

# The 1986 MTT-S International Microwave Symposium

EDWARD C. NIEHENKE, SENIOR MEMBER, IEEE

**B**ALTIMORE was for the first time the host for the 1986 IEEE MTT-S International Microwave Symposium and Workshops, held jointly with the 1986 IEEE Microwave and Millimeter-Wave Monolithics Circuits Symposium during the week of Monday, June 2, through Friday, June 6, 1986. This Symposium broke all previous records in attendance with many innovations and activities, both technical and social. Baltimore offered the attendees a convenient location at the beautiful Baltimore Inner Harbor complex. The technical activities were held at the new, spacious Baltimore Convention Center, with the majority of hotels located within walking distance of the Center. Many hotels had over-the-street walkways to the Convention Center. The weather was perfect, with the sun shining every day and an average day temperature of 80 degrees F. The many attractions of the Inner Harbor within walking distance of the Convention Center were enjoyed by the attendees at lunchtime and in the evenings.

The Microwave Symposium was held on Monday, June 2, through Wednesday, June 4. The Monolithic Symposium was held jointly with the Microwave Symposium on Wednesday afternoon and all day Thursday. Six panel sessions were held on Monday, Wednesday, and Thursday, and six workshops as well as the 27th ARFTG Conference were held on Thursday and Friday. These well-attended panel sessions and workshops explored the latest issues and technologies to complete the technical program. This year's exhibition, with 425 booths, was the largest in MTT-S history.

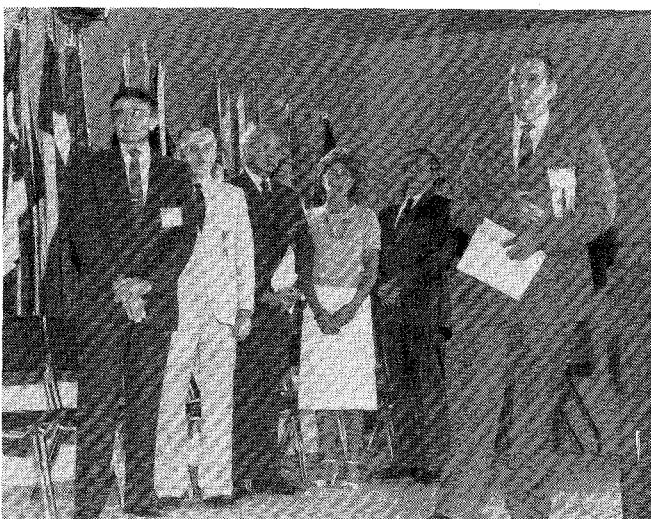
A full social program throughout the week made for an enjoyable time for the attendees and their families. On the Sunday evening prior to the symposium, 800 persons attended the complimentary Microwave Journal Reception at the Maryland Science Center. The entire Science Center, including all exhibits, was open exclusively for us. Complimentary continental breakfasts were served to all technical attendees at the Convention Center every morning prior to the start of the sessions to get people together and to make it convenient for the attendees. A complimentary Crab Feast/Bull Roast, a Maryland tradition, was enjoyed by 1050 persons on Wednesday evening. The guests' program, with visits to historic Baltimore, picturesque Annapolis, and Washington, DC, was well attended, with a total of 338 participants during the three days.

## OPENING CEREMONIAL SESSION

The week's program started on Monday morning with the opening ceremonial session, attended by about 1200



Suman Patel, Chairman of the Baltimore MTT-S Chapter, carries the Maryland state flag to the music of the Zim Zemarel Orchestra at the opening ceremony.



"The Star Spangled Banner," written in Baltimore, was sung by all at the opening ceremonial session. From left to right are Reinhard Knerr, Helmut Schrank, Joseph Charyk, Sylvia Ramsey, Francis Kuchta, and Edward Niehenke.

persons. In keeping with the Symposium theme, *Microwaves Linking Nations*, the 51 Chapter Chairmen/representatives from the various MTT-S chapters from 36 states and 15 countries carried their state/country flags in procession to the music of the Zim Zemarel orchestra. "The Star Spangled Banner," written by Francis Scott Key



Edward Niehenke welcomes all to the Microwave Symposium.

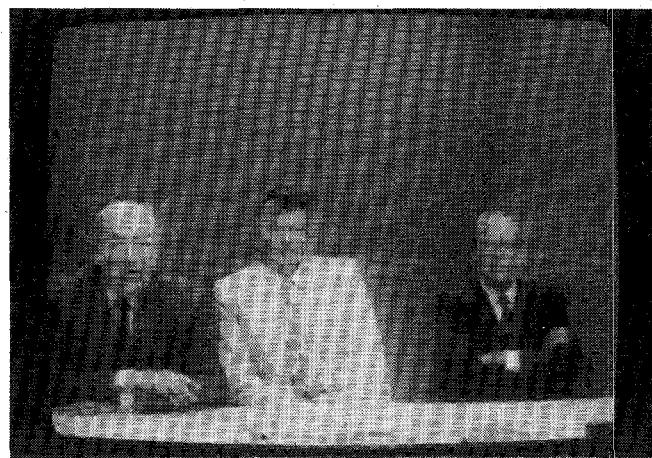


Reinhard Knerr delivers a special message in German via live two-way satellite transmission to the West Germans.

in Baltimore on September 13, 1814, was played and sung by all.

The Symposium was officially opened with a two-way live microwave transmission between Baltimore and West Germany, representing our overseas members. AT&T long lines carried the transmission from Baltimore to Etam, West Virginia, where the signal was beamed up to the INTELSAT satellite and beamed down to Raisting, West Germany. The transmission link was completed with a special overland microwave link to the West German studio in Bonn. Edward Niehenke, the Symposium Steering Committee Chairman, and Dr. Reinhard Knerr, the MTT-S President, welcomed everyone to the Symposium. Niehenke showed original slides of the planet Uranus, some 1.8 billion miles away, its ten rings, and two of its eight moons as taken in January 1986 by Voyager II, launched eight years ago, a spectacular application of the use of microwaves. Dr. Knerr presented a special message in German to the West Germans, who included Dr. Winfried Florian from the Ministry of Posts and Telecommunications, Professor Dr. Horst Groll of the Technical University in Munich, and Dr. Nigel Keen, founder of the West Germany MTT-S Chapter. Professor Groll commented on the history of microwaves and showed some experiments of Hertz from the Deutsches Museum. Nigel Keen showed some recent exciting antenna and mixer developments in West Germany.

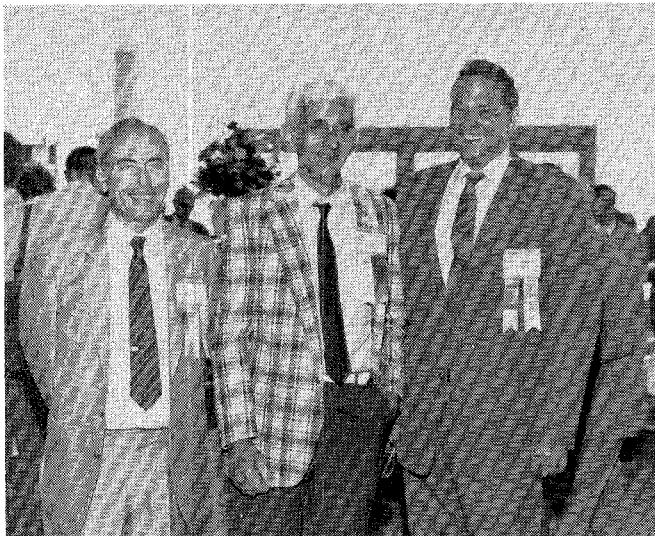
Helmut Schrank, the Symposium Vice-Chairman, introduced Dr. Arthur Clarke, the well-known author and inventor of the geostationary earth-orbit satellite in the 1940's, who presented us with a special message via videotape made for this Symposium from his home in Sri Lanka. Dr. Clarke introduced Dr. Joseph Charyk, his personal friend and the founder of COMSAT, who gave the keynote speech, which may be found in this issue. Dr. Charyk traced the developments of microwaves from Maxwell, Hertz, and Marconi to the present and gave some projections on what the future holds in microwave communication.



The West German speakers, on a giant projection screen, talk to the Symposium attendees. From left to right are Winfried Florian, Nigel Keen, and Professor Groll.



Dr. Joseph Charyk delivers his keynote speech to 1200 persons at the opening ceremonial session.



Marvin Cohn (left), Dan Buck (middle), and Edward Niehenke are all smiles at the successful Open Forum.

A proclamation by the governor of Maryland was presented to Niehenke by Sylvia Ramsey proclaiming June 1-7, 1986, International Microwave Week in Maryland. Francis Kuchta from the office of the mayor of Baltimore presented Niehenke with the key to the city of Baltimore.

Dr. Marvin Cohn, the Symposium Technical Program Chairman, summarized the events of the Technical Program as well as the many innovations for the Baltimore Symposium. One of these is the introduction of focused sessions, which this year were on "Advances in Low-Cost Component Manufacturing" (one session) and "Microwave Aspects of GHz/Gbit Optical Transmission" (two sessions). Each of these focused sessions, which were considered technically significant this year, were opened with a recognized leader in that area. Another innovation was to provide recognition to especially well presented papers in every session. A third new feature, which was appropriate for this year's Symposium theme, was the inauguration of an exchange of technical sessions with the European Microwave Conference. Four papers by prominent European microwave research people were presented in a special International Session. Added to this session was a paper by Professor Weigan Lin from the Peoples Republic of China on "Microwave Research in China." An exchange with four U.S. authors is planned for the 1986 European Microwave Conference.

#### AWARDS BANQUET

The social highlight of the Symposium, perfectly organized by Helene Malinow, was the Awards Banquet on Tuesday evening, attended by 556 persons to honor the recipients of this year's awards. In keeping with our theme, *Microwaves Linking Nations*, the banquet hall at the Hyatt Regency Hotel was beautifully decorated, with the 36 state and 15 country flags of the 51 MTT-S Chapters hung from the ceiling. In addition, every table was decorated with a world globe encircled by flags and flowers. A five-piece



George Matthaei addresses the banquet after receiving the Microwave Career Award.



Clarence Burke Swan addresses the banquet after receiving the Microwave Application Award.

roving musical ensemble played individual requests, which added a festive air during the delicious gourmet international dinner.

This year the Microwave Career Award was presented to Dr. George Matthaei "for a career of meritorious achievement and outstanding technical contributions in the field of microwave theory and techniques." The Microwave Application Award was next presented to Dr. Clarence Burke Swan "for pioneering the application of diamond heat sinks useful for high-thermal-power-density semiconductor devices." The Microwave Prize was presented to Dr. Yalcin Ayasli, Mr. Leonard Reynolds, Jr., Dr. James Vorhaus, and Dr. Larry Hanes for their paper "2-20-GHz GaAs Traveling-Wave Amplifier," which was published in this TRANSACTIONS in January 1984. The Distinguished Service Award was presented to Dr. Harold Sobol for his outstanding service for the benefit and advancement of the Microwave Theory and Techniques Society.



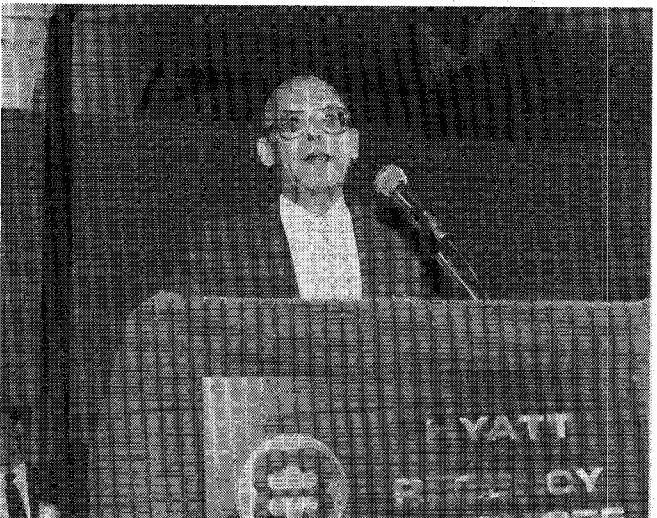
Reinhard Knerr presents Yalcin Ayasli with the Microwave Prize.



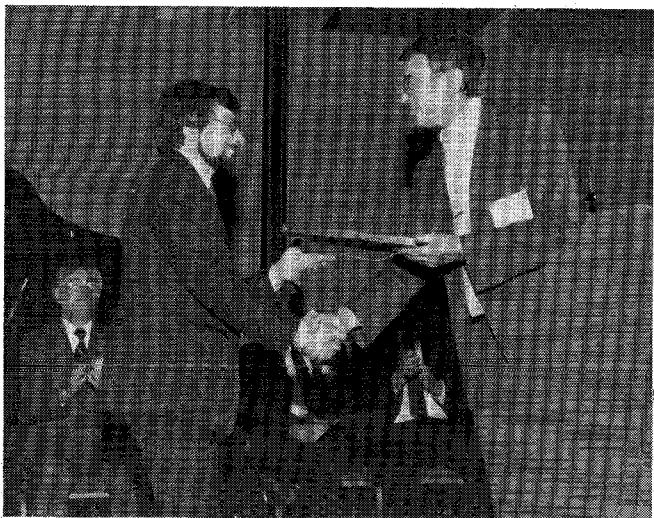
Larry Hanes receives the Microwave Prize.



Leonard Reynolds receives the Microwave Prize.



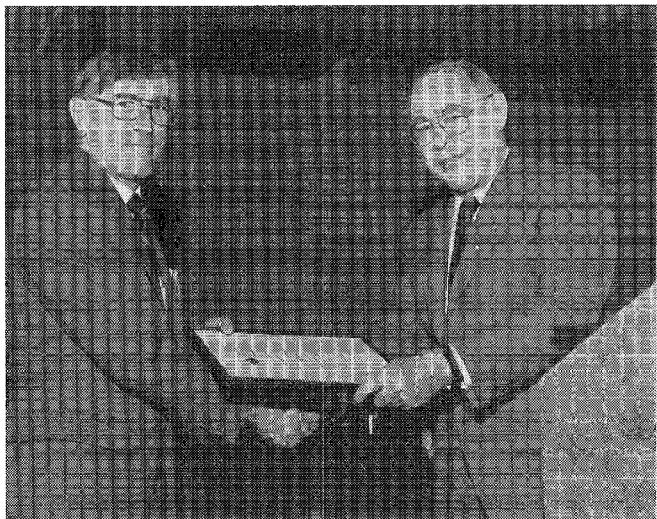
Harold Sobol addresses the banquet after receiving the Distinguished Service Award for his many years of dedication and contribution to the MTT-S.



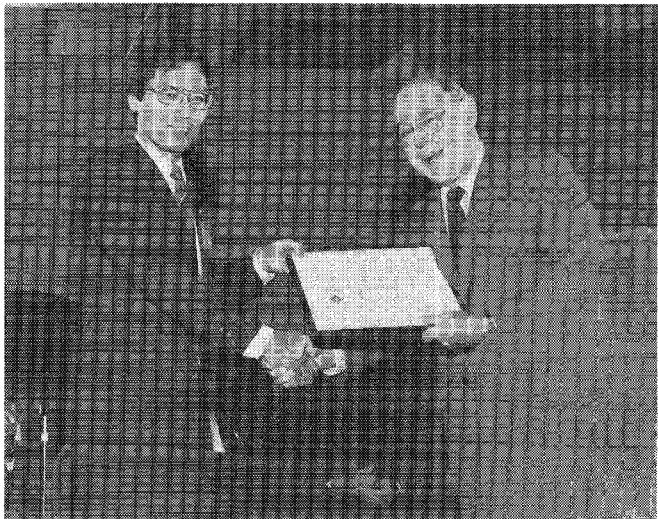
James Vorhaus receives the Microwave Prize.

Dr. Bruno Weinschel, President of IEEE, presented the Fellow Awards to Mr. Kenneth Carr, Dr. James Degenford, Mr. John Horton, Professor James Chin-I. Lin, Dr. David McQuiddy, Jr., Dr. Barry Perlman, and Dr. Jorg Raue. The Distinguished Lecturer Award was given to Mr. Kenneth Carr for his lecture "The Detection and Treatment of Cancer Using Microwave Technology." Harlan Howe, Jr., was given the Past President's Pin. The presentation of a number of certificates of recognition rounded out the evening of awards.

The entertainment following the awards was an exciting climax to this event. The Sweet Adelines, a group of 80 Baltimore area women of national musical reputation, presented precision vocal and dance routines. They were dressed in beautiful white gowns with gold sequins, and presented memorable songs, fitting for this occasion. The star of the show, Ethel Ennis, an internationally recognized



IEEE President, Bruno Weinschel, presents the Fellow Certificate to Kenneth Carr.



James Chin-I. Lin receives the Fellow Certificate.



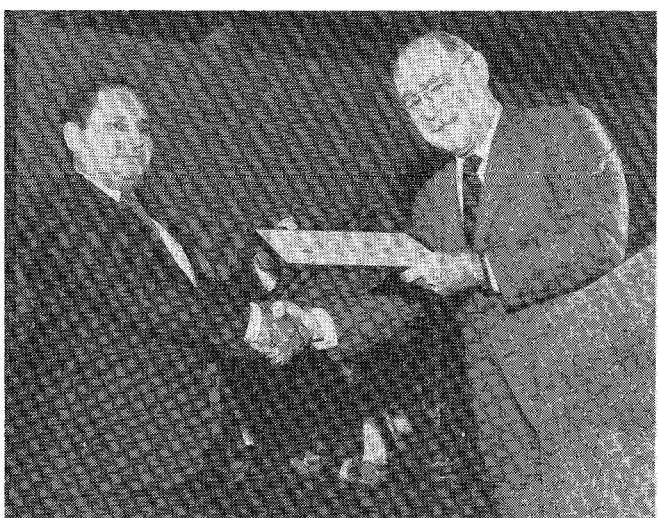
James Degenford receives the Fellow Certificate.



David McQuiddy receives the Fellow Certificate.



John Horton receives the Fellow Certificate.



Barry Perlman receives the Fellow Certificate.



Jorg Raue receives the Fellow Certificate.



Sweet Adelines from the Baltimore area sing memorable songs during the banquet.



Kenneth Carr accepts a plaque marking his service as the Distinguished Microwave Lecturer on the topic of the use of microwave technology in the detection and treatment of cancer.



Singer Ethel Ennis entertained the banquet with warmth and personality.



Harlan Howe accepts the Past President's Pin from Reinhard Knerr.

jazz-oriented singer from Baltimore, entertained us with all her warmth and personality. We now know why the mayor of Baltimore named her the Official Cultural Ambassador of the city.

#### MICROWAVE EXHIBITION

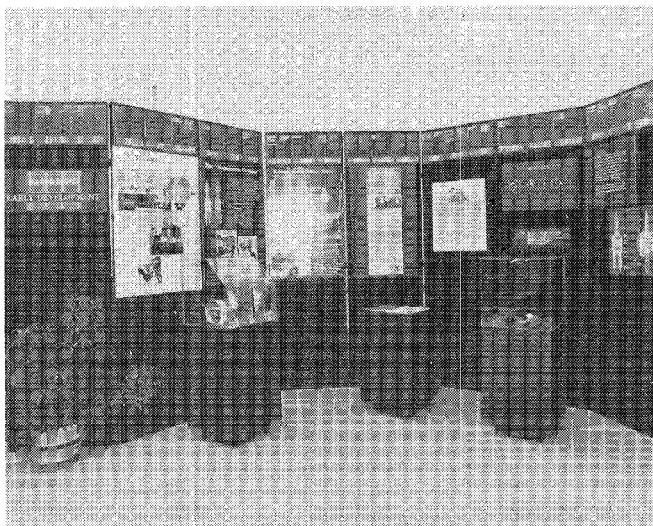
The exhibition this year was the largest ever, with 256 companies in 425 booths presenting the latest microwave products and services. Howard Ellowitz did an outstanding job in flawlessly organizing this mammoth exhibition. All four halls of the Baltimore Convention Center were used, and the new Center provided a beautiful setting for this event. The exhibition layout at the Center was perfect, with high ceilings, Hollywood lighting, wide aisles, color-coordinated accessories, and rest areas with refreshments throughout.

#### HISTORICAL EXHIBIT

The Historical Exhibit was well attended this year, with major loans from Baltimore's Historical Electronics Museum as well as from numerous companies throughout



The microwave exhibition drew a record 256 companies displaying at 425 booths. Shown above is one of four halls.



Magnetron developments were shown at the Historical Exhibit.

the United States. Ted Saad, Melvin Zisserson, and Ellen Prucha did an outstanding job in obtaining and presenting the many artifacts and memorabilia in a professional and eye-catching manner this year. In addition to the many exhibits, ranging from early magnetron developments to the history of radar, there was a separate reading area with comfortable couches for browsing through the books, as well as a separate cinema complete with a large screen and comfortable seats for viewing the many historic films presented continuously throughout the day.

#### SYMPOSIUM ATTENDANCE

The excellent Technical Program, with many technical breakthroughs, the many innovations introduced this year, the exciting social program, and the location all contributed to a record attendance in Baltimore. The final count showed 6671 in attendance from all over the world. Of these, 1871 registered for the Microwave Symposium while 773 registered for the Monolithic Symposium; 655 attended

the six workshops and approximately 800 attended the six panel sessions. Another 127 attended the ARFTG Conference. The Awards Banquet was attended by 556 persons and the Crab Feast/Bull Roast attracted 1050 persons.

#### SYMPOSIUM DIGEST

The Symposium Digest of Technical Sessions was edited and prepared by C. Roger Westgate of the Johns Hopkins University, Baltimore, MD. Additional copies of the Digest are available from the Institute of Electrical and Electronics Engineers Incorporated, Publication Order Department, 445 Hoes Lane, Piscataway, NJ 08854. The IEEE catalog number is 86CH2301-0. The Library of Congress card number is 77-645125.

#### TECHNICAL PROGRAM

The Technical Program consisted of 183 papers, of which 87 were 20 minutes long, 50 were 10 minutes long, and 46 were open-forum papers. These were presented in three parallel sessions. The papers presented the latest results and technical breakthrough in over 20 areas. Included in this count were seven papers held jointly with the Microwave and Millimeter-Wave Monolithic Circuits Symposium on Wednesday afternoon. The layout of the open forum was arranged in rectangular alcoves for each presenter to provide spatial and sound isolation. Open-forum topics were grouped at common times and locations, which provided for a lively and well-attended forum on Monday and Tuesday afternoon. Dan Buck did a creative and outstanding job in the layout and organization of the open forum. The Technical Program Sessions and their Chairmen are listed below.

<i>Session A:</i>	Opening Ceremony
<i>Session B:</i>	Guided Wave Structures I A. K. Sharma, RCA David Sarnoff Research Center, Princeton, NJ
<i>Session C:</i>	Low Noise Techniques V. Soholov, Honeywell, Inc. (PSC), Bloomington, MN
<i>Session D:</i>	IMPATT's E. D. Cohen, Space and Naval Warfare Systems Command, Alexandria, VA
<i>Session E:</i>	Guided Wave Structures II S. T. Peng, New York Institute of Technology, Farmingdale, NY
<i>Session F:</i>	Passive Components I. J. Bahl, ITT/GTC, Roanoke, VA
<i>Session G:</i>	Oscillator Topics P. Staeker, MIT Lincoln Laboratory, Lexington, MA
<i>Session H:</i>	MM-Wave Oscillators M. Dydyk, Motorola, Inc., Scottsdale, AZ
<i>Session I:</i>	Special International Session R. A. Sparks, Raytheon, Bedford, MA
<i>Session J:</i>	Open Forum I D. C. Buck, Westinghouse, Baltimore, MD

**Session K:** Solid State Topics  
J. F. White, MA/COM, Inc., Burlington, MA

**Session L:** Microwave Systems I  
J. B. Knorr, Naval Postgraduate School, Monterey, CA

**Session M:** Distributed FET Amplifiers and Circuits  
S. J. Temple, Raytheon Co. Bedford, MA

**Session N:** Filters for Satellite Applications  
H. C. Bell, WAVECOM/LORAL, Northridge, CA

**Session O:** Microwave Systems II  
G. L. Heiter, AT&T Bell Labs, North Andover, MA

**Session P:** Microwave Systems III  
F. N. Sechi, Microwave Power Research, Santa Clara, CA

**Session Q:** Dielectric Resonators and Filters  
C. M. Kudsia, COM DEV, Ltd., Cambridge, Ontario, Canada

**Session R:** Focused Session—Manufacturing Methods  
G. Klein, Westinghouse, Baltimore, MD

**Session S:** GaAs FET Amplifiers  
M. Kumar, Microwave Semiconductor Corp., Somerset, NJ

**Session T:** Open Forum II  
D. C. Buck, Westinghouse, Baltimore, MD

**Session U:** Microwave Acoustics and Magnetostatics  
T. Lukaszek, U.S. Army LABCOM, Fort Monmouth, NJ

**Session V:** GaAs FET Oscillators, Doublers, and Mixers  
E. J. Crescenzi, Jr., Watkins-Johnson, Palo Alto, CA

**Session W:** Focused Session—Microwave Aspects and Applications of GHz/Gbit Optical Transmission Systems I  
N. R. Dietrich, AT&T Bell Labs, Allentown, PA

**Session X:** Microwave Measurements I  
D. R. Laton, Raytheon, Bedford, MA

**Session Y:** MIC Subsystems  
J. C. Wiltse, Georgia Tech Research Inst., Atlanta, GA

**Session Z:** Focused Session—Microwave Aspects and Applications of GHz/Gbit Optical Transmission Systems II  
H. F. Taylor, Texas A&M University, College Station, TX

**Session AA:** Microwave Measurement Techniques II  
M. A. Maury, Jr., Maury Microwave Corp. Cucamonga, CA

**Session BB:** Passive Circuit Modeling  
N. G. Alexopoulos, UCLA, Los Angeles, CA

**Session CC:** Optical Devices for Microwave Applications  
K. T. Yano, TRW, Redondo Beach, CA

**Session DD:** Ferrites  
J. E. Pippin, Electromagnetic Sciences Inc., Atlanta, GA

**Session EE:** Joint with Monolithics Symposium—Opening Session  
R. Sudbury, MIT Lincoln Lab, Lexington, MA

**Session FF:** Biological Effects and Medical Applications  
A. Rosen, RCA David Sarnoff Research Ctr., Princeton, NJ

**Session GG:** Analytical and Numerical Methods  
T. Itoh, University of Texas-Austin, Austin, TX

**Session HH:** Joint with Monolithics Symposium—Microwave Amplifiers  
R. Gold, Adams-Russel Co., Burlington, MA  
Co-Chairman: V. Nair, Motorola, Inc., Phoenix, AZ

#### PANEL SESSIONS AND WORKSHOPS

Six panel sessions and six workshops complemented the technical program. They are listed below along with their organizers.

- I. Issues in Government Funding of Microwave R&D  
R. A. Moore, Westinghouse Electric Corp., Baltimore, MD
- II. Manufacturing MIC Assemblies for Performance, Reliability, and Profit  
Chuck Buntschuh, Narda Microwave Corp., Hauppauge, NY  
Rudy Henning, University of South Florida, Tampa, FL
- III. Millimeter Wave System Development  
J. J. Whelehan, Eaton Corp., Melville, NY  
H. Paczkowski, Eaton Corp., Melville, NY
- IV. Millimeter Wave Integrated Circuit Sources  
H. J. Kuno, Hughes Aircraft Company, Torrance, CA  
D. W. Maki, General Electric Company, Syracuse, NY
- V. GaAs Microwave Monolithic Integrated Circuits from Research Lab to Production  
Krishna K. Agarwal, Rockwell International Corp., Dallas, TX
- VI. Microwave GaAs FET and MMIC Reliability  
Frank Sullivan, Raytheon Company, Missile Systems Division, Bedford, MA  
Barry Spielman, Naval Research Lab, Washington, DC

\* Microwave Procurement Challenges of the Late 80's and 90's  
Frank A. Walker, Sanders Associates, Nashua, NH

\* Microwave Aspects of GHz/Gbit Optical Transmission Systems  
Henry K. Taylor, Texas A&M University, College Station, TX  
N. R. Dietrich, AT&T Bell Labs, Allentown, PA

- \* Trends in Microwave CAD  
K. C. Gupta, University of Colorado, Boulder, CO
- \* Dielectric Resonators  
A. E. Williams, COMSAT Laboratories, Clarksburg, MD
- \* Filters and Multiplexers  
A. M. K. Saad, M/A Electronics Canada, Mississauga, Ontario, Canada
- \* Microwave/Millimeter Wave Magnetics and MMIC Compatibility  
James C. Sethares, RADC, Hanscom AFB, MA

#### 1986 SYMPOSIUM STEERING COMMITTEE

The Baltimore Symposium Steering Committee was motivated by a sense of pride in Baltimore, a dedication to professionalism, and the desire to make the 1986 International Microwave Symposium "The Best" for the 6671 attendees plus their families who visited Baltimore from all over the world the first week in June 1986. The volunteer Committee, some 38 strong, worked hard over a period of five years, devoting countless hours to make this Symposium one that will be remembered for years to come. I thank all of the Committee members for the excellent job they did and I cherish the friendships we have all experienced in this endeavor. A list of the Steering Committee members and their employers follows.

*Chairman:*

Edward Niehenke, Westinghouse Electric Corporation

*Vice-Chairman:*

Helmut Schrank, Westinghouse Electric Corporation

*Secretary:*

Lawson Cooper, Westinghouse Electric Corp.

*Technical Program*

*Chairman:*

Marvin Cohn, Westinghouse Electric Corp.

*Vice-Chairman:*

Bernard Geller, COMSAT Laboratories

*Special Sessions:*

Pradeep Wahi, Loral Advanced Technology Labs

*Open Forum:*

Daniel Buck, Westinghouse Electric Corp.

*Arrangements*

*Chairman:*

Theodore Nelson, Westinghouse Electric Corp.

*Catering/Day Book:*

Alfred W. Morse, Westinghouse Electric Corp.

*Convention Center:*

Allen Sullender, AAI Corp.

*Awards Banquet*

Charles and Helene Malinow, C. L. Malinow and Co.

*Airlines, Rental Car:*

Richard Bernstein, K&L Microwave, Inc.

*Symposium Opening:*

Cheryl Jacobs, Nurad Inc.

*Satellite Communications Link:*



1986 Symposium Program Committee  
*Standing (l-r):* W. E. Hord, J. J. Whelehan, Jr., J. Taub,  
 A. Vander Vorst, F. Ivanek  
*Seated (l-r):* B. D. Geller, M. Cohn, R. Kagiwada



1986 Symposium Steering Committee  
*Front row (l-r):* A. Rubin, P. Wahi, H. E. Schrank, R. Mahoney,  
 A. Sullender  
*Middle row (l-r):* B. Rubin, T. Klein, H. Malinow, L. Czirjak,  
 E. C. Niehenke, B. Niehenke, M. Cohn  
*Back row (l-r):* C. R. Westgate, A. Estes, L. F. Cooper, J. Blackburn,  
 M. Zisserson, D. C. Buck, W. Getsinger, J. Lambden, S. N. Stitzer,  
 K. Claborn, D. Dawson, M. Whicker, L. R. Whicker, T. M. Nelson,  
 A. W. Morse, J. E. Degenford, C. Considine, C. L. Malinow  
*Not present:* R. Bernstein, H. W. Cooper, H. I. Ellowitz, B. Geller,  
 G. I. Klein, S. D. Patel, E. Prucha, C. Jacobs

*Technical Meeting Rooms /  
 Audio Visual:*

Joseph Lambden, Nurad, Inc.

Lisa Czirjak, Nurad, Inc.

Cathy Considine, Nurad, Inc.

Gerry Klein, Westinghouse Electric Corp.

Alma Estes, Westinghouse Electric Corp.

*Signs:*

Cheryl Jacobs, Nurad Inc.

*Gifts:*

Richard Bernstein, K&L Microwave, Inc.

*Special Events:*

*Airport Welcoming Booth:**Guest Program:**Transactions Special Editor:**Publications:**Finance:**Exhibits:**Publicity**Chairman:**Vice-Chairman:**Registration:**Historical Exhibit:**Liaison to Monolithic Symposium:**Liaison to ARFTG Conference:**Symposium Management:**Members-at-large:***1986 TECHNICAL PROGRAM COMMITTEE**

The Technical Program Committee, under the able direction of Dr. Marvin Cohn, has done an excellent job this year in soliciting and selecting the papers which describe important advances in the field. Due to the record number of submissions this year, the committee had a hard task evaluating and selecting from the record number of papers. The quality of this year's Technical Program is a tribute to the work done by the Technical Program Committee. The Committee members were:

S. Adam  
M. G. Alexopoulos  
A. E. Atia  
I. J. Bahl  
J. Barrera  
H. C. Bell  
E. F. Belohoubek  
D. M. Bolle

C. R. Boyd  
D. C. Buck  
L. Q. Bui  
C. Buntschuh  
K. J. Button  
A. G. Cardiasmenos  
R. H. Chilton  
E. Cohen

M. Cohn  
H. W. Cooper  
J. Cotton  
M. W. Cox  
J. Crescenzi  
N. Dietrich  
R. Dydyk  
G. F. Engen

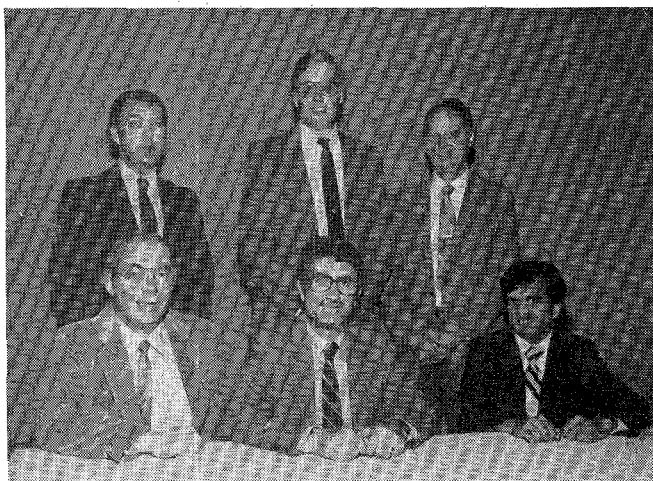


1986 Technical Program Committee  
(l-r): D. C. Buck, J. C. Lin, A. Rosen



1986 Technical Program Committee  
Standing (l-r): R. A. Pucel, R. Gilmore, L. Q. Bui  
Seated: K. C. Gupta

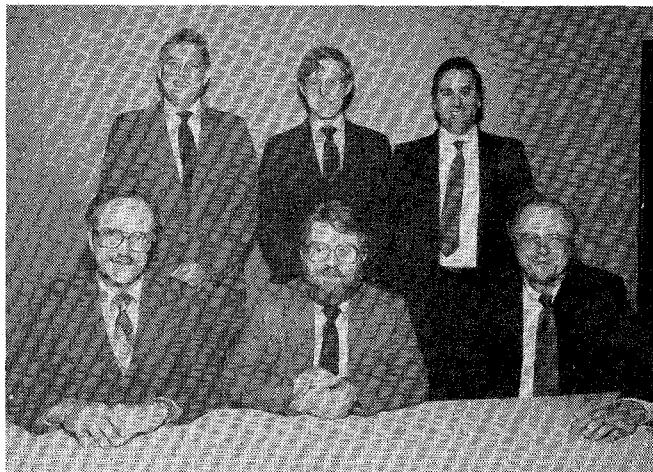
B. D. Geller	J. B. Knorr	K. B. Niclas
O. P. Ghandi	C. R. Kudsia	E. C. Niehenke
R. Gilmore	M. Kumar	S. Okwit
P. T. Greiling	J. R. Lane	A. A. Oliner
E. L. Griffin	R. W. Laton	H. G. Oltman, Jr.
K. C. Gupta	R. Levy	J. R. Owens
G. R. Harrison	P. Latourrette	D. Parker
G. L. Heiter	J. C. Lin	S. T. Peng
W. E. Hord	T. J. Lukaszek	R. A. Pucel
J. B. Horton	D. W. Maki	J. R. Rau
H. Howe, Jr.	R. M. Malbon	A. Rosen
T. Itoh	S. L. March	F. J. Rosenbaum
F. Ivanek	G. Matthaei	C. T. Rucker
G. Jerinic	M. A. Maury, Jr.	J. Schellenberg
R. Kagiwada	B. R. McAvoy	F. M. Sechi
G. I. Klein	J. Mink	J. C. Sethares
R. H. Knerr	R. Neidert	A. K. Sharma



1986 Technical Program Committee  
*Standing (l-r): J. Barrera, S. J. Temple, H. Willing  
Seated (l-r): J. Crescenzi, F. M. Sechi, M. Kumar*



1986 Technical Program Committee  
*Standing (l-r): R. Neidert, M. W. Cox, D. K. Maki,  
E. F. Belohoubek, P. T. Greiling  
Seated (l-r): M. G. Alexopoulos, J. C. Wiltse, J. Mink*



1986 Technical Program Committee  
*Standing (l-r): E. C. Niehenke, P. Staeker, E. Cohen  
Seated (l-r): R. Dydyk, G. Jerinic, J. F. White*



1986 Technical Program Committee  
*Standing (l-r): J. R. Owens, B. R. McAvoy, G. R. Harrison,  
D. Webb  
Seated (l-r): J. C. Sethares, T. J. Lukaszek, C. R. Boyd, Jr.*



1986 Technical Program Committee  
*Standing (l-r): J. R. Lane, S. Okwit, E. L. Griffin  
Seated (l-r): J. Cotton, V. Sokolov*



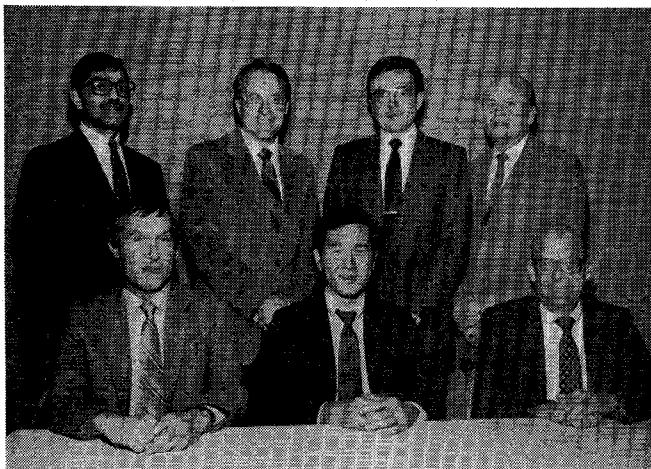
1986 Technical Program Committee  
*Standing (l-r): S. T. Peng, P. Latourrette, A. K. Sharma  
Seated (l-r): A. A. Oliner, T. Itoh*



1986 Technical Program Committee  
*Standing (l-r):* R. Sparks, J. B. Horton, R. Week, G. L. Heiter,  
 D. Steinbrecher  
*Seated (l-r):* D. Parker, H. W. Cooper, J. B. Knorr



1986 Technical Program Committee  
*Standing (l-r):* R. W. Laton, G. F. Engen, H. G. Oltman, Jr.  
*Seated (l-r):* M. A. Maury, Jr., S. Adam



1986 Technical Program Committee  
*Standing (l-r):* P. Wahi, J. Raue, R. H. Knerr, N. Dietrich  
*Seated (l-r):* H. F. Taylor, S. K. Yao, H. Sobol



1986 Technical Program Committee  
*Standing (l-r):* R. H. Chilton, H. Howe, Jr., R. M. Malbon  
*Seated (l-r):* G. I. Klein, C. Buntschuh



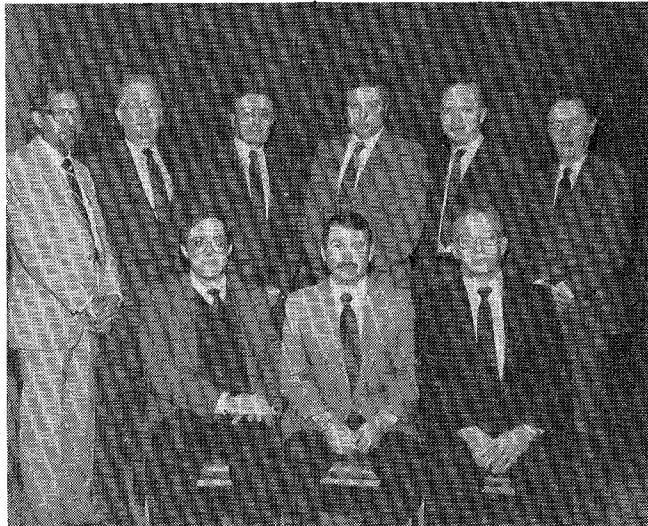
1986 Technical Program Committee  
*Standing (l-r):* I. J. Bahl, C. R. Kudsia, H. C. Bell, G. Matthaei  
*Seated (l-r):* A. E. Atia, A. E. Williams, R. Levy

H. Sobol	H. F. Taylor	J. F. White
V. Sokolov	S. J. Temple	A. E. Williams
R. Sparks	G. Thoren	M. Willing
P. Staeker	P. Wahi	J. C. Wiltse
D. Steinbrecher	D. Webb	K. T. Yano
J. Taub	R. Week	S. K. Yao
	J. J. Whelehan, Jr.	

#### 1986 MTT-S ADMINISTRATIVE COMMITTEE

The MTT Society is governed by the Administrative Committee, whose 18 elected members volunteer and commit their time on behalf of the Society. The 1986 AdCom is listed below.

Society Officers		
<i>President:</i>	R. H. Knerr	
<i>Vice-President:</i>	D. N. McQuiddy, Jr.	
<i>Secretary/Treasurer:</i>	K. K. Agarwal	



1986 Administrative Committee  
*Standing (l-r):* K. K. Agarwal, R. A. Moore, R. H. Knerr,  
 D. N. McQuiddy, Jr., A. Vander Vorst, F. Ivanek  
*Seated (l-r):* B. E. Spielman, S. L. March, R. Levy



1986 Administrative Committee  
*Standing (l-r):* Z. Galani, N. W. Cox, S. V. Temple, R. A. Sparks,  
 P. Staecker  
*Seated (l-r):* R. S. Kagiwada, H. J. Kuno, M. A. Murray, Jr.



1986 Administrative Committee  
*Standing (l-r):* A. A. Oliner, T. S. Saad, E. C. Niehenke, H. Howe, Jr.  
*Seated (l-r):* P. T. Greiling, T. Itoh, H. G. Oltman, Jr.

#### Administrative Committee Membership

N. W. Cox	R. H. Knerr	E. C. Niehenke
V. G. Gelnovatch	H. J. Kuno	J. E. Raue
P. T. Greiling	R. Levy	M. V. Schneider
T. Itoh	S. L. March	B. E. Spielman
F. Ivanek	M. A. Maury, Jr.	P. W. Staecker
R. S. Kagiwada	D. N. McQuiddy, Jr.	S. J. Temple

#### Ex-Officio (Past Presidents)

C. T. Rucker	H. G. Oltman, Jr.	H. Howe, Jr.
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#### Honorary Life Members

A. C. Beck	A. A. Oliner	K. Tomiyasu
S. B. Cohn	T. S. Saad	L. Young