exclusive live music.

And last but not least, we would like to cite some messages from "Book of impressions": B.Evans, UK: "I have thoroughly enyoed my visit to Ni{", O.Fratu, Romania: "Congratulations for your successful effort in organizing this Conference. I think that the kindly atmosphere which I find here during TELSIKS'97, promise a new high-level meeting during the next Conference TELSIKS'99".

How to Get Your Paper Into the MTT Symposium

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Today I finished reviewing the last of 51 papers submitted to the 1998 MTT International Microwave Symposium (IMS) sessions on Nonlinear Modeling and Analysis. Like my nine colleagues on this subcommittee and the other couple hundred reviewers on other subcommittees, I'm exhausted. Anyone who thinks that this is fun is kidding himself.

A majority of these papers will be rejected. This should be no surprise; the competition is stiff. Of our 51 papers, we will accept about a dozen for regular sessions and a few more for the open forum. Our acceptance rate will be a little over 30%. The symposium's overall acceptance rate probably will be about 50%. With this kind of competition, papers with even modest flaws—to say nothing of major ones—don't stand a chance.

The frustration of seeing many potentially good papers rejected has inspired me to write this article. Still, I should start with a disclaimer: the following are my own opinions and observations; they are not official MTT or IMS policy. Still, after several years on the TPC, I think I have a good idea of what is accepted and why.

So, here's the story:

First, before submitting a paper, consider whether your paper really belongs in the IMS. The IMS deals with RF and microwave technology. Many subjects, which arguably fit within our range of interests, actually belong in other symposia. For example, we no longer have sessions on solid-state devices; such papers belong in the Electron Device Meeting. Although we obviously deal with aspects of circuit theory, papers on general circuit theory should be submitted to the International Symposium on Circuits and Systems. Similarly, most antenna papers are best submitted to the Antennas and Propagation Society Symposium.

Many types of papers that do fall within our sphere of interest still are not well suited to an IMS presentation; these should be sent to a print journal, perhaps *the IEEE Transactions on Microwave Theory and Techniques*. For example, a paper that includes a lot of industrial-strength mathematics probably does not belong in the IMS. Unless the results can be summarized without a lot of Greek letters and other funny symbols, the paper will not do well in a presentation. Be honest: how many of these papers, consisting of slide after slide of heavy-duty mathematics and a terse digest paper, do you really understand on first sight? Shouldn't these be in a print journal, where there is more room for explanation and readers have time to study them?

We sometimes divert these turgid works to an open-forum session. This is a better venue for heavy subjects, but still not as good as a print journal. Unfortunately, many people view the open forum as a dumping ground for mediocre papers and can't imagine their shining creations in such lowly surroundings. If you have this attitude problem, get help. Meanwhile, submit your little wonder to a print journal.

The open forum sessions are not for marginal papers; the standards of novelty and quality are the same as for the presentation sessions. The open forum is simply for a different type of paper: one that requires demonstrations, hardware exhibition, or extensive discussions. So, if your paper really is better suited to the open forum, submit it to the open forum.

Second, a point I repeat until I'm breathless, yet it still needs to be said: *before submitting it, have your paper reviewed by someone in your organization who publishes regularly*. This is especially important for beginning grad students. Go to your advisor (that's the guy who is always too busy to see you) and ask him to help you with the paper. Don't feel like your requesting a favor; that's his job (after all, he is a co-author) and his input is essential. Nothing is more irritating than to

get a paper full of sophomoric drivel written by Joe Student, Jane Student, and Great God Professor, and it's obvious that G. G. P. never even looked at the paper. This is an insult to the reviewers: we supposedly have time to read and evaluate "his" paper, but he doesn't. What, do you suppose, are the chances that a reviewer will accept a paper that offends him in this way?

Here's a technique I perfected in graduate school for getting a piece of a busy advisor's time: wait until he goes to the restroom, follow him in, and stand in front of the door so he can't escape until he talks to you. This presupposes, of course, that you are the same sex as your advisor. But if you're not, the trick might work even better.

Third, think long and hard about what you should put into your submission. An IMS submission is different from other kinds of publications. Especially, it is not an *MTT Transactions* paper. Unlike a *Transactions* paper, an IMS paper is accepted on the basis of a summary of the paper, not the paper itself. Unfortunately, most authors submit a complete paper, not a summary, forcing the reviewers to slog through a lot of unnecessary details and to exhume the paper's main idea from a mound of nonessentials. Believe me, this does not endear you to a reviewer who has a pile of 50 more papers in front of him! On the other hand, a few authors take the other extreme. Recognizing that the reviewer has a lot of work to do, they submit a one-page summary that is far too brief to be evaluated. Both types of papers are likely to be rejected, even though the work may be very good.

So, what should a summary contain? First, it must have an abstract (more on that later.) Second, it must explain, as clearly, directly, and succinctly as possible, the nature of the problem, the methods used, and the results. This description must show the novelty of the results and how they advance the state of the art. Statements like "Excellent results were achieved" are marketing claims that tell the reviewer nothing. A long *Transactions*-style introduction with lofty statements about the importance of the technology and a description of all previous efforts, along with their shortcomings, is a waste of the reviewer's time. Similarly, lots of mathematical derivations are a waste of space: I can guarantee that no reviewer (except, perhaps, a few with far too much spare time) will go through them in detail. Above all, don't add a lot of superfluous mathematics to show how smart you are and to make the paper a seem "high-level." This ploy will backfire, for sure. IMS reviewers have very sensitive "BS" detectors.

A good summary rarely requires more than two pages of text and a few figures. As a reviewer and editor, I have always maintained that *any* paper can be shortened to *any* length. Most unimaginative authors think that shortening a paper requires discarding basic information. Nonsense! To shorten a paper, discard layers of detail, not basic information. After all, what is an abstract, but a paper shortened to a paragraph or two?

Fourth, spend some time on the abstract. The abstract helps the reviewer a lot. Unfortunately, few authors write good abstracts, or even know what an abstract is; I often feel that a paper's abstract sounds like conclusions, and its conclusions sound like an abstract. (In this case, merely reverse the two!)

How do you write a good abstract? A suggestion: imagine that you're walking down the hallway and a friend stops you. "Hey," he says, "I hear that you submitted a paper to the IMS. What's it about?" Your answer is an abstract. You're likely to say, for example, "We investigated the problem of giving enemas to elephants as part of our management-consulting research. We found that a six-foot-long silicon-rubber hose worked best, because it was most similar to the elephant's digestive tract. This increased the productivity of the enema by 38%." 47 words, and it tells the whole story.

Fifth, be sure you know the rules for publications. An unethical paper has a 100% probability of rejection. One common lapse is to submit a paper before the results are in. Another is to submit two papers covering only slightly different territory in a transparent attempt to inflate publication lists. This sort of thing should be rare, but, because of pressure on academics to publish large numbers of papers, it is becoming more common.

Sixth, learn how the papers are evaluated and evaluate your own in this light. IMS papers are evaluated according to four criteria:

Originality: Is this significant, new research of technical or commercial significance?

Qualitative Content: Is the paper an explicit summary with all necessary supporting data?

Quality: Is the work correct and nontrivial? Does it have value that extends beyond previous work?

Interest to MTT Membership: Is this something thing that IMS attendees will be interested in?

If the fourth criterion seems a little anti-intellectual, consider this: an IMS paper, although technically an archival publication, is not quite the same as most archival print-journal publications. People come to the IMS because it is a place to discuss current and emerging technologies, not to hear about things that are far outside the mainstream. Print journals gladly publish such work. That's their job, not ours.

I know that I've prescribed a lot of work, but it's essential. Musicians, who face even stiffer competition for acceptance, have the saying, *somewhere, right now, someone is practicing*. Somewhere, right now, someone is preparing a first-rate symposium paper. How will yours compare to it?

Book Review of *Introduction to Avionics*

Author: R. P.G. Collinson, Formerly with GEC Marconi-Avionics Ltd., Rochester, Kent, UK.

ISBN 0-412-48250-9
Price: $59.95
Pages: 456
Published by: Chapman & Hall, 2-6 Boundary Row, London, SE1, 8HN, UK 1996

This is a book intended for graduate students and professionals who deal with avionic systems.

The table of contents is:

This book is a part of the Chapman & Hall Microwave Technology Series edited by Michel-Henri Carpentier, Professor in 'Grandes Ecoles', France and Bradford L. Smith, International Patents Consultant and Engineer with the Alcatel group in Paris, France.

The book is very well written and will give the working engineer a good understanding of airframe components. Reading the book really triggered memorys of 20 years ago when I was a college coop student working with the guidance and control group on the HARM missle program. I learned a lot by asking questions and having things explained by different coworkers. This book would have been a godsend for me. In reading the book concepts that were kind of known became comfortable. For example Kalman filters and stapdown systems became better understood by reading this book. I highly recommend a copy for the engineer working with airframes or needs to converse with airframe customers.

Book Review of *Phased Array-Based Systems and Applications*

Author: Nicholas Fourikis, Defence Science & Technology Organization in Salisbury, South Australia.

TK6590.A6F69 1996
ISBN 0-471-01212-2
Price: $74.95
Pages: 426
Published by: John Wiley and Sons, Inc. 1997

This book is a part of the Wiley Series in Microwave and Optical Engineering edited by Kai Chang of Texas A&M University.

This is a great book on Phased Array Systems. It is a comprehensive coverage of the detailed design issues and trade-offs that effect the Phased Array System engineer. The book is in a very readable format, with good use of tables, equations and illustrations. As a T/R module designer and Power Amplifier MMIC designer by trade I am impressed by his coverage of those areas. The readability of the book is outstanding. The references are up to date and thorough.

The working professional in the area of Phased Array Systems t needs this book for well rounded coverage of the technology and trade-offs.

The table of contents is:

In summary, here is a phenominal book, that is up to date and very readible and should be in the library of every Phased Array design engineer.

International Workshop on Finite Elements for Microwave Engineering

From Electromagnetics to Microwave Electronics Software

Futuroscope — Poitiers, France
July 10-11, 1998

Final Call for Papers

Organized by IRCOM, University of Limoges, UMR CNRS, France with the collaboration of the University of California at Los Angeles, USA and the University of Florence, Italy

Conference Themes

The Workshop on Finite Elements for Microwave Engineering will focus principally on finite element software relevant to problems of microwave electronics, passive and active microwave devices, antennas and field simulation. Other related topics of current interest and importance will also be considered. Papers presented at the Workshop will be fully refereed and published in the French scientific journal Annales of Telecommunications.

Location

The Workshop is planned to be held at the Futurescope Center in Poitiers, France on Friday and Saturday, 10-11 July 1998. The Workshop will immediately precede PIERS (Progress In Electromagnetics Research Symposium), which will take place in Nantes, France. Poitiers is an attractive city located just a brief train ride from Nantes and Paris, making it convenient to attend PIERS as well as this Workshop.

Call For Papers And Deadlines

Prospective authors are requested to submit a two-pages paper by January 31, 1998 (by this date your paper must bein the hands of the Conference Secretariat). Acceptance notification: May 15, 1998. Extended paper will be requested at the date of the Conference: July 10, 1998. The instruction for the authors are available at the Internet site http://ingfi9.die.unifi.it/poitiers/ where up to date informations are also available. Papers should be addressed to Conference Secretariat.

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Language

The official language of the conference for written contributions and discussions will be English

Conference Secretariat FEM-Poitiers 98

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The Sixth IEEE International Conference on Terahertz Electronics

The University of Leeds, United Kingdom

3-4 September 1998

Further information: http://www.elec-eng.leeds.ac.uk/THz98

Scope and Objectives

The Sixth IEEE International Conference on Terahertz Electronics will take place 3-4 September 1998 at Weetwood Hall, The University of Leeds, England, co-sponsored by the MTT Society of the IEEE. The previous meeting in this series was held, under IEEE sponsorship, at IRAM Grenoble, France in September 1997. This conference has established itself as the primary meeting for the terahertz electronics research community. Its main goal is to provide a forum for the exchange of information on the theory, technology and application of the emerging and interdisciplinary field of terahertz electronics, and to foster an appreciation of the capabilities and future directions of this technology.

The meeting will be of particular interest to all who use or develop technology in the frequency range 100 GHz - 10 THz. This broad region lies at the transition from optics to electronics, and while it has traditionally been studied for a limited number of specialist applications, recent developments in several fields such as semiconductor physics, short-pulse lasers, micromachining and other areas mean that the terahertz frequency band will soon be utilised far more widely. Together with the themes traditionally represented in this series of meetings, contributions in areas of emerging technologies and new applications are particularly welcome.

The following is a representative list of topics to be covered at the Conference:

A. Antennas and Arrays

B. Detectors and Receivers (Schottky diodes, mixers, SIS receivers, hot electron bolometers)

C. Imaging (active and passive)

D. Measurements (quasi-optical measurements, developments in vector analyzer and other methods.)

E. Modelling of Active and Passive Components

F. New Fabrication & Integration Technologies (membrane and micromachining technologies)

G. Opto/Terahertz interactions (pulsed optical techniques for THz generation; THz modulation and optical control of THz)

H. Quasi-Optical Design

I. Sources (developments in existing fundamental solid-state sources eg Gunn diodes, HEMTs etc; new concepts in fundamental sources using intersubband transitions, exciton effects, tunelling, plasma wave electronics; developments in multiplier technology eg Quantum Barrier Varactors)

Submission of Abstracts: Deadline: 1 June 1998

Electronic submission of abstracts is the preferred approach for this year's event. The organizing committee strongly encourages all prospective authors to take advantage of this facility, and to only use postal submission if they are unable to submit abstracts electronically. Full details can be found at: http://www.elec-eng.leeds.ac.uk/THz98

Postal Submission of Abstracts

If you are unable to use electronic submission, then mail six copies of an abstract to: THz98 c/o Dr Martyn Chamberlain, Department of Physics, University of Nottingham, Nottingham NG7 2RD United Kingdom to arrive no later than 1 June 1998. The abstract should be between two and four pages long (including illustrations). It must emphasize what is novel and contain enough detail for the reviewers to evaluate the contribution. On the first page, full contact information (i.e. address, tel. and fax numbers and email address) for the corresponding author must be provided, along with the most appropriate topic code (letters A to I) and the preferred mode of presentation (oral, poster or either).

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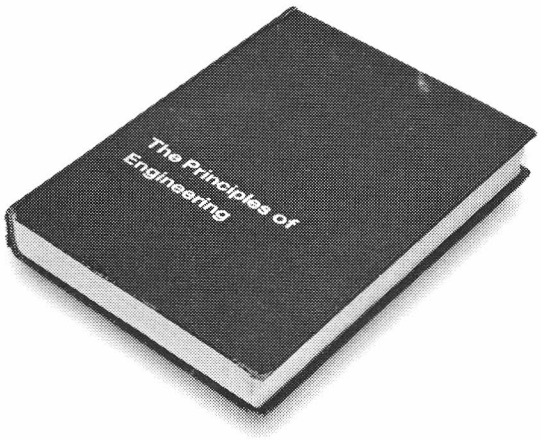

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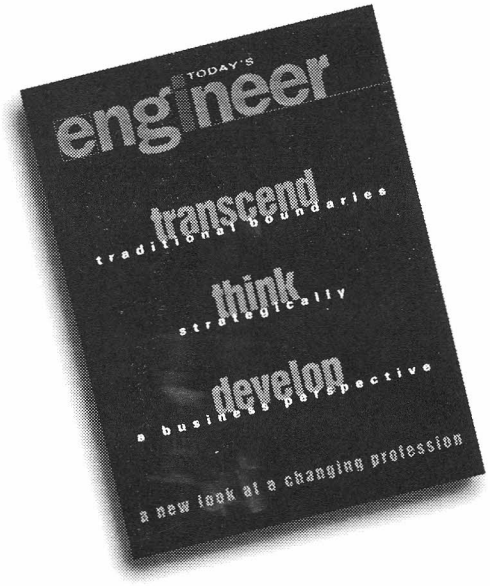

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