

IEEE SOCIETY ON
MICROWAVE THEORY
AND TECHNIQUES

NEWSLETTER



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cindy

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MICROWAVES: GATEWAY TO THE FUTURE THE 1985 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM ST. LOUIS, MISSOURI: JUNE 4-6



by Fred J. Rosenbaum

The St. Louis Steering Committee heartily invites you to attend the 1985 IEEE MTT-S International Microwave Symposium and Workshops. This year they will be held in St. Louis, the Gateway to the West. This is the first time that the Symposium has visited St. Louis and the first Mid-Western meeting since 1971 when the Symposium met in Arlington Heights, Illinois.

The Technical Sessions will be held in the Cervantes Convention Center, a spacious facility that will comfortably accommodate the technical meetings and the Exhibits. Headquarters is the Sheraton St. Louis Hotel, directly adjacent to the Convention Center, which will be the site of many of our social functions and committee meetings. In order to accommodate the many thousands of expected participants, arrangements have been made with six hotels, located in the vicinity of the Cervantes Center. Although all are within a pleasant 15 minute walk through downtown St. Louis, we have arranged for continuous shuttle service between the Convention Center and the Symposium hotels.

Microwave Week begins on Monday morning, June 3, with the Microwave and Millimeter Wave Monolithic Circuits Symposium. Interest is great in this grow-

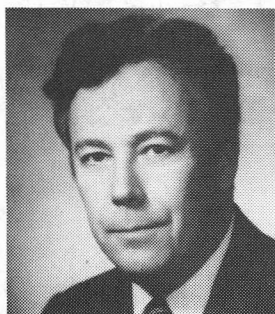
ing part of the microwave field, and 22 papers will be presented. Two joint sessions will be held with the Microwave Symposium on Tuesday morning, open to all Symposium registrants. The Symposium Technical Program itself consists of 159 papers which will be presented in three parallel sessions on each of the three days of the Symposium. Two Open Forum Sessions afford authors and participants time for in-depth discussions. Once again solid-state microwaves and FET components will dominate the technical sessions. Computer techniques for both linear and nonlinear networks also will be considered. The strong and continued interest in millimeter wave topics will be addressed in three regular sessions and in two panel sessions. As usual, there will be a wealth of information on a wide variety of topics such as microwave measurements, filters, guided wave structures and microwave systems.

In addition to the regular sessions, seven workshops and panel sessions will be presented. On Monday, June 3, the topic of Phased Arrays for Hyperthermia Treatment of Cancer will be explored. Friday, June 7 brings a workshop on Modern Microwave Oscillator Design Techniques. On Thursday and Friday, the 25th ARFTG Conference will be meeting to advance the art of microwave measurements.

Panel sessions provide the setting for the exchange of information between expert panelists and Symposium participants. The future of microwave engineers will be discussed over lunch on Tuesday, noon in the panel on the Relationship of Engineers to the Federal Government: The R & D Funding Process, sponsored by PACE. This is intended as a continuation of the Plenary Session which will be described a bit later. Advances in Millimeter Wave Subsystems will be considered on Tuesday night. Also that night will be a stimulating discussion on the Historical Perspective of Microwaves. Professor Harold Shipton has invited a select panel to recount some of our history in an amusing and informative way. Thursday afternoon brings us a comprehensive discussion on the state of Millimeter Wave Integrated Circuits.

(Continued on page 6)

PRESIDENT'S REPORT



by Harlan Howe

As I start my term as president, I am keenly aware of the contributions made by past presidents towards the establishment of MTT-S, as one of the healthiest societies within the IEEE. In February, I attended a society presidents forum, and it was interesting to see that many of the problems which the other societies are facing now were solved by the MTT-S years ago due to the foresight and energy of our past presidents. Most recently we all owe a vote of thanks to George Oltman for his outstanding leadership during the previous year.

The Microwave Theory and Techniques Society is a sound, dynamic, growing organization. At the present time our membership is growing at a rate which is the fifth highest of all the societies within the IEEE. Our fiscal conservatism through the years has placed us in a position where we are one of the wealthiest societies within IEEE and have the necessary financial capability to implement some of the programs for the benefit of our members which we have been discussing for years. Perhaps the most important aspect, however, is the activity of our membership as demonstrated by the attendance at our international symposium and the number of people who volunteer their efforts for the betterment of MTT. This past January when I made the various committee assignments, I was faced with the happy dilemma of having far more volunteers for jobs, than available jobs. From what I can tell from conversation with other society presidents that is a problem which is unique to MTT-S.

During this coming year I expect a great deal of attention will be focused on education and educational activities. We have two co-chairman for education this year, Glenn Thoren and Kris Agarwal both of whom have brought unique concepts to this area. Kris has been spearheading a program to improve the industry and academic interface for the mutual benefit of both and Glenn has proposed a unique teaching concept which is in the early stages of investigation. In addition to this, our long awaited scholarship program for the benefit of children of members is in the final stages of organization and should be announced shortly.

These are exciting times for our society. I know I speak for all of the ADCOM members committee and other volunteers when I say that we all look forward to working together in the coming year to better serve our members.



EDITOR'S NOTES



by R.S. Kagiwada

As June approaches, our thoughts turn toward the International Microwave Symposium.² Once again there is a jam packed schedule of events that can satisfy everyone's needs for microwave. As Reinhart Knerr points out, everyone is looking forward to enjoying Fred Rosenbaum's hospitality. The 1985 International Microwave Symposium has ever extensive guest programs. There are several entertaining tours. These tours are #1 - St. Louis Highlights, #2 - Forest Park #3 - The Fabulous Fox and Shaw's Garden #4 - Grant's Farm and #5 - Mississippi River cruise and Anheuser-Busch brewery. St. Louis will truly be a remarkable experience. I hope to see all of you at St. Louis.

The Division IV Director's Report is written by a dear friend of the MTT-Society, Kiyo Tomiyasu. Kiyo is honorary life member of the MTT-S ADCOM and one of the founding fathers of the Society. Kiyo will welcome your support and interest at TAB and IEEE levels. He has already appointed several MTT Society members to various TAB Committees and other IEEE Boards.

John Horton's Special Articles are doing extremely well. The third "Aircraft Small Radars" by Gerald Schaffner is of great interest to the Society members. However, Kurt Kurisu's Feedback column is dying from malnutrition. Perhaps we have not written anything controversial material in the Newsletter. Kurt would appreciate your comments. At this point, he will even appreciate disparaging remarks.

ADCOM HIGHLIGHTS



by Reinhart Knerr

The January ADCOM meeting took place in St. Louis. Why in St. Louis? Because the 1985 Microwave Symposium is in St. Louis. Why is the 1985 . . . ? Well, on the plane to St. Louis I overheard a conversation about this subject matter, and it kind of resonated with me:

Q: "What's so interesting about St. Louis?"

A: "Fred Rosenbaum. . ."

It does not really matter how many dBs the level of laughter rose after this; it gave me a good feeling. I was not on the way to still another meeting but more like visiting a friend! And Fred Rosenbaum, this year's Symposium chairman, acted just that way — a gracious host who made us all feel at home. Thank you Fred!

Harlan Howe, Jr., our new President, opened the ADCOM meeting in the evening of January 16, and after a three-hour effort, we had finally managed to make our constitution consistent with our by-laws and bring both in line with what we have been doing for years — a tough job, which took some conditioning (there was a rumor that Walter Cox had insisted on presenting the subject matter immediately after the cocktail hour).

MTT-S is doing well. Our membership has risen 21% over the last 3 years and 8.5% last year to a new record high of 8,067 members in 1984. Our income and surplus have been rising accordingly. MTT-S has been discussing the question of the surplus for several years, and I think we have finally made progress and set the direction on how to use some of the surplus. There have been two views on ADCOM:

Some ADCOM members felt that we should use our money to further the microwave profession in response to a real or perceived shortage of microwave engineers. Their proposals called for research grants and graduate scholarships for aspiring microwave engineers — in short, to "make" more microwave engineers.

Another significant section of ADCOM felt a strong obligation to feed the surplus back to the membership

since the money belongs to the members, and it was felt that the free market, i.e., the salaries paid to microwave engineers, would take care of any possible shortages. It was even pointed out and recognized that a shortage of microwave engineers would only enhance the financial remuneration of our members.

A compromise was reached, and while ADCOM did approve graduate scholarships last year, we did, at the January '85 meeting, in what I think was a historic moment after many years of discussions, vote to spend \$20K over 4 years for aid to deserving undergraduate students (of any discipline) who are children of MTT members. The amount is modest considering our surplus, but it was initially restricted by some IEEE guidelines. We are in the process of significantly expanding the program, and you will hear more about it soon. I am personally committed to this program and will actively pursue it.

On another subject, MTT-S is proud to have six new IEEE Fellows. They are:

Charles R. Boyd
David C. Chang
Edgar J. Denlinger
Paul T. Greiling
Toshio Makimoto
Paul J. Meier

We are sorry to see Norman Dietrich of AT&T Bell Labs retire as our MTT Transactions Associate Editor for Patents, and we welcome John Daly, also of AT&T Bell Labs, as his successor. Thank you, Norm, for a job well done, which truly provides an essential service to our members.

Our MTT Transactions Associate Editor for Asian Abstracts has been replaced by M. Akaike. We thank Dr. E. Yamashita for his efforts.

The Centennial Issue of the MTT Transaction which was edited by Ted Saad received many complimentary reviews, and ADCOM recognized Ted for his outstanding contribution.

Finally, a note to this year's Technical Program Committee: 270 papers submitted, 110 rejected. Twenty-four technical sessions and 2 open forum sessions are planned.

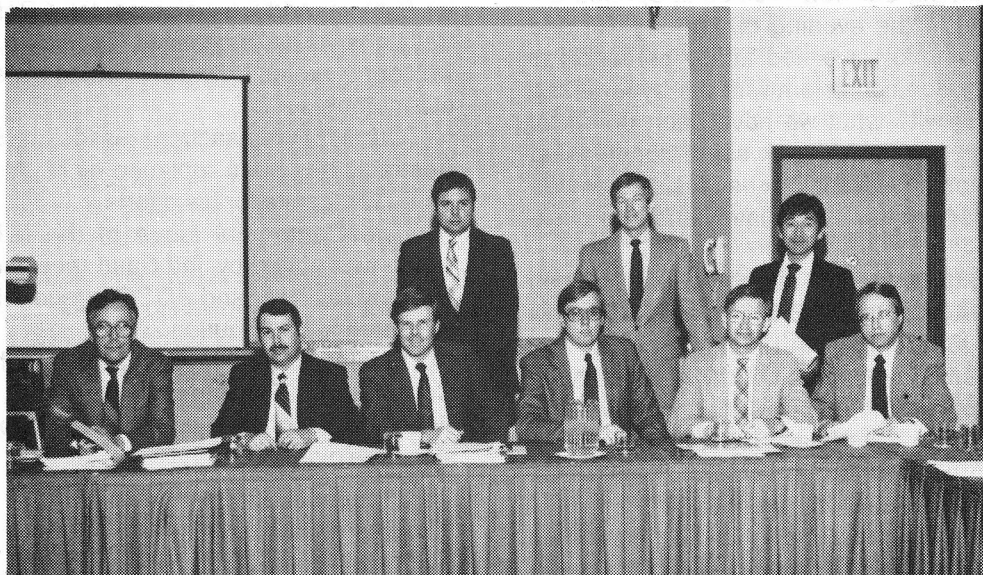


St Louis Missouri

1985 MTT-S ADCOM COMMITTEE MEMBERS



Front row, left to right: E.C. Niehenke, M.A. Maury, Jr., C.T. Rucker, H.G. Oltman, Jr., P. Staecker. Rear row, left to right: T. Itoh, M.V. Schneider, F. Ivanek, R.S. Kagiwada



Front row, left to right: H.H. Howe, Jr., S. March, G.R. Thoren, S. Temple, P. Greiling, J. Raue. Rear row, left to right: D. McQuiddy, W. Cox, H.J. Kuno

1985 MTT-S ADCOM COMMITTEE MEMBERS



Front row, left to right: R.A. Sparks, G. Jerinic, R.H. Knerr, B.E. Spielman. Rear row, left to right: V.G. Gelnovatch, T.S. Saad, H. Sobol.

1985 MTT-S ADCOM COMMITTEE MEETING IN ST. LOUIS IN ACTION



CALL FOR ADCOM NOMINATIONS



by C.T. Rucker, Chairman
Nominations Committee

The bylaws of MTT-S state that the Nominations Subcommittee should select a slate of at least two members of the Society for each vacancy which occurs on the Administrative Committee on January 1 of the next year. Each nominee is contacted to assure his willingness to serve and his ability to attend ADCOM meetings. Nominees by the Nominations Subcommittee are selected by the principles of efficiency and geographic and organizational distribution. Elections of the nominees are made by members of the ADCOM who are not eligible for re-election at that time.

The Bylaws provide three means by which one may be nominated for the Administrative Committee. They are:

- 1) Nomination by the Nominations Committee,
- 2) Nomination by petition signed by 25 Society members and submitted to the Nominations Chairman prior to 1 September 1985 and
- 3) "Informal Chapter suggestions are also in order." Please discuss suggestions with your chapter, ADCOM liaison member or with a member of the Nominations Committee. This informal route does not guarantee nomination but it is an easier approach.

This year your Nominations Committee consists of eight Society members, half of whom are not current ADCOM members, as specified by the Bylaws. They are:

John T. Barr IV; Santa Rosa, CA;	(707) 577-2350
V. (Walt) Gelnovatch; Monmouth, NJ;	(202) 544-4883
Dave McQuiddy; Richardson, TX;	(214) 995-2808
Dr. Harvey Newman; Washington, DC;	(202) 767-3008
H. George Oltman; Canoga Park, CA;	(818) 702-2293
James M. Roe; O'Fallon, MO;	(314) 625-1944
Richard V. Snyder; Butler, NJ;	(210) 492-1207
B.E. Spielman, Washington, DC;	(202) 767-3312

As you can see, the committee gives a relatively wide geographic representation. I sincerely hope this will provide fair representation to chapters and to all who might wish to serve.

For your information and guidance, the table below summarizes the makeup of the present Administrative Committee.

Present (1985) Adcom, Total = 18

EAST	10	INDUSTRY	14
CENTRAL	3	GOVERNMENT	2
WEST	5	UNIVERSITY	2

HOLDOVER MEMBERS (1986) ADCOM, TOTAL = 12

EAST	8	INDUSTRY	9
CENTRAL	2	GOVERNMENT	1
WEST	2	UNIVERSITY	2

TERMS END 1985 - ELIGIBLE

FOR COMMITTEE RENOMINATION*; TOTAL = 6

EAST	2	INDUSTRY	5
CENTRAL	1	GOVERNMENT	1
WEST	3	UNIVERSITY	0

Your Nominations Committee will have already begun work when you receive this Newsletter. I urge you to participate actively in its work. Contact the Committee member nearest you with your suggestions or recommendations. Remember, each nominee should be able to attend three meetings of the ADCOM each year and must specifically commit to attend at least two.

*An Administrative Committee member who has served three consecutive three year terms may not be renominated by the Nominations Committee.



(Continued from page 1)

We have also organized a working lunch on Tuesday June 4, for those interested in acquainting microwave engineers and marketing and sales managers with the procurement process of large system houses. We hope that this will become an on-going feature of future Symposia to provide a forum for the procurement and marketing members of our microwave community.

The theme of the 1985 MTT-S Symposium is Microwaves: Gateway to the Future. The Steering Committee has invited three prominent speakers to address the Future of Microwave Engineers in the Plenary Ses-

sion. Dr. Merrill Skolnik, Superintendent of the Radar Laboratory, Naval Research Laboratory, will consider the technical future and the preparations that must be made by the microwave engineer to participate fully in that future. Dr. David Leeson, President, California Microwaves will present a view of the professional future of microwave engineers in industry and how it appears from a management perspective. Finally, Dr. Steven Honickman, President, STG Electrosystems, suggests possibilities and alternatives relating to the economic future of microwave engineers.

A full social program has been planned to allow us time to relax and to renew friendships from past Symposia. Once again Horizon House — Microwave Journal is hosting a reception for all MTT-S and Monolithic Symposium registrants, Workshop participants and exhibitor personnel. The site of this reception is the historic Pavilion of the 1904 Worlds Fair in Forest Park. It will be held from 6:00 p.m. to 8:00 p.m. on Monday June 3, 1985. Bus service from and to the conference hotels will be provided free of charge. Liquid- and Solid-state refreshments will be served.

The annual Awards Banquet Wednesday, June 5, will once again be preceded by the Industry Sponsored Cocktail Party. Both of these events will be at the Marriott Hotel in downtown St. Louis. Awards will be presented to recognize the accomplishments of some outstanding contributors. Drs. Nathan Marcuvitz and Harold M. Barlow will share the Microwave Career Award for a career of meritorious achievement and outstanding technical contribution in the field of Microwave Theory & Techniques.

We will also be honoring our newly elected MTT-S Fellows of the IEEE. This years fellows are: Dr. Charles R. Boyd, Jr., Dr. David C. Chang, Dr. Edgar J. Denlinger, Dr. Paul T. Greiling, Dr. Toshio Makimoto, and Mr. Paul J. Meier.

After the presentation of the awards, banquet attendees will be treated to a musical entertainment drawing its inspiration from the songs and stories of the Mississippi River. This delightful "Riverboat Review" will be followed by dancing to the big band sound. Bring your partner and enjoy a sumptuous meal and a memorable evening in St. Louis.

In keeping with our growing awareness of the technical debt owed to the pioneers of the microwave field, this years Historical Exhibit highlights early radar work in the U.S. and abroad. Professor Harold Shipton, in cooperation with Ted Saad, has assembled an informative collection of memorabilia and films. I urge you all to enjoy this glimpse of our past.

The Microwave Exhibition continues to grow and attract many of the finest companies in the field. This

year some 200 exhibitors bring the latest in technology to us.

The city of St. Louis affords a wealth of cultural and historical opportunities which have provided the Committee with the elements for an exciting social program. Interesting tours are offered, at nominal cost. In fact, there are rates which will allow families to enjoy our city at only nominal cost. In your spare time walk along the riverfront, ride a train to the top of the spectacular Gateway Arch, find hot music and cold drinks in Laclede's Landing. The Guest Hospitality Suite in the South Lounge of the Sheraton Hotel, open from 8:30 a.m. to 5:00 p.m., provides a gathering place where a hostess can help your guests to explore and enjoy St. Louis. A complimentary guest continental breakfast will be served each morning in the Suite and coffee will be available all day. Films on St. Louis and the construction of the Gateway Arch will be shown throughout the day.

In order to accommodate the many Symposia participants, continuous free shuttle service will be provided throughout the day between the Cervantes Convention Center and the Symposium Hotels. Bus service to the Microwave Journal Reception, the Industry sponsored Cocktail Party, and the Awards Banquet is also provided free of charge.

There are a number of innovations offered to the Symposium participant this year. Visa and Mastercard will be accepted for those registering at the Symposium. And feel free to take away extra digests and all the information that you want from the Exhibitions. You will be able to ship it all home via UPS at nominal cost. Look for the booth where packing materials, boxes, labels, etc. will be available. We are cultivating students to pursue their careers in microwaves by helping students presenting papers to attend the Symposium. By making your travel arrangements for discounted fares through our official agent, you will help us in this effort. TWA will provide one free round-trip ticket to the Symposium for every 50 round trips booked through Tenholder Travel. See the Advance Program for more details.

The Committee hopes you are enjoying your MTT-S calendar and wants you to remember to "MTT me in St. Louis in June. We are all looking forward to seeing you there.



TAB HIGHLIGHTS



by George Oltman
1984 MTT President

This report selects a number of topics which I believe may be of interest to Newsletter readers. Topics are extracted from both the President's Forum and the December 1, 1984 meeting of the Technical Activities Board. These were the last meetings of the year that I, as 1984 MTT President, represented our society's interests.

STUDENT SUPPORT FOR PRESENTING PAPERS AT MTT SYMPOSIA

The MTT ADCOM has commissioned an Ad Hoc Committee to establish procedures for supporting needy students whose paper has been selected for presentation at our annual symposium. The support would be limited to travel expenses. While at the President's Forum, I learned that other IEEE societies are also considering support or else already supporting students. I brought back a number of tips for our committee to consider while establishing the guidelines for MTT support.

PROPOSAL TO REDUCE THE PRICE OF TRANSACTIONS FOR LIBRARIES

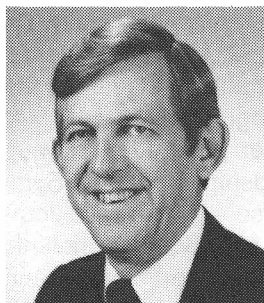
The Antennas and Propagation President, Dr. Allan Love, had planned to introduce a TAB motion to reduce the cost to libraries of the IEEE All-Transactions subscription package. They are currently about \$3,200/year. However, during informal discussion at the President's Forum, it became clear that there was no support from other societies for such action and he dropped the issue. The AP ADCOM was concerned that because of their society's large cash surplus; they might be criticized for becoming rich at the expense of the libraries. Currently 52% of the annual AP Society income comes from library subscriptions. The MTT percentage is slightly less. As the president of MTT ADCOM and an AP ADCOM Representative, I found the discussion very interesting.

Reasons cited by society presidents for maintaining current pricing policy were:

1. Surveys show that compared to others, IEEE publications are a bargain.
2. By their own admissions, most libraries believe

(Continued on page 25)

1985 INTERNATIONAL MICROWAVE SYMPOSIUM TECHNICAL PROGRAM COMMITTEE REPORT



by William E. Hord



by Stephen N.
Honickman

The Technical Program Committee met on January 16, 1985 in St. Louis, Missouri to formulate the technical program for the 1985 IEEE MTT-S International Microwave Symposium. During this session 269 papers were considered of which 150 papers were accepted and 110 rejected. Papers were submitted from 22 countries, and 17 countries had papers accepted for the final program.

The Technical Program Committee was divided into seventeen review groups and the Symposium Program Group. The Symposium Program Group was charged with the responsibility of coordinating the TPC January meeting and, upon the completion of the work of the review groups, structuring the overall symposium program. This group was composed of the TPC Chairmen for 1984 (Ferdo Ivanek), 1985 (William Hord), 1986 (Marvin Cohn), the Chairman of the 1985 Steering Committee (Fred Rosenbaum), the 1985 TPC Co-Chairman (Steve Honickman) and Larry Whicker of LRW Associates who provided technical and clerical assistance to the TPC. The efforts of this group were instrumental in developing the technical program.

The seventeen review groups produced twenty-six regular sessions and two Open Forum sessions. Of the twenty-six regular sessions, two are joint with the Monolithic Symposium. The coordination of the MTT-S TPC, with the Monolithic Symposium TPC chaired by Roger Sudbury, was most competently handled by Marvin Cohn.

The structure of the technical program is quite similar to that introduced last year in San Francisco. Session length is one and one-half hours which enables a more homogeneous grouping of papers within the session. Both regular length and short papers are featured in these sessions. The very successful Open Forum format is continued with one session on Tuesday, June 4 and another session on Wednesday, June 5.

1985 MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM STEERING COMMITTEE MEMBERS



Standing (l-r): M.R. Rosen, R.J. Gilmore, G.A. Lindauer, J.K. Hoyt, J.L. Bogdanor, H.W. Ship-ton, S.N. Honickman, M.W. Muller, J.M. Madson, F.J. Rosenbaum. Seated (l-r): C.E. Larson, L.N. Medgyesi-Mitschang, J.M. Roe, W. Hord, W.A. Ruff, W.P. Connors. Not present: P.K. Gran-teer, D. Granteer, G. Lampel, J. Caldwell.

SYMPOSIUM PROGRAM GROUP



Standing (l-r) F. Ivanek, S.N. Honickman. Seated (l-r): M. Cohn, L.R. Whicker, W. Hord, F.J. Rosenbaum.

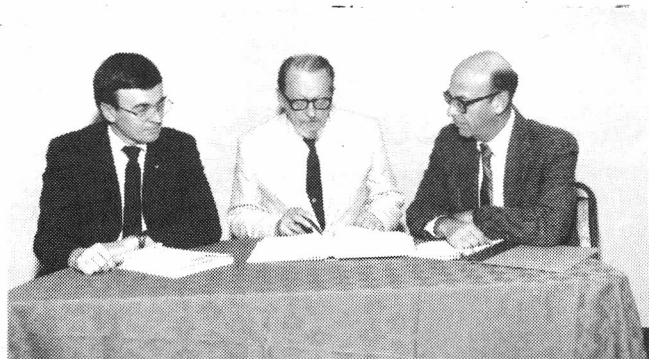
1985 MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM TECHNICAL PROGRAM COMMITTEE MEMBERS



Standing (l-r): S.L. March, S.T. Peng. Seated (l-r): D. Kajfez, B.S. Perlman, E.J. Denlinger.



Seated (l-r): L. Bui, C.M. Krowne, A.K. Sharma, T. Itoh.



Seated (l-r): R.H. Knerr, K.J. Button, H. Sobol.



Seated (l-r): P.M. LaTourrette, G.L. Matthaei, R.V. Snyder, A.E. Williams.

1985 MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM TECHNICAL PROGRAM COMMITTEE MEMBERS



Standing (l-r): E. J. Crescenzi, Jr., F.N. Sechi.
(Seated) (l-r): J.S. Barrera, E.C. Niehenke, B.L. Berson.



Standing (l-r): J.E. Degenford, K.B. Niclas.
Seated (l-r): B.D. Geller, S.J. Temple, R.L. Camisa.



Seated (l-r): N.G. Alexopoulos, J.W. Mink, D.M. Bolle.

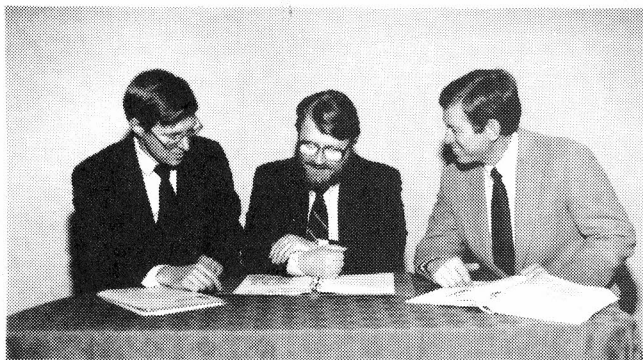


Standing (l-r): D.H. Steinbrecher, B.R. Hallford.
Seated (l-r): C.D. Buntschuh, J.F. White, E.D. Cohen, C.T. Rucker.

1985 MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM TECHNICAL PROGRAM COMMITTEE MEMBERS



Standing (l-r): J.E. Raue, S. Dixon. Seated (l-r): G.R. Harrison, G.R. Thoren, A.G. Cardiasmenos, M. Dydyk.



Seated (l-r): P.W. Staecker, G. Jerinic, N.W. Cox.



Standing (l-r): J.J. Whelehan, R.A. Pucel. Seated (l-r): R.E. Ham, J.M. Ownes, E.F. Belohoubek, N.R. Dietrich.



Seated (l-r): C.R. Boyd, T.J. Lukaszek, J.C. Lin, A. Rosen.

1985 MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM TECHNICAL PROGRAM COMMITTEE MEMBERS



Standing (l-r): G.L. Heiter, K.K. Agarwal. Seated (l-r): J.B. Horton, S. Okwit, R.A. Sparks, D.N. McQuiddy.

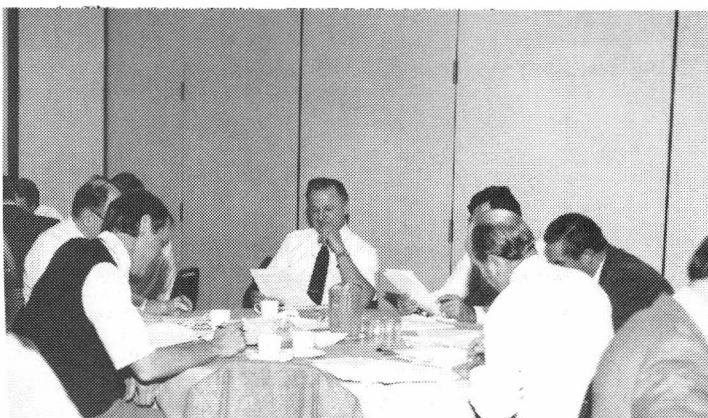
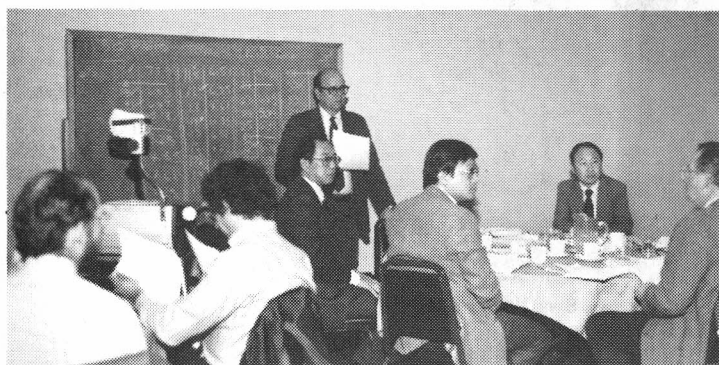


Standing (l-r): H.M. Cronson, M.A. Maury, Jr., R.H. Swartley. Seated (l-r): S.F. Adam, R.W. Laton, H.G. Oltman, Jr., G.F. Engen.



Standing (l-r): C.M. Kudsia, A.E. Atia. Seated (l-r): J.J. Taub, H.C. Bell, H. Howe, Jr., T.S. Saad.

1985 MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM TECHNICAL PROGRAM COMMITTEE IN ACTION



1985 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM SCHEDULE OF EVENTS

MONDAY, JUNE 3, 1985

8:30 am - 5:00 pm MW & MMW MONOLITHIC SYMPOSIUM Room 120 (Conv. Center)	8:30 am - 5:00 pm WORKSHOP ON PHASED ARRAYS FOR CANCER TREATMENT Room 122 (Conv. Center)	6:00 pm - 8:00 pm MICROWAVE JOURNAL RECEPTION World's Fair Pavilion (Forest Park)
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TUESDAY, JUNE 4, 1985

A 8:00 am - 10:00 am PLENARY SESSION Room 120 (Conv. Center)		
B 10:30 am - Noon MONOLITHIC RECEIVER CIRCUITS (Joint Session) Room 120 (Conv. Center)	C 10:30 am - Noon BIOMEDICAL ASPECTS OF MICROWAVES Room 260 (Conv. Center)	D 10:30 am - Noon COMMUNICATION SYSTEMS Room 123 (Conv. Center)
Noon - 1:30 pm PANEL ON FUTURE OF MW ENGINEERS Room 261 (Conv. Center)	Noon - 1:30 pm WORKING GROUP ON PROCUREMENT STRATEGIES Pierre Laclede (Sheraton)	
E 1:30 pm - 3:00 pm MONOLITHIC MMW CIRCUITS (Joint Session) Room 120 (Conv. Center)	F 1:30 pm - 3:00 pm GUIDED WAVES Room 260 (Conv. Center)	G 1:30 pm - 3:00 pm INTEGRATED MICROWAVE SYSTEMS Room 123 (Conv. Center)
8:00 pm - 10:00 pm EVENING PANEL SESSIONS Rooms 120, 123 (Conv. Center)	H 3:30 pm - 5:30 pm OPEN FORUM I Room 276 (Conv. Center)	I 3:30 pm - 5:00 pm ACOUSTICS AND FERRITES Room 260 (Conv. Center)

WEDNESDAY, JUNE 5, 1985

J 8:30 am - 10:00 am FET OSCILLATORS Room 120 (Conv. Center)	K 8:30 am - 10:00 am MICROWAVE FILTER NETWORKS Room 260 (Conv. Center)	L 8:30 am - 10:00 am OPTICAL AND SUBMILLIMETER WAVELENGTH TECHNOLOGY Room 123 (Conv. Center)
M 10:30 am - Noon FET AMPLIFIERS Room 120 (Conv. Center)	N 10:30 am - Noon FILTERS AND MULTIPLEXERS Room 260 (Conv. Center)	O 10:30 am - Noon MILLIMETER-WAVE COMPONENT TECHNOLOGY Room 123 (Conv. Center)
P 1:30 pm - 3:00 pm SOLID STATE SOURCES AND AMPLIFIERS Room 120 (Conv. Center)	Q 1:30 pm - 3:00 pm COMPUTER MODELING AND DESIGN OF NONLINEAR NETWORKS Room 260 (Conv. Center)	R 1:30 pm - 3:00 pm ADVANCED MILLIMETER-WAVE TECHNOLOGY Room 123 (Conv. Center)
	S 3:30 pm - 5:30 pm OPEN FORUM II Room 276 (Conv. Center)	T 3:30 pm - 5:00 pm SOLID STATE DEVICE TOPICS Room 123 (Conv. Center)
5:45 pm - 7:30 pm INDUSTRY-HOSTED COCKTAIL PARTY Ballroom Foyer (Marriott)	7:30 pm AWARDS BANQUET Main Ballroom (Marriott)	

THURSDAY, JUNE 6, 1985

U 8:30 am - 10:00 am LOW NOISE HEMT AMPLIFIERS Room 120 (Conv. Center)	V 8:30 am - 10:00 am CONTINUOUS AND DISCONTINUOUS MICROSTRIP STRUCTURES Room 123 (Conv. Center)	W 8:30 am - 10:00 am NETWORK ANALYZER TECHNIQUES Room 260 (Conv. Center)
X 10:30 am - Noon FET APPLICATIONS Room 120 (Conv. Center)	Y 10:30 am - Noon WAVEGUIDING STRUCTURES Room 123 (Conv. Center)	Z 10:30 am - Noon MICROWAVE MEASUREMENTS Room 260 (Conv. Center)
AA 1:30 pm - 3:00 pm SOLID STATE DEVICE APPLICATIONS- NON FET Room 120 (Conv. Center)	BB 1:30 pm - 3:00 pm MICROWAVE INTEGRATED CIRCUIT TECHNIQUES Room 123 (Conv. Center)	CC 1:30 pm - 3:00 pm COMPUTER-AIDED DESIGN TECHNIQUES FOR LINEAR CIRCUITS Room 260 (Conv. Center)
1:00 pm - 5:00 pm ARFTG CONFERENCE Room 261 (Conv. Center)	3:00 pm - 5:00 pm PANEL ON MMW INTEGRATED CIRCUITS Room 276 (Conv. Center)	7:00 pm - 10:00 pm ARFTG BANQUET Ballroom West (Sheraton)

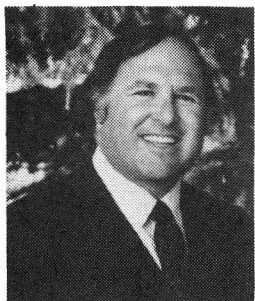
FRIDAY, JUNE 7, 1985

8:30 am - 4:30 pm ARFTG CONFERENCE Room 261 (Conv. Center)	8:30 am - 5:00 pm WORKSHOP ON MODERN MICROWAVE OSCILLATOR DESIGN TECHNIQUES Room 260 (Conv. Center)	
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1985 MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM

PLENARY SPEAKERS

The Plenary Session of the 1985 Symposium will address the Future of Microwave Engineers. Three prominent speakers will address this topic from their own individual perceptions. Dr. Merrill Skolnik, NRC will consider the technical future, Dr. David Leeson, president, California Microwaves will discuss the professional future of microwave engineers, which Dr. Stephen Honickman, President, of STG Electrosystems, will examine the economics of microwave engineering.



DAVID B. LEESON

Dr. Leeson is Chairman and Chief Executive Officer of California Microwave, Inc. California Microwave, Inc. is a supplier of satellite, microwave and digital transmission equipment to the telephone industry, and is a prime contractor for government communications and intelligence systems. The company employs 1250 and has revenues of \$112 million in its most recent fiscal year.

Dr. Leeson holds degrees from Caltech, M.I.T., Stanford, and has served as a Director of the American Electronics Association (AEA) and of the Electronic Industries Association (EIA).

Prior to the 1968 founding of California Microwave, Dr. Leeson was with Applied Technology, Inc. and Hughes Aircraft Company, where he was involved in the design of airborne and satellite systems.



MERRILL I. SKOLNIK

Dr. Skolnik has been Superintendent of the Radar Division at the Naval Research Laboratory since 1965 where he has been responsible for supervising research and development relating to Navy radar. Prior to that he was with the Institute for Defense Analyses, the Research Division of Electronic Communications, Inc., MIT Lincoln Laboratory, Sylvania Electric, and the Johns Hopkins University Radiation Laboratory. Dr.

Skolnik also teaches courses at the Johns Hopkins University School of Engineering and in the Continuing Engineering Education program at George Washington University. He received the B.E. (1947), M.S.E. (1949), and Dr. Eng. (1951) degrees, all in Electrical Engineering, from the Johns Hopkins University. He is the author of "Introduction to Radar Systems" (1962, 1980), and the editor of "Radar Handbook" (1970), both published by McGraw-Hill Book Co. In addition to radar, his technical interests have been in antennas, electronic systems, electronic warfare, and gaseous electronics. He is a Fellow of the IEEE. He received the Heinrich Hertz Premium from the (British) Institute of Radio and Electronic Engineers in 1964, the Navy Distinguished Civilian Service Award in 1982, the IEEE Harry Diamond Award in 1983, and the IEEE Centennial Medal in 1984. He is a member of the Society of Scholars of the Johns Hopkins University and has received the Johns Hopkins Distinguished Alumnus Award. Dr. Skolnik also is a member of the Board of Visitors of the Duke University School of Engineering.



STEPHEN N. HONICKMAN

Dr. Stephen N. Honickman, during twenty years of professional experience, has served as program manager and system manager/engineer for a number of radar, communications, computer, ASW, and EW system projects. System engineering functions include customer liaison, requirements analysis and definition, concept formulation, functional design, performance analysis, hardware design, management of prototype development, system field testing, and performance testing and evaluation.

Since 1980, he has been President of STG ELECTROSYSTEMS, INC. in Ballwin, MO, designing electronic warfare systems. At Emerson Electric from 1975-1980, he was Director of Research. His responsibilities included administrative, technical, and financial management of IR&D programs. Projects included high resolution ground map radar/navigator system, microprocessor based signal and display processors, MM wave radar and microprocessor based portable automatic test equipment. Prior to this, he was at Teledyne-Brown Engineering from 1973-1975 as the Manager of a Radar Design Group evaluating performance characteristics and recommending changes to the Site Defense Radar System.

Dr. Honickman received his Bachelor of Science degree in electrical engineering in 1962 from the City College of New York, and his Masters in electrical engineering in 1964 from New York University. He was awarded his Doctor of Science degree from the New Jersey Institute of Technology in 1971.

1985 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM

SYMPOSIUM SCHEDULE

SUNDAY, JUNE 2 — CERVANTES CONVENTION CENTER

5:00 pm-9:00 pm Symposium Registration, Lobby
7:00 pm-10:00 pm MW & MMW Monolithic Symposium, Cocktail Reception, Atrium

MONDAY, JUNE 3 — CERVANTES CONVENTION CENTER

7:30 am-11:30 pm Symposium Registration, Lobby
8:30 am-Noon MW & MMW Monolithic Symposium Technical Program, Room 120
1:30 pm-5:00 pm MW & MMW Monolithic Symposium Technical Program, Room 120
6:00 pm-8:00 pm Microwave Journal Reception, World's Fair Pavilion in Forest Park. Shuttle service will be provided.

TUESDAY, JUNE 4 — CERVANTES CONVENTION CENTER

8:00 am-10:00 am MTT-S Plenary Session, Room 120
10:30 am-Noon MTT-S International Microwave Symposium Technical Program, Room 120, Room 260, and Room 123
10:30 am-Noon MW & MM Monolithic Symposium Technical Program, Room 120 (Joint session MTT-S International Microwave Symposium)
Noon-1:30 pm Panel on Future of MW Engineers, Room 261
Noon-1:30 pm Working Group on Procurement Strategies, Pierre Laclede (Sheraton)
1:30 pm-5:30 pm MTT-S International Microwave Symposium Technical Program, Room 120, Room 260, Room 123 and Room 276
1:30 pm-3:00 pm MW & MM Monolithic Symposium Technical Program, Room 120 (Joint session MTT-S International Microwave Symposium)

GUEST PROGRAM

In addition to the MW & MMW Monolithic Symposium reception Sunday and the Microwave Journal reception, guest of participants in the Symposium are invited to participate in the following:

- Hospitality Suite (South lounge, on the ballroom level of the Sheraton Hotel) providing refreshments and snacks and information on St. Louis, from 8:30 am to 5:00 pm, Monday, June 3 through Friday, June 7.
- On Tuesday, June 4, the MTT-S International Microwave Symposium guest program tours will be available. See Guest Programs and the Advance Registration Form.

TUESDAY MORNING, JUNE 4, 1985

CERVANTES CONVENTION CENTER ROOM 120 PLENARY SESSION

8:10 am **Steering Committee Chairman**
Fred J. Rosenbaum
Central Microwave, St. Louis, MO
8:15 am **MTT-S President's Welcome**
Harlan Howe
M/A-COM, Inc., Burlington, MA
8:20 am **Technical Program Overview**
Co-Chairman: William Hord
Microwave Applications Group, Santa Maria, CA
8:25 am **Introduction of Plenary Session**
Robert A. Moore
8:30 am **Keynote Speakers**
8:30 am Dr. Merrile Skolnik, NRL, Washington, D.C.
9:00 am Dr. David Leeson, California Microwave, Sunnyvale, CA
9:30 am Dr. Stephen Honickman, STG Electrosystems, St. Louis, MO

ROOM 120

10:30 am **MONOLITHIC RECEIVER CIRCUITS***
Chairman: C. Huang, Anadigics, Morristown, NJ
Co-Chairman: R. Kagiwada, TRW, Redondo Beach, CA
10:40 am **X-Band Monolithic Series Feedback LNA**
B-1 R.E. Lehmann, D. D. Heston
Texas Instruments, Inc., Dallas, TX
11:00 am **0.5 - 2.6 GHz Si-Monolithic Wideband Amplifier IC**
B-2 T. Nakata, S. Miyajuki, K. Shirofori
NEC Corporation, Kawasaki, Japan
11:20 am **A GaAs Double-Balanced Dual-Gate FET Mixer IC for UHF Receiver Front End Applications**
B-3 K. Kanazawa, M. Kazumura, G. Kano, I. Teramoto
Matsushita Electric Corp., Osaka, Japan
11:40 am **Air Bridge Gate FET for GaAs Monolithic Circuits**
B-4 E. M. Bastida, G. P. Doinzelli
CISE SpA, Milan, Italy
* Joint Session of MTT-S and MW&MMW Monolithic Symposia

ROOM 260

10:30 am **BIOMEDICAL ASPECTS OF MICROWAVES**
Chairman: J.C. Lin, University of Illinois at Chicago, Chicago, IL
10:40 am **Microwave Radiometric Detection of Thermal Asymmetry of Varicocele**
C-1 T. P. Felderman, J. Shaeffer, A. M. El-Mahdi, J. F. Stecker, Jr.
Eastern Virginia Medical School, Norfolk, VA
K. L. Carr, M/A-COM, Inc., Burlington, MA
11:00 am **Inversion of Microwave Thermographic Data by the Singular Function Method**
C-2 F. Bardati, M. Mongiardo, D. Solimini
Universita di Roma Tor Vergata, Roma, Italy
11:10 am **Exact Image Theory for Field Calculation in Layered Biological Medium**
C-3 E. Alanen, I. V. Lindell
Helsinki University of Technology, Espoo, Finland
11:20 am **A Coplanar Waveguide Short Gap Resonator for Medical Applications**
C-4 Y. X. Wang
Beijing Institute of Radio Measurement, Beijing, China
11:30 am **Direct Contact Applicator with Convergent Effect of EM Field for Microwave Hyperthermia**
C-5 Y. Takahashi, Y. Nikawa, T. Katsumata,
S. Mori, M. Nakagawa
Keio University, Yokohama, Japan
M. Kikuchi, National Defense Medical College, Saitama, Japan
11:50 am **A Microwave Apparatus for Producing Uniform Hyperthermic Temperatures over Large Surfaces**
C-6 F. Sterzer, R. Paglione, RCA Laboratories, Princeton, NJ
E. Friedenthal, J. Mendecki
Albert Einstein College of Medicine, Bronx, NY

ROOM 123

10:30 am **COMMUNICATION SYSTEMS**
Chairman: G. L. Heiter, AT&T - Bell Laboratories, North Andover, MA
10:40 am **A Novel Technique to Realize SMSK Conversion and Matched Filters at Microwave Frequencies**
D-1 F. Ananasso, Telespazio S.p.A. per le Comunicazioni Spaziali, Roma, Italy
11:00 am **Temperature Controlled Predistortion Circuits for 64 QAM Microwave Power Amplifier**
D-2 N. Nannicini, Telettra S.p.A., Vimercate, Italy
11:20 am **Up/Down Converter for SCPC Applications**
D-3 A. K. Ghose, M. S. Ravichandran, A. Chattopadhyay, N. M. Ahmed
Indian Telephone Industries, Bangalore, India
11:40 am **MIC Assembly for 12-GHz Direct Broadcast Satellite Receiver**
D-4 G. Molin, H. Chuandong, Z. Shaoshi, G. Zhongru, X. Qiang
Nanjing Research Institute of Electronic Technology, Nanjing, China

TUESDAY AFTERNOON, JUNE 4, 1985

ROOM 120

- 1:30 pm MONOLITHIC MILLIMETER-WAVE CIRCUITS**
Chairman: H. J. Kuno, Hughes Aircraft Co., Torrance, CA
Co-Chairman: A. Chu, M/A-COM, Burlington, MA
- 1:40 PM A W-Band Monolithic Balanced Mixer**
E-1 L. T. Yuan, P. G. Asher
Hughes Aircraft Co., Torrance, CA
- 2:00 pm A 30 GHz Monolithic Single Balanced Mixer with Integrated Dipole Receiving Element**
E-2 S. J. Nightingale, M. A. G. Upton, U.S. Mishra, S. M. Palmateer, P. M. Smith
General Electric Co., Syracuse, NY
- 2:20 pm Dual Function Mixer Circuit for Millimeter-Wave Transceiver Applications**
E-3 A. Chu, W. E. Courtney, L. J. Mohoney, M. J. Monfra,
R. Calawa
MIT Lincoln Lab, Lexington, MA
- 2:40 pm High Efficiency Millimeter-Wave Monolithic IMPATT Oscillators**
E-4 B. Bayraktaroglu, H. D. Shih
Texas Instruments, Inc., Dallas, TX
- Joint Session MTT-S and MW&MMW Monolithic Symposia

ROOM 260

- 1:30 pm GUIDED WAVES**
Chairman: C. M. Krowne, Naval Research Laboratory, Washington, DC
- 1:40 pm Wave Interaction in Doubly Periodic Structures**
F-1 S. T. Peng, J. M. Dong, L. M. Wang
New York Institute of Technology, Old Westbury, NY
- 2:00 pm Formulation of the Singular Integral Equation Technique for General Planar Transmission Lines**
F-2 A. S. Omar, K. Schünemann,
Technical University Hamburg — Harburg, Hamburg, West Germany
- 2:20 pm Fin Line Taper Design Made Easy**
F-3 A. Beyer, I. Wolff
Duisburg University, Duisburg, FRG
- 2:40 pm The Influence of Metallization Thickness and Mounting Grooves on the Characteristics of Fin Lines**
F-4 R. Vahldieck, W. J. R. Hoefer
University of Ottawa, Ottawa, Canada
- 2:50 pm Effect of Side-Wall Grooves on Transmission Characteristics of Suspended Strip Lines**
F-5 E. Yamashita, B. Y. Wang, K. Atsuki
University of Electro-Communications, Tokyo, Japan

ROOM 123

- 1:30 pm INTEGRATED MICROWAVE SYSTEMS**
Chairman: K. K. Agarwal, Rockwell International, Dallas, TX
- 1:40 pm Integrated Ka-Band Front End with Monolithic Mixer**
G-1 P. J. Meier, J. A. Calviello, A. J. Cappello, L. D. Cohen,
R. J. Pomian, P. R. Bie
Eaton Corp., AIL Division, Melville, NY
- 2:00 pm A Low Cost, Accurate, Target Detecting Device for Altimetry and Fuzing**
G-2 T. O. Perkins, III, W. J. Bradley
Sanders Inc., Manchester, NH

- 2:20 pm Transceiver Module for Lightweight Phased Array**
G-3 A. Afrashteh, V. Stachejko, D. Staiman
RCA (MSR), Moorestown, NJ
- 2:40 pm Miniature Millimeter-Wave Integrated Circuit Wideband Downconverters**
G-4 A. Grote, R. S. Tahim, K. Chang
TRW Electronics and Defense, Redondo Beach, CA

ROOM 276

- 3:30 - OPEN FORUM I**
- 5:30 pm Characterisation of Large-Single Bipolar Transistors in L-Band**
H-1 J. L. Hutchings, Council for Scientific and Industrial Research, Pretoria, South Africa
- A New Approach for the Design of Microwave Oscillators and Filters Using Dielectric Resonators**
H-2 A. Podcameni, L. F. M. Conrado
Catholic University of Rio de Janeiro, Rio de Janeiro, Brazil
- Gaussian Beam Imaging with Cylindrical Lenses**
H-3 P. F. Goldsmith
Millitech Corp., South Deerfield, MA
- Planar Integrated Microwave Space Components for Terrestrial and Satellite Application**
H-4 A. M. K. Saad
MA Electronics Canada Ltd., Mississauga, Canada
- Waveform Generation and Modulation by Optoelectronic Switching**
H-5 C. S. Chang, C. H. Lee, M. G. Li, M. J. Rhee,
A. M. Yurek, E. Chauchard, R. P. Fischer
University of Maryland, College Park, MD
- A New Class of Optimized Fin Line and Metal Insert Filters with Improved Characteristics**
H-6 R. Vahldieck, W. J. R. Hoefer
University of Ottawa, Ottawa, Canada
- Microwave Characterization of Liquid Films**
H-7 R. P. Roy, J. Ku, I. Kaufman
Arizona State University, Tempe, AZ
- Investigation and Evaluation of Low Loss Interconnects on Soft Substrates Clad to Aluminum**
H-8 S. P. Kalra, Electric Power Research Institute, Palo Alto, CA
- The Design and Performance of a Double Balanced Mixer using FETs**
H-9 S. J. Nightingale, M. A. G. Upton
General Electric Co., Syracuse, NY
- GaAs MESFET Optimization and New Device Applications Based on Wave Property Studies**
H-10 K. Fricke, H. L. Hartnagel
Technische Hochschule Darmstadt, Darmstadt, FRG
- Microwave Heating System Using Lens Applicator for Localized Hyperthermia**
H-11 Y. Nikawa, Y. Takahashi, W. Watanabe, S. Mori
Keio University, Yokohama, Japan
- Sensitivity Analysis of a 15.0 GHz Monopulse Radar Receiver Using a Logarithmic Amplifier Detection Scheme**
H-12 M. Kikuchi,
National Defense Medical College, Saitama, Japan
- The Relationship of Magnetotransconductance Mobility Profiles**
H-13 G. W. Stilwell, A. M. Madni, L. A. Wan
Systron Donner Corp., Van Nuys, CA

and RF Performance of GaAs FETs

S. K. Chan, K. M. Lau,
University of Massachusetts, Amherst, MA
P. White, Raytheon, Northborough, MA

- H-14 Performance of Microwave FM Signal Frequency Division Circuits**
A. Jacob, M. Jenett
Technische Univ. Braunschweig, Braunschweig, W. Germany
- H-15 Optically Controlled Microwave Oscillators and PIN Diode Phase Shifter**
P. R. Herczfeld, A. S. Daryoush
Drexel University, Philadelphia, PA
A. Rosen, P. Stabile
RCA Laboratories, Princeton, NJ
Z. Turski, A. Khana
Loral, Lanham, MD
V.M. Contarino, J. Smith
Naval Air Development Center, Warminster, PA
- H-16 New Multilayered Microstrip and Coplanar Structures for High-Directivity Coupler Applications**
B. J. Janiczak
Tech. University of Gdansk, Gdansk, Poland
- H-17 A Dual-Gate FET Constant Phase Variable Power Amplifier**
D. M. Drury, D. C. Zimmermann, D. E. Zimmerman
Texas Instruments, Dallas, TX
- H-18 A Study of W-Band Subharmonically Pumped Mixer**
W. Yun-Yi, S. Yong-Hui
Nanjing Institute of Technology, Nanjing, China

ROOM 260

- 3:30 pm ACOUSTICS AND FERRITES**
Chairman: J. M. Owens, University of Texas, Arlington, TX
- 3:40 pm A High Performance Hexagonal Ferrite Tunable Bandpass Filter for the 40-60 GHz Region**
I-1
D. Nicholson
Hewlett Packard, Santa Rosa, CA
- 4:00 pm 140 and 220 GHz Ferrite Components**
I-2
D. Davidson, J. Rabel, S. Schell
TRW Electronic Systems Group, Redondo Beach, CA
- 4:10 pm Millimetric Non-Reciprocal Coupled-Slot Fin-Line Components**
I-3
L. E. Davis, D. B. Sillars
Paisley College of Technology, Paisley, Scotland
- 4:20 pm UHF Film Resonator Evaluation and Resonator - Controlled Oscillator Design Using CAD Techniques**
I-4
M. M. Driscoll, S. V. Krishnaswamy, R. A. Moore, J. R. Szedon
Westinghouse D & E Systems, Baltimore, MD
- 4:30 pm Stable Microwave Source Using High Overtone Bulk Resonators**
I-5
J. T. Haynes, M. S. Buchalter, R. A. Moore, H. L. Salvo, S. G. Shepherd
Westinghouse D & E Systems, Baltimore, MD
- 4:40 pm SAW Resonator Filters: Applications & Capabilities**
I-6
B. Horine
SAWTEK, Inc., Orlando, FL
- 4:50 pm A 16 Tap Hybrid Programmable Transversal Filter Using Monolithic GaAs Dual-Gate FET Array**
I-7
C. M. Panasik, D. E. Zimmerman
Texas Instruments, Dallas, TX

WEDNESDAY MORNING, JUNE 5, 1985

ROOM 120

- 8:30 am FET OSCILLATORS**
Chairman: E. C. Niehenke, Westinghouse Electric Corp., Baltimore, MD
- 8:50 am A Novel GaAs FET Oscillator with Low Phase Noise**
J-1
A. N. Riddle, R. J. Trew
North Carolina State University, Raleigh, NC
- 9:00 am An Approach to Realizing Multi-Octave Performance in GaAs FET YIG Tuned Oscillators**
J-2
C. F. Schiebold
Watkins-Johnson Company, Palo Alto, CA
- 9:20 am Miniature FET Oscillator Stabilized by a Dual Mode Dielectric Resonator Loaded Cavity**
J-3
S. F. Fiedziuszko
Ford Aerospace, Palo Alto, CA
- 9:40 am Push-Push Dielectric Resonator Oscillator for 20-40 GHz Operation**
J-4
A. M. Pavio, M. A. Smith
Texas Instruments, Dallas, TX

ROOM 260

- 8:30 am MICROWAVE FILTER NETWORKS**
Chairman: A. E. Williams, COMSAT Laboratories, Clarksburg, MD
- 8:30 am Distributed Microwave Active Filters with GaAs FETs**
K-1
C. Rauscher
Naval Research Laboratory, Washington, DC
- 8:50 am Dielectric Waveguide Bandpass Filters with Broad Stopbands**
K-2
P. K. Ikalainen, G. L. Matthaei, D. C. Park, M. S. Wei
University of California, Santa Barbara, CA
- 9:10 am Influence of Conductor Shields on the Q-Factors of a TE₀ Dielectric Resonator**
K-3
Y. Kobayashi, T. Aoki, Y. Kabe
Saitama University, Urawa, Japan
- 9:30 am A Bandpass Filter Using LPE YIG Film**
K-4
Y. Murakami, S. Itoh
Sony Corporation Research Center, Yokohama, Japan
- 9:40 am 800 MHz Band Dielectric Channel Dropping Filter Using TM₁₁₀ Triplet Mode Resonance**
K-5
T. Nishikawa, K. Wakino, H. Wada, Y. Ishikawa
Murata Mfg. Co. Ltd., Kyoto, Japan

ROOM 123

- 8:30 am OPTICAL AND SUBMILLIMETER WAVELENGTH TECHNOLOGY**
Chairman: K. J. Button, MIT, Cambridge, MA
- 8:30 am Optics for Microwave Applications**
L-1
P. K. Wahi
Loral Advanced Technology Labs, Lanham, MD
- 8:50 am Acoustooptic Interaction of Acoustic Surface Waves with Guided Optical Waves in Planar Tantalum-Pentoxide Waveguides**
L-2
S. Patela, J. Radojewski, J. Kadziela
Technical University of Wroclaw, Wroclaw, Poland
- 9:05 am Analog Signal Transmission over Optical Fiber Systems**
L-3
M. Ramadan
Rockwell International, Richardson, TX
- 9:20 am A New Approach to Dispersion Analysis of Graded Index Optical Fibers**
L-4
H. J. Carlin
Cornell University, Ithaca, NY
H. Zmuda
Stevens Institute of Technology, Hoboken, NJ

- 9:35 am L-5 A Very Low-Noise, Fixed-Tuned Mixer for 240-270 GHz**
M. T. Faber, J. W. Archer
National Radio Astronomy Observatory,
Charlottesville, VA
- 9:50 am L-6 Theoretical Efficiency for Triplers Using Real Schottky Diode Varistors at Submillimeter Wavelengths**
K. Benson
Duke University, Durham, NC
M. A. Frerking
Jet Propulsion Laboratory, Pasadena, CA

ROOM 120

- 10:30 am FET AMPLIFIERS**
Chairman: S. J. Temple, Raytheon Co., Bedford, MA
- 10:40 am M-1 A 30 GHz Low Noise FET Amplifier**
J. M. Schellenberg, E. T. Watkins
Hughes Aircraft Co., Torrance, CA
- 11:00 am M-2 A 1 Watt 28 GHz Band Amplifier Using Clustered FETs**
T. Takagi, K. Seino, A. Iida, M. Kobiki, Y. Mistui, F. Takeda
Mitsubishi Electric Corp., Kamakura City, Japan
- 11:10 am M-3 Wide-Band Limiting Amplifiers with Low Second Harmonic Distortion, Utilizing GaAs MMIC Limiters**
E. J. Crescenzi Jr., R. S. Besser, B. A. Tucker, T. R. Kritzer
Watkins-Johnson Co., Palo Alto, CA
- 11:30 am M-4 High-Power and High-Efficiency Ion-Implanted Power GaAs FETs for C and X Bands**
S. Yanagawa, Y. Yamada, M. Itoh, K. Arai, N. Tomita
Toshiba Corp., Kawasaki, Japan
- 11:50 am M-5 High-Voltage FET Amplifiers for Satellite and Phased-Array Applications**
A. Ezzeddine, H. L. Hung, H. C. Huang
COMSAT Laboratories, Clarksburg, MD

ROOM 260

- 10:30 FILTERS AND MULTIPLEXERS**
Chairman: A. E. Atia, COMSAT, Washington, DC
- 10:40 am N-1 Dielectric Resonator Output Multiplexer for C-Band Satellite Applications**
W. C. Tang, J. Sferrazza, B. Beggs, D. Siu
COM DEV Ltd., Cambridge, Canada
- 11:00 am N-2 A Ku-Band Contiguous Multiplexer Employing Low-Loss, Odd-Order Mixed Dual Mode and Triple Mode Cavity Filters**
M. Pley, W. C. Tang
COM DEV Ltd., Cambridge, Canada
- 11:20 am N-3 Design and Performance of a W-Band Finline Diplexer with over 20 GHz Bandwidth**
C. Nguyen, K. Chang
TRW, Redondo Beach, CA
- 11:40 am N-4 Practical Aspects and Limitations of Dual Mode Dielectric Resonator Filters**
S. J. Fiedziuszko
Ford Aerospace, Palo Alto, CA
- 11:50 am N-5 Two-Path Cutoff Waveguide Dielectric Resonator Filters**
H. Shigesawa, M. Tsuji, K. Takiyama
Doshisha University, Kyoto, Japan

ROOM 123

- 10:30 am MILLIMETER-WAVE COMPONENT TECHNOLOGY**
Chairman: A. G. Cardenas, Raytheon Co., Bedford, MA
- 10:30 am O-1 A High Efficiency Frequency Doubler for 100 GHz**
M. T. Faber, J. W. Archer
National Radio Astronomy Observatory,
Charlottesville, VA
- 10:50 am GaAs Gunn Oscillators Reach the 140 GHz**

- O-2 Range**
H. Barth, W. Menzel
AEG Telefunken, Ulm, FRG
- 11:10 am O-3 W-Band (75 to 110 GHz) Microstrip Components**
K. Chang, R. S. Tahim, D. English, A. Grote, T. Pham, C. Sun, G. Hayashibara, P. Yen
TRW Electronics and Defense, Redondo Beach, CA
- 11:30 am O-4 Wideband Electronically Tuneable GaAs VCO's at W-Band (75-110 GHz)**
J. Ondria
Marconi Electron Devices Ltd., Lincoln, UK
- 11:50 am O-5 An 18-40 GHz Double Balanced Microstrip Mixer**
M. A. Smith, A. M. Pavio
Texas Instruments, Dallas, TX

WEDNESDAY AFTERNOON, JUNE 5, 1985

ROOM 120

- 1:30 pm SOLID STATE SOURCES AND AMPLIFIERS**
Chairman: P. W. Staecker, MIT Lincoln Laboratory, Lexington, MA
- 1:40 pm P-1 A 0.5 Micron Silicon Bipolar Transistor for Low Phase Noise Oscillator Applications up to 20 GHz**
C. C. Leung, C. P. Snapp, V. Grande
Avantek, Inc., Santa Clara, CA
- 2:00 pm P-2 Superconducting Low Noise Microwave Parametric Amplifier**
A. D. Smith, R. D. Sandell, J. F. Burch, A. H. Silver
TRW Space & Technology Group, Redondo Beach, CA
- 2:20 pm P-3 100 W, 5% Bandwidth X-Band IMPATT Amplifier**
R. Mallavarpu, G. MacMaster
Raytheon Co., Waltham, MA
- 2:40 pm P-4 EHF IMPATT Amplifier**
G. H. Nesbit, W. H. Leighton
Hughes Aircraft Company, Torrance, CA
- 2:50 pm P-5 Gain Saturation in Circulator-Coupled Reflection Amplifiers**
M. B. Steer
North Carolina State University, Raleigh, NC

ROOM 260

- 1:30 pm COMPUTER MODELING AND DESIGN OF NONLINEAR NETWORKS**
Chairman: B. S. Perlman, RCA Laboratories, Princeton, NJ
- 1:40 pm Q-1 A New Frequency Domain Approach to the Analysis of Nonlinear Microwave Circuits**
G. W. Rhyne, M. B. Steer
North Carolina State University, Raleigh, NC
- 2:00 pm Q-2 A Nonlinear GaAs FET Model for Use in the Design of Output Circuits for Power Amplifiers**
W. R. Curtice
RCA Laboratories, Princeton, NJ
- 2:20 pm Q-3 Power Characterization of a MESFET Amplifier Using Small Signal Measurements**
G. Lambrianou, C. S. Aitchison
Chelsea College, University of London, London, UK
- 2:40 pm Q-4 Circuit Design to Reduce 3rd Order IMD in FET Amplifiers**
R. J. Gilmore, R. Kiehne, F. J. Rosenbaum
Central Microwave Co., Maryland Heights, MO
- 2:50 pm Q-5 A General CAD Tool for Large-Signal GaAs MESFET Circuit Design**
J. M. Golio, P. A. Blakey, R. O. Grondin
Arizona State University, Tempe, AZ

ROOM 123

- 1:30 pm ADVANCED MILLIMETER WAVE TECHNOLOGY**
Chairman: G. R. Thoren, Raytheon Co., Bedford, MA
- 1:30 pm Contiguous Domain Transferred-Electron Oscillators**
R-1 J. A. Cooper, Jr.
Purdue University, West Lafayette, IN
K. K. Thornber
AT&T Bell Laboratories, Whippany, NJ
- 1:50 pm Very Broadband GaAs MESFET Injection Planar Transferred Electron Oscillators**
R-2 P. A. Rolland, A. Cappy, M. R. Friscourt
Universite' des Sciences et Techniques de Lille I, Cedex, France
- 2:10 pm Limitations of Microwave and Millimeter-Wave Mixers Due to Excess Noise**
R-3 G. Hegazi, A. Jelenski, S. Yngvesson
University of Massachusetts, Amherst, MA
- 2:30 pm Millimeter-Wave Diplexers with Printed Circuit Elements**
R-4 Y. C. Shih, L. Q. Bui
Hughes Aircraft Co., Torrance, CA
T. Itoh
University of Texas at Austin, Austin, TX
- 2:50 pm Dielectric Measurements of Common Polymers at Millimeter Wavelengths**
R-5 M. N. Afsar
City University of New York, New York, NY

ROOM 276

- 3:30 - OPEN FORUM II**
5:30 pm Analysis and Design of Spurline Bandstop Filters
S-1 C. Nguyen, K. Chang
TRW, Redondo Beach, CA
- S-2 Analysis and Design of Five Port Circular Disc Structures for Six-Port Analyzers**
M. Abouzahra
MIT Lincoln Laboratory, Lexington, MA
K. C. Gupta
University of Colorado, Boulder, CO
- S-3 Accurate Models for Computer Aided Design of Suspended Microstrip, Inverted Microstrip, and Fin-Lines**
P. Bhartia
Defence Research Establishment Ottawa, Ottawa, Canada
P. Pramanick
Canadian Marconi Company, Kanata, Canada
- S-4 A Generalized Algorithm for the Modeling of the Dispersive Characteristics of Microstrip, Inverted Microstrip, Stripline, Slotline, Finline and Coplanar Waveguide Circuits**
A. Nakatani, N. G. Alexopoulos
University of California, Los Angeles, CA
- S-5 Field Distribution of Hybrid Modes in Dielectric Loaded Waveguides**
K. A. Zaki, C. Chen
University of Maryland, College Park, MD
- S-6 Loss Mechanisms in Dielectric Loaded Resonators**
K. A. Zaki, C. Chen
University of Maryland, College Park, MD
- S-7 A Superlinearly Convergent Minimax Algorithm for Microwave Circuit Design**
J. W. Bandler, W. Kellermann
McMaster University, Hamilton, Canada
K. Madsen
Technical University of Denmark, Lyngby, Denmark
- S-8 Self-Equalized, Equiripple Microwave Filter Synthesis**
L. W. Hendrick, P. J. Tatomir
Hughes Aircraft Co., El Segundo, CA

- S-9 The Use of Higher Resonant Modes in Measuring the Dielectric Constant of Dielectric Resonators**
D. Kajfez, W. P. Wheless, Jr.
University of Mississippi, University, MS
- S-10 A High Performance - Wide Bandwidth - Diplexing - Tracking - Depolarization Correcting - Compact Earthstation Antenna Feed**
A. Prata, Jr., E. A. Filho
Telebras - CPqD, Campinas, Brazil
S. Ghosh
International Telecommunication Union, Geneva, Switzerland
- S-11 MICROS 2 - A CAD/CAM Program for Fast Realization of Microstrip Masks**
J. F. Zürcher
Ecole Polytechnique Federale, Lausanne, Switzerland
- S-12 Analysis of Dielectric Resonators with Tuning Screw and Supporting Structure**
F. H. Gil
E. T. S. Ingenieros de Telecomunicacion, Madrid, Spain
- S-13 Complete Determination of Circulator Eigenvalues without Transmission Phase Measurement**
Ch. Schiebllich, U. Goebel
Technische Universität Hamburg-Harburg, Hamburg, W. Germany
- S-14 Development of a Coupler in Finline Technique**
A. Beyer, D. Kother, I. Wolff
Duisburg University, Duisburg, FRG
- S-15 Equivalent Circuit of Broadside-Coupled Microstrip Open Ends**
S. K. Koul, B. Bhat
Indian Institute of Technology, New Delhi, India
- S-16 Analysis and Synthesis of Guides with Closely Spaced Discontinuities**
B. Harris, P. E. Mayes
University of Illinois, Urbana, IL
- S-17 Stokes Vector Representation of the Six-Port Network Analyzer, Calibration and Measurement**
T. Oishi
COMSAT, Washington, DC
W. K. Kahn
George Washington University, Washington, DC
- S-18 Short Millimeter-Wave Region High Accuracy Power Meter with Self-Calibration Function**
M. Sasaki
SPC Electronics Corp., Tokyo, Japan
- S-19 A Simple Network Analog Approach for the Quasi Static Characteristics of General Lossy, Anisotropic, Layered Structures**
V. K. Tripathi, R. J. Bucolo
Oregon State University, Corvallis, OR
- S-20 $TM^0_{\gamma\delta}$ Mode of Cylindrical Dielectric Resonators: Applications to Microwave Filters**
B. Byzery, P. Guillon
Lab. de Communications Microondes et Optiques
L.A.C.N.R.S., Limoges, France
- S-21 Collinearly Excited Edge-Coupled Resonators**
K. W. Reed, A. K. Reddy, W. A. Davis
University of Texas, Arlington, TX

ROOM 123

- 3:30 pm SOLID STATE DEVICE TOPICS**
Chairman: J. F. White, M/A-COM, Inc., Burlington, MA
- 3:40 pm 20 GHz High Efficiency GaAs IMPATT Diode**
T-1 M. J. Delaney, M. H. Jones, C. Sun
TRW, Redondo Beach, CA

- 4:00 pm T-2** **Controlled Bias Preheating for Variable Pulse IMPATT Transmitter**
R. L. Eisenhart, R. S. Robertson
Hughes Aircraft Co., Canoga Park, CA
- 4:20 pm T-3** **High Speed Varactor Tuned Notch Filter**
M. Mehdizadeh, B. Smilowitz
General Microwave Corp., Farmingdale, NY
- 4:40 pm T-4** **Dynamic Diode Mixer Damage Measurement**
R. V. Garver, C. Fazi
Harry Diamond Labs, Adelphi, MD

THURSDAY MORNING, JUNE 6, 1985

ROOM 120

- 8:30 am** **LOW NOISE HEMT AMPLIFIERS**
Chairman: R. L. Camisa, RCA, Princeton, NJ
- 8:40 am U-1** **X-Band Noise Parameters of HEMT Devices at 300K and 12.5K.**
S. Weinreb, M. Pospieszalski
National Radio Astronomy Observatory,
Charlottesville, VA
- 8:50 am U-2** **Low Noise Amplifiers using Two Dimensional Electron Gas FETs**
T. Mochizuki, Y. Itoh, K. Honma, K. Handa, Y. Fujiki,
W. Akinaga, S. Fukuda
NEC Corporation, Yokohama, Japan
- 9:00 am U-3** **Broadband HEMT and GaAs FET Amplifiers for 18-26.5 GHz**
K. Shibata, B. Abe, H. Kawasaki, S. Hori, K. Kamei
Toshiba Corporation, Kawasaki, Japan
- 9:20 am U-4** **A 20 GHz Peltier-Cooled Low-Noise HEMT Amplifier**
M. Iwakuni, M. Niori, T. Hamabe, T. Saito,
H. Kurihara, K. Joshin, M. Mikuni
Fujitsu Laboratories, Kawasaki, Japan
- 9:40 am U-5** **36.0 - 40.0 GHz HEMT Low-Noise Amplifier**
M. Sholley, J. Berenz, K. Nakano, R. Sawires, A. Nichols, J. Abell
TRW, Redondo Beach, CA

ROOM 123

- 8:30 am** **CONTINUOUS AND DISCONTINUOUS MICROSTRIP STRUCTURES**
Chairman: J. W. Mink, U. S. Army Research
Office Research Triangle Park, NC
- 8:30 am V-1** **A Perturbation Theory for Microstrip Propagation**
R. E. Collin
Case Western Reserve University, Cleveland, OH
- 8:50 am V-2** **Surface Wave Losses at Discontinuities in Millimeter Wave Integrated Transmission Lines**
R. W. Jackson, D. M. Pozar
University of Massachusetts, Amherst, MA
- 9:10 am V-3** **Comparative Study of Mode Matching Formulations for Microstrip Discontinuity Problems**
Y. C. Shih
Hughes Aircraft Co., Torrance, CA
- 9:30 am V-4** **Microstrip Discontinuity Modelling for Millimetric Integrated Circuits**
P. B. Katehi
University of Michigan, Ann Arbor, MI
- 9:50 am V-5** **Convergence of Numerical Solutions of Open-Ended Waveguide by Modal Analysis and Hybrid Modal-Spectral Techniques**
J. A. Encinar, J. M. Rebollar
Universidad Politecnica de Madrid, Madrid, Spain

ROOM 260

- 8:30 am** **NETWORK ANALYZER TECHNIQUES**
Chairman: H. G. Oltman, Jr., Hughes Aircraft,
Canoga Park, CA
- 8:40 am W-1** **A Broadband Homodyne Network Analyzer System with Binary Phase Modulation**
U. Gaertner, B. Schiek
Ruhr-Universitaet Bochum, Bochum, West Germany
- 9:00 am W-2** **Pulse Network Analyzer**
D. L. Landt, R. J. Weber
Rockwell International, Collins Div., Cedar Rapids, IA
- 9:10 am W-3** **Vector Method of Characterizing Nonlinearity in Microwave Power Devices**
W. J. Thompson, K. K. Agarwal
Rockwell International, Dallas TX
- 9:30 am W-4** **Calibrating a Six-Port Reflectometer using Three Known Loads**
M. E. Bialkowski, G. S. Woods
James Cook University of North Queensland,
Townsville, Australia
- 9:50 am W-5** **Waveguide Star Junction used in Ka Band Dual Six Port Measurements**
M. Riazat, G. Zdasiuk
Varian Central Research, Palo Alto, CA

ROOM 120

- 10:30 am** **FET APPLICATIONS**
Chairman: F. N. Sechi, RCA Laboratories,
Princeton, NJ
- 10:40 am X-1** **Miniature Ceramic Circuit Components for Ku Band Receivers**
B. Dornan, G. Lan, P. Goldgeier, P. Pelka, F. Sechi
RCA Laboratories, Princeton, NJ
- 11:00 am X-2** **A 4.5 to 18 GHz Phase Shifter**
D. C. Boire, J. E. Degenford, M. Cohn
Westinghouse Electric Corp., Baltimore, MD
- 11:10 am X-3** **A Practical Microwave Travelling-Wave MESFET Gate Mixer**
O. S. A. Tang, C. S. Aitchison
Chelsea College, University of London, London, UK
- 11:20 am X-4** **Broadband and Broad Dynamic Range GaAs Dual-Gate MESFET Linearizer for TWTA and SSPA used in Satellite Transponder**
M. Kumar, J. C. Whartenby, H. J. Wolkstein
RCA Laboratories, Princeton, NJ
- 11:30 am X-5** **30 dB or AGC from an FET**
B. R. Hallford
Rockwell International, Dallas, TX

ROOM 123

- 10:30 am** **WAVEGUIDING STRUCTURES**
Chairman: N. G. Alexopoulos, Univ. of California,
Los Angeles, CA
- 10:30 am Y-1** **Leakage from a Gap in NRD Guide**
A. A. Oliner, S. T. Peng, K. M. Sheng
Polytechnic Institute of New York, Brooklyn, NY
- 10:50 am Y-2** **Discontinuity in Open Dielectric Waveguides and its Applications to Periodic Structures**
M. Tsuji, H. Shigesawa, K. Takiyama
Doshisha University, Kyoto, Japan
- 11:10 am Y-3** **Scattering of Surface Waves by Nonuniform Waveguides**
S. T. Peng, S. J. Xu
New York Institute of Technology, Old Westbury, NY
- 11:30 am Y-4** **Finite Element Analysis Applied to Gyroelectrically Loaded Waveguiding Structures**
N. Mohsenian, T. J. Delph, D. M. Bolle
Lehigh University, Bethlehem, PA

11:50 am Y-5 On the Question of the Dyadic Operation of Dyadic Green's Functions at the Source Region
P. Shenggen
Shanghai University, Shanghai, China

ROOM 260

10:30 am MICROWAVE MEASUREMENTS

Chairman: S. F. Adam, Adam Microwave Consulting, Los Altos, CA

10:40 am Z-1 An Improved Method of Mixer Noise Figure Measurement as Applied to Beam Lead Schottky Diodes at 94 GHz
F. Azan
Thomson-CSF, Orsay, France

11:00 am Z-2 Quasi-Optical Slot Ring Mixer Noise Figure Measurements

K. D. Stephan, G. Perks
University of Massachusetts, Amherst, MA

11:20 am Z-3 Dynamic Measurement of Complex Permittivity and Temperature During Microwave Heating
M. R. Ollivon
C.N.R.S., Thiais, France

11:30 am Z-4 Measurement of TDC in Engine by Microwave Technique

T. Yamanaka, M. Esaki, M. Kinoshita
Toyota, Aichi-Ken, Japan

11:40 am Z-5 A Novel Cavity Resonator Measurement Method for Leaky Waveguides

A. A. Oliner, J. S. Myung
Polytechnic Institute of New York, Brooklyn, NY

THURSDAY AFTERNOON, JUNE 6, 1985

ROOM 120

1:30 pm SOLID STATE DEVICE APPLICATIONS - NON FET

Chairman: C. Buntschuh, Narda Microwave Corp., Hauppauge, NY

1:40 pm AA-1 Linear Analog Hyperabrupt Varactor Diode Phase Shifters

E. C. Niehenke, V. V. DiMarco, A. Friedberg
Westinghouse Electric Corp., Baltimore, MD.

2:00 pm AA-2 A Reflective Diode Linearizer for Spacecraft Applications

A. Katz, R. Sudarsanam, D. Aubert
RCA Astro, Princeton, NJ

2:20 pm AA-3 An Experimental Linearized Power Upconverter for SSB Signals

E. H. Löser
Institute für Hochfrequenztechnik,
Braunschweig, W. Germany

2:40 pm AA-4 A Simple Integrated Matching Element for SIS Quasiparticle Mixers

P. L. Richards
University of California, Berkeley, CA

ROOM 123

1:30 pm MICROWAVE INTEGRATED CIRCUIT TECHNIQUES

Chairman: E. F. Belohoubek, RCA Labs, Princeton, NJ

1:40 pm BB-1 An Experimental Investigation of Microstrip Properties on Soft Substrates from 2-40 GHz

R. R. Romanofsky, K. B. Bhasin, G. E. Ponchak,
A. N. Downey, D. J. Connolly

1:50 pm BB-2 Modelling and Measurement of Microstrip Transmission Line Structures

P. R. Shepherd, P. Daly
University of Leeds, Leeds, UK

2:00 pm BB-3 A New Slotline-Microstrip Frequency Halver

G. A. Kalivas, R. G. Harrison
Carleton University, Ottawa, Canada

2:20 pm BB-4 Microstrip Mixer Design with Image Cancellation and Low Conversion Loss
Ch. Ansoerge
Technische Univ. Hamburg-Harburg, Hamburg, W. Germany

2:30 pm BB-5 Small Size VCO Module for 900 MHz Band Using Coupled Microstrip-Coplanar Lines

K. Kawamoto, K. Hirota, N. Niizaki
Hitachi, Ltd., Yokohama, Japan

Y. Fujiwara, K. Ueki
Hitachi Denshi, Ltd., Tokyo, Japan

2:40 pm BB-6 Frequency Agile Circular Microstrip Antennas

G. L. Lan, D. L. Sengupta
University of Michigan, Ann Arbor, MI

ROOM 260

1:30 pm COMPUTER-AIDED DESIGN TECHNIQUES FOR LINEAR CIRCUITS

Chairman: S. L. March, Compact Software, Round Rock, TX

1:40 pm CC-1 A C.A.D. Solution to the Generalized Problem of Noise Figure Calculation

V. Rizzoli, A. Lipparini
University of Bologna, Bologna, Italy

2:00 pm CC-2 A SPICE Model for Multiple Coupled Microstrips and Other Transmission Lines

V. K. Tripathi
Oregon State University, Corvallis, OR
J. B. Rettig

2:20 pm CC-3 MIDAS, A New Microwave/RF CAD Program

D. Rhodes, S. Perlow
RCA Laboratories, Princeton, NJ

2:40 pm CC-4 A Novel CAD Tool and Concept Compatible with the Requirements of Multilayer GaAs MMIC Technology

R. H. Jansen
University of Duisburg, Duisburg, West Germany

PANEL SESSIONS

Future of Microwave Engineers: Impact of DoD Funding of R&D on Small and Large Companies and Academic Institutions

Date: Tuesday, June 4, 1985, Noon to 1:30 pm
Location: Cervantes Convention Center, Room 261
Organizer: Robert A. Moore

Westinghouse Electric Corporation

Moderator: Robert A. Moore

Panelists: Dr. Leo Young, The Pentagon
Dr. H. C. Nathanson, Westinghouse R&D Center

Dr. Stephen Honickman, STG
Electrosystems

Dr. George Gamota, University of Michigan

Dr. Merrill Skolnik, Naval Research Lab

Dr. David Leeson, California Microwave

Abstract:

DoD R&D funding distribution and procurement policies and procedures impact in major ways the careers of microwave engineers. Dr. Young will lead off with an overview of DoD sponsored funding. He will be followed by Drs. Nathanson, Honickman, and Gamota representing, respectively, large company, small company, and academic views. Audience discussion with the panelists will be encouraged.

Box lunches will be available to ticketholders at this informal luncheon session. Tickets for box lunches may be purchased through advanced registration, or at the main registration desk.

Advances in Millimeter Wave Sub Systems

Sponsor: MTT-16, Technical Committee on Microwave Systems
Date: Tuesday, June 4, 1985, 8:00 pm to 10:00 pm
Location: Cervantes Convention Center, Room 120
Organizers: T.H. Oxley, Marconi Electronics Devices Ltd.
J.B. Horton, TRW
Moderator: T.H. Oxley

Abstract:

Rapid advances in millimeter wave technology in recent years have led to a new generation of device applications and increasingly higher level of integration in millimeter wave subsystems. Members of this panel have been selected to represent a cross section of technologies and applications of these subsystems.

Each panel member will review the technical advances and current state-of-the-art in his own area of expertise. Emphasis will be on current construction techniques and how these techniques are used to produce practical multi-function subsystems. Techniques applicable to low volume and high volume production will be discussed. Panel members have been selected from Europe, Japan and the USA.

Historical Perspective of Microwaves

Date: Tuesday, June 4, 1985, 8:00 pm to 10:00 pm
Location: Cervantes Convention Center, Room 123
Organizer: Prof. Harold Shipton, Washington University, St. Louis, MO
Moderator: Prof. Harold Shipton

Abstract

Whereas most of the Symposium is involved with the current state-of-the-art in microwave technology, it is interesting and instructive to glance into the past at the origins of our current microwave practice. This panel session will do just that. The discussion will cover the early development of radar, telecommunications, and biomedical applications. Panel members participated in the early development of these fields, and will offer historical perspectives, as well as personal recollections and anecdotes. Dr. Sean Swords (Trinity College, Dublin), author of one of the most complete histories of early radar will participate. Prof. Harold Shipton, who served in the British Royal Air Force during World War II, will moderate. This panel session will complement the Historical Exhibit located in Room 263 of the Convention Center.

Millimeter-Wave Integrated Circuits

Sponsor: MTT-6, Microwave and Millimeter-Wave Integrated Circuits
Date: Thursday, June 6, 1985, 3:00 pm to 5:00 pm
Location: Cervantes Convention Center, Room 276
Organizer: Dr. James C. Wiltse
Georgia Tech Research Institute, Atlanta, GA
Moderator: Dr. James C. Wiltse
Panelists: Dr. Barry Spielman, Naval Research Laboratory
Dr. Tom Midford, Hughes Aircraft EED
Dr. Joseph McClintock, Martin Marietta
Dr. Roger Sudbury, MIT Lincoln Laboratory
Dr. Kai Chang, TRW

Abstract

This session will consider the state-of-the-art progress in the advancement of materials, components, and devices for integrated subsystems at millimeter wavelengths.

WORKSHOPS

Phased Arrays for Hyperthermia Treatment of Cancer

Sponsor: MTT-10, Technical Committee on Biological Effects and Medical Applications
Date: Monday, June 3, 1985, 8:30 am to 5:00 pm

Location: Cervantes Convention Center, Room 122
Organizer: Dr. James C. Lin
Department of Bioengineering
University of Illinois at Chicago
Box 4348
Chicago, IL 60680
(312) 996-2331

Abstract

Hyperthermia has been shown to be effective in treatment of superficial tumors, especially when combined with chemo- and radio-therapy. Its use in combating deep-seated tumors has been restricted by problems associated with noninvasive heating of deep tumors. Recent calculations and experimental measurements indicate the possibility that, with proper choice of applicator parameters, it is possible to produce maximum power deposition inside models of biological tissues. This workshop brings together the leading researchers to discuss the technological advances, difficulties and solutions.

Modern Microwave Oscillator Design Techniques

Sponsor: MTT-6, Technical Committee on Microwave and Millimeter-Wave Integrated Circuits
Date: Friday, June 7, 1985, 8:30 am to 5:00 pm
Location: Cervantes Convention Center, Room 260
Organizer: Edward C. Niehenke
Westinghouse Electric Corporation
P.O. Box 746, MS-339
Baltimore, MD 21203
(301) 765-4573

Abstract

Developments in material and active device technology combined with requirements for sophisticated frequency generation have paved the way for advances in oscillator design techniques, circuits, and performance. This workshop will focus on oscillator synthesis and stabilization, electrical tuning, noise reduction and efficiency enhancement. The discussion will be extended to include application of these concepts to microwave frequency synthesizers.

Automated RF Techniques (25TH CONFERENCE)

Sponsor: The Automatic RF Techniques Group in affiliation with MTT-12
Date: Thursday and Friday, June 6 & 7, 1985
Location: Cervantes Convention Center
Organizer: Robert Nelson
National Bureau of Standards
325 Broadway
Boulder, CO 80303
(303) 497-5736

Abstract

The conference's main topic will be "Automated Active Device Measurements". Papers will be given on recent hardware and software developments in the main topic and other computer-aided RF design and testing topics. Technical exchange will be accomplished by informal twenty minute talks.

Manufacturers who have new equipment/software specifically designed for use in computer-aided design and test are encouraged to present technical papers, and a separate area will be available for demonstration.

ARFTG CONFERENCE SCHEDULE

Thursday, June 6 Cervantes Convention Center

1:00 pm to 5:00 pm Technical Session/ARFTG
Business Meeting — Room 261
6:00 pm to 7:00 pm Cocktail Party — Ballroom Foyer
(Sheraton)
7:00 pm to 10:00 pm ARFTG Banquet — Ballroom West
(Sheraton)

Friday, June 7 Cervantes Convention Center

7:30 am to 8:30 am Continental Breakfast — Room 274
8:30 am to 5:00 pm ARFTG Exhibits — Room 275
8:30 am to 12:00 pm Technical Session — Room 261
12:00 pm to 1:00 pm Lunch — Room 274
1:00 pm to 4:30 pm Technical Session — Room 261

The conference fee includes the ARFTG Banquet, lunch on Thursday and Friday, and continental breakfast on Friday. Spouses of registered delegates are invited to the ARFTG Banquet at no additional cost. A post conference Digest is also included.

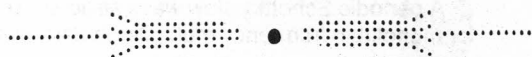
The Hospitality Suite (South Lounge on the ballroom level of the Sheraton), providing refreshments and information on St. Louis, will be available from 8:30 am to 5:00 pm each day. Shuttle buses will continuously circulate among the Symposium hotels and the Convention Center.

WORKING GROUPS

Microwave Procurement Strategies for the Late 80s and 90s

Date: Tuesday, June 4, 1985, Noon to 1:30 pm
Location: Sheraton Hotel, Pierre Laclede Room
Organizer: Frank Walker
Manager, Subcontracts
Sanders Associates, EW Division
95 Canal Street
Nashua, NH 03061
(603) 885-3979

This working lunch is organized to plan a program at the 1986 International Microwave Symposium in Baltimore. It is intended to acquaint microwave engineers, and marketing and sales managers, with the procurement process of large system houses and to provide a forum for procurement and marketing people at the Symposium.



(Continued from page 8)

they get a good deal from IEEE.

3. The expense of publishing transactions exceeds the income of all societies from libraries.

4. Many societies do not have alternate means as does the AP (and MTT) for supporting their transactions and need that income.

SUPPORT CHANGES FOR IEEE GENERAL FUND

The IEEE is evaluating a revision of the current plan for charging Societies on their funds. The revision includes a 20% charge which I and other Division IV presidents support. My opinion is that it was a reasonable way for Societies with comfortable surpluses to support the IEEE. Otherwise, the IEEE would have to raise membership dues. Under the current plan, the following earnings resulted for the period from 10/83 through 9/84:

- IEEE earned	\$1.22 M	
- IEEE returned to societies	.82M	67%
- IEEE retained	.40M	33%

Thus the IEEE is currently receiving 33% for handling societies funds. Over 50% of all funds invested and handled are IEEE funds. Other comments were:

- The stated purpose is to support IEEE HQ financial investment staff.
- Many voices were heard that plan penalizes those societies that do well and saved their funds.
- Many voices were heard that the IEEE needs the financial support.
- The Computer Society takes the view that it would tax them on their separate investments not handled by the IEEE.

THE IEEE POLICY FOR LATE WITHDRAWAL OF SYMPOSIUM DIGEST PAPERS

In a reversal of a prior vote, the TAB approved a proposed policy for charging the costs for excising paper from digests. When a company or agency of the Department of Defense changes its mind and asks that the paper be withdrawn. This has happened twice at MTT symposiums. Each time the symposium chairman had to assemble crews and physically cut a paper from the digest. Fortunately, there were no other author's paper printed on a reverse page. In each case a company or DoD agency decided the paper really should have been classified Confidential or Secret. After printing and delivery of Digest, they requested that the paper be cut out. In each of these cases the company paid the expense. Now, however, the IEEE may have an explicit policy to guide the symposia chairman in future situations. The proposed policy will now go to the IEEE BoD for its approval before it can become an official IEEE policy.

A NEW IEEE MAGAZINE ENTITLED "DIELECTRICS"

The Dielectrics and Electrical Insulation Society received TAB approval to start a new IEEE magazine on dielectrics. Many MTT members have more than a passing interest in dielectrics and will be interested in subscribing. Keep your eyes open for it when you receive your 1986 IEEE dues. The subscription notice will come next September. For promotional purpose, the DEI-S will offer it free as an audited, controlled circulation magazine during the first year.

NOMINATION OF FELLOW CANDIDATES

Richard K. Moore, Chairman of the IEEE Fellow Committee, presented an indepth discussion of their evaluation procedures (except for weights in evaluation formula). One very interesting point was that the candidate is more likely to be elected if his candidacy is evaluated by one society. That strongly supports his award. Listing a second society that can only weaken the candidate chances. Those of you planning to nominate one of your associates in the future might keep that in mind.

1985 IEEE MICROWAVE AND MILLIMETER-WAVE MONOLITHIC CIRCUITS SYMPOSIUM



by William R. Wisseman
Chairman,
Steering Committee

The 1985 IEEE Microwave and Millimeter-Wave Monolithic Circuits Symposium will be held at the Cervantes Convention Center, St. Louis, MO, on June 3 and 4, 1985. The Symposium Headquarters will be in the adjacent Sheraton St. Louis Hotel. Other nearby hotels will be used to satisfy your housing needs. Shuttle bus service will be provided between the hotels and the Cervantes Convention Center. A reception for all attendees and their spouses will be held at the Convention Center on Sunday evening, June 2.

A total of twenty-three papers will be presented at the Symposium. The first session, Monday morning, June 3, will follow a continental breakfast open to all attendees. This session includes eight papers on switching and control circuits. The afternoon session includes eight papers on microwave amplifiers. On Tuesday, June 4, the technical sessions will be held jointly with the 1985 IEEE MTT-S International Microwave Symposium. The morning session, which follows the MTT-S Plenary session, includes four papers on receiver circuits. The afternoon session includes four papers on millimeter-wave circuits.

The Technical Program Committee has done an excellent job in putting together a very strong program that is indicative of the rapid advances in monolithic technology. You are invited to participate.

Registration hours will be 5:00 p.m. to 9:00 p.m. on Sunday, June 2, 1985 and 7:30 a.m. to 12:00 noon and 1:30 p.m. to 9:30 p.m. on Monday, June 3, 1985. Registration will be done in the lobby of the Cervantes Convention Center. On Sunday June 2, 1985 there will be a wine and cheese reception at Atrium Foyer of the Cervantes Convention Center between 7:00 p.m. and 10:00 p.m. The Symposium program is as follows:

TECHNICAL PROGRAM

All the technical session will be held at the Convention Center, Room 120

Monday, June 3

I. SWITCHING AND CONTROL CIRCUITS

Chairman: A. Podell, Pacific Monolithics, Inc., Palo Alto, CA

Co-Chairman: D. Hornbuckle, Hewlett Packard Company, Santa Rosa, CA

8:45 am Welcome — W. R. Wisseman, Symposium Steering Committee Chairman

R. W. Sudbury, Technical Program Committee Chairman

10:30 am Chairman's Introduction

9:10 am "Monolithic GaAs Dual Gate FET Variable Power Amplifier Module,"

P. Saunier, H. Q. Tserng, B. Kim, and G. H. Westphal, Texas Instruments, Inc., Dallas, Texas 75265.

A four stage dual-gate FET variable power amplifier was developed and 21 dB gain and 500 mW output power were achieved at 18 GHz.

9:30 am "30 GHz 3-bit Monolithic Phase Shifters,"

P. Bauhahn, C. Butler, V. Sokolov, and A. Contolatis, Honeywell Corp., Bloomington, MN 55420.

A 30 GHz, 3-bit monolithic switched-line phase shifter with 2 dB/bit insertion loss will be presented.

9:50 am "C-Band 6-Bit GaAs Monolithic Phase Shifters,"

C. Andricos, I. Bahl, and E. Griffin, ITT Gilfillan, Van Nuys, CA 91409.

A 6-bit monolithic phase shifter with 1.6 dB/bit insertion loss is described.

10:10 am "A Novel MMIC X-Band Phase Shifters,"

K. Wilson, J. M. C. Nicholas, and G. McDermott, GEC Research Laboratories, Wembley, UK.

A MMIC X-Band phase shifter consisting of diodes and switched delay lines was developed.

10:30 am COFFEE BREAK

11:00 am "Nonlinear Slow-Wave Propagation on Schottky Coplanar Lines,"

D. Jager, University Munster, Munster, Germany.

A periodic Schottky slow wave structure useful for monolithic frequency multiplier is described.

11:20 am "A 3-Bit GaAs Analog-To-Digital Converter,"

M. R. Namordi, M. R. O'Connell, and P. F. Newman, Raytheon Company, Lexington, MA 02173.

A 3-bit GaAs A/D converter with parallel architecture and latched comparators will be presented.

11:40 am "A 2 Gb/S Throughput GaAs Digital Time Switch using LSCFL,"

T. Takada, Y. Shimazu, K. Yamasaki, M. Togashi, K. Hoshikawa, and M. Iida, NTT, Atsugi, Japan.

Development of GaAs 4 channel digital time switch consisting of 1176 devices with 0.55 um gate, low power source coupled FET logic capable of 2 Gb/S throughput is presented.

II. MICROWAVE AMPLIFIERS

Chairman: W. H. Perkins, General Electric Co., Syracuse, NY

Co-Chairman: D. R. Ch'en, Microwave Monolithics, Inc., Thousand Oaks, CA

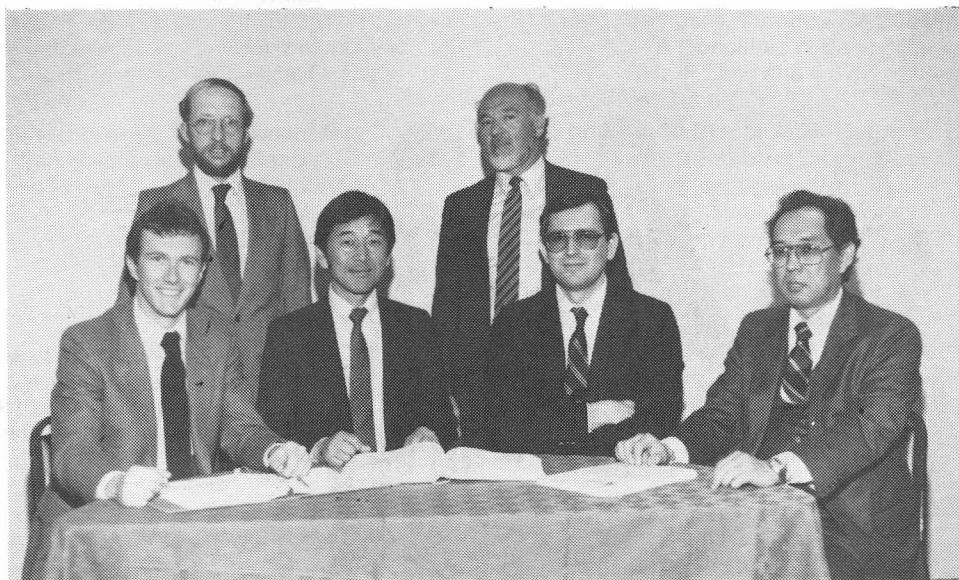


(Continued from page 29)

1985 IEEE MICROWAVE AND MILLIMETER WAVE MONOLITHIC CIRCUITS STEERING COMMITTEE



Standing (l-r): V.G. Gelnovatch, B.E. Spielman, R.W. Sudbury. Seated (l-r): M. Cohn, W.R. Wisse-
man, M.N. Yoder, D.R. Ch'en.



Standing (l-r): D.P. Hornbuckle, O. Pitzalis. Seated (l-r): R.J. Gilmore, H.J. Kuno, Y. Ayasli, R.S.
Kagiwada

1985 IEEE MICROWAVE AND MILLIMETER WAVE MONOLITHIC CIRCUITS TECHNICAL PROGRAM COMMITTEE



Standing (l-r): R.S. Kagiwada, V.K. Nair, D.P. Hornbuckle. Seated (l-r): W.R. Wisseman, Z.J. Lemnios, R.J. Gilmore. B.E. Spielman.



Standing (l-r): M.N. Yoder, A. Chu, C. Huang. Seated (l-r): D. Ch'en, Y. Ayasli, A. Podell, C. Chao.



Standing (l-r): W.H. Perkins, R.A. Gilson, P.T. Greiling, H.J. Kuno. Seated (l-r): M. Cohn, R.W. Sudbury, O. Pitzalis, V.G. Gelinovatch.

(Continued from page 26)

1:30 pm Chairman's Introduction

1:40 pm "A 2-Watt Ku-Band Monolithic GaAs FET Amplifier,"

H. M. Macksey, H. Q. Tserng, and H. D. Shih, Texas Instruments, Inc., Dallas, TX 75265.

A 3-stage, 16 GHz monolithic GaAs FET amplifier producing 2 Watt power output with 12 dB gain and 20% efficiency is described.

2:00 pm "A Ka-Band GaAs Power MMIC,"

M. Kobiki, Y. Mitsui, Y. Sasaki, M. Komaru, K. Seino and T. Takagi, Mitsubishi Electric Corp., Itami, Hyogo, Japan.

A Ka-Band GaAs MMIC power amplifier producing 1 Watt output power with 3 dB gain over 27-28.5 GHz band will be presented.

2:20 pm "High Power Distributed Amplifier using MBE Synthesized Material,"

B. Kim, H. Q. Tserng, H. D. Shih, Texas Instruments, Inc., Dallas, TX 75265.

A distributed power amplifier is described which used dual layer MBE material with an output power of 800 mW and 4dB gain over the 2-20 GHz frequency.

2:40 pm "A Miniaturized 6.5-16 GHz Monolithic Power Amplifier Module,"

S. D. Bingham, S. D. McCarter, and A. M. Pavio, Texas Instruments, Inc., Dallas TX 75265.

A production design of a 6.5-16 GHz power amplifier module consisting of a two stage small signal feedback amplifier and a cascaded large signal driver and output amplifier will be described.

3:00 pm COFFEE BREAK

3:30 pm "Design and Process Sensitivity of a Two-Stage 6-18 GHz Monolithic Feedback Amplifier,"

J. M. Beall, S. R. Nelson, and R. E. Williams, Texas Instruments, Inc., Dallas, TX 75265.

The design of a two-stage 6-18 GHz monolithic amplifier is described along with critical FET and process parameters.

3:50 pm "Production Technology Development for High Yield, High Performance X-Band Monolithic Power and Low Noise Amplifiers,"

C. D. Chang, S. K. Wang, L. C. T. Lim, M. Siracusa, H. Yamasaki, and J. M. Schellenberg, Hughes Aircraft Company, Torrance, CA 90509.

Monolithic X-Band power and low noise amplifiers fabricated with high yield production technology will be described.

4:10 pm "Power Saturation Characteristics of High Electron Mobility Transistors,"

A. K. Gupta, R. T. Chen, E. A. Sovero, and J. A. Higgins, Rockwell International, Thousand Oaks, CA

MBE grown High Electron Mobility Transistors (HEMTs) have achieved 530 mW/mm at 10 GHz at 1 dB gain compression.

Tuesday, June 4

III. MONOLITHIC RECEIVER CIRCUITS

Chairman: C. Huang, Anadigics, Morristown, NJ

Co-Chairman: R. Kagiwada, TRW, Inc., Redondo Beach, CA

10:30 am Chairman's Introduction

10:40 am "X-Band Monolithic Series Feedback LNA,"

R. E. Lehmann and D. D. Heston, Texas Instruments, Inc., Dallas, TX 75266.

An X-Band monolithic 3-stage low noise amplifier with series feedback has demonstrated 2.1 dB noise figure with 28 dB gain and input VSWR less than 1.5:1.

11:00 am "0.5-2.6 GHz Si-Monolithic Wideband Amplifier,"

T. Nakata, S. Miyazaki and K. Shirotori, NEC Corporation, Kawasaki, Kanagawa, Japan.

A monolithic silicon 0.5-2.6 GHz amplifier with 23 dB gain and 6 dB noise figure was developed.

11:20 am "A GaAs Double-Balanced Dual-Gate FET Mixer IC for UHF Receiver Front End Applications,"

K. Kanazawa, M. Kazumura, G. Kano, and I. Teramoto, Matsushita Electric Corp., Osaka, Japan.

A double-balanced dual-gate FET mixer was developed for UHF receivers.

11:40 am "Air Bridge Gate FET for GaAs Monolithic Circuits,"

E. M. Bastida and G. P. Doinzelli, CISE SpA, Milan Italy.

A new, high-yield mass production technique for monolithic DBS mixer front end is described.

IV. MONOLITHIC MILLIMETER-WAVE CIRCUITS

Chairman: H. J. Kuno, Hughes Aircraft Company, Torrance, CA

Co-Chairman: A. Chu, M/A COM, Lowell, MA

1:30 pm Chairman's Introduction

1:40 pm "A W-Band Monolithic Balanced Mixer,"

L. T. Yuan and P. G. Asher, Hughes Aircraft Company, Torrance, CA 90509.

A monolithic W-Band balanced mixer with 8-18 GHz IF band and 4.6 dB conversion loss was developed.

2:00 pm "A 30 GHz Monolithic Single Balanced Mixer with Integrated Dipole Receiving Element,"

S. J. Nightingale, M. A. G. Upton, U. S. Mishra, S. M. Palmateer, and P. M. Smith, General Electric Company, Syracuse, NY 13221.

A 30 GHz monolithic balanced mixer with an integral "bow-tie" antenna/WG transistor and Mott diodes is described.

2:20 pm "Dual Function Mixer Circuit for Millimeter-Wave Transceiver Applications,"

A. Chu, W. E. Courtney, L. J. Mohoney, M. J. Monfra, and R. Calawa, MIT Lincoln Lab, Lexington, MA 02173.

A mixer circuit is presented which can be used as a transmitter or receiver by means of switching the bias applied to the diodes.

2:40 pm "High Efficiency Millimeter-Wave Monolithic IMPATT Oscillators,"

B. Bayraktaroglu and H. D. Shih, Texas Instruments, Inc., Dallas, TX 75265.

Monolithic IMPATT oscillators with 1.25 W. output power and 27% efficiency at 33 GHz have been developed.

MEMBERSHIP SERVICES



by E.C. Niehenke
Membership
Services Chairman

FINANCIAL ASSISTANCE AVAILABLE TO MTT-S CHAPTERS

To provide better services to MTT-S membership, the MTT-S ADCOM has again approved financial assistance to all active MTT-S Chapters in 1985 to subsidize Chapter activities. The Chapters play a key role in serving the membership by providing technical meetings, lecture series, one-day symposia, tours, and social events. Up to \$350 in 1985 can be used by each Chapter to enhance the Chapter's program. This amount was increased from the previous \$300. Eighteen Chapters made good use of this assistance in 1984. Chapters should prepare a letter requesting a specific amount describing how the Chapter plans to use the money. Address the letter to:

E.C. Niehenke
Westinghouse Electric Corporation
P.O. Box 746, MS 339
Baltimore, MD 21203
(301) 765-4573

Two New MTT-S Chapters Formed

San Fernando Valley of the Los Angeles Council and West Germany have formed new MTT-S Chapters. Welcome to MTT-S. The new chapter chairmen are listed below:

San Fernando Valley	Harry Pomeranz
West Germany	Nigel J. Keen

The West Germany Chapter's formation process was quite lengthy and Nigel Keen is to be commended for his patience. This brings the total number of MTT-S Chapters to 44 to serve the MTT-S membership. The MTT-S membership is at an all-time high of 7754 as of January 31, 1985, increasing 9.4 percent over the previous 12 months.

Distinguished Microwave Lecturers

1984/85

Dr. Paul Greiling ("Highspeed Digital IC Performance Outlook") and Dr. Sander Weinreb ("Radio Astronomy — A Challenge to the Microwave Engineer") the 1984/85 Distinguished Microwave Lecturers, have received 90 requests and have presented to

date 43 lecturers to MTT-S Chapters, IEEE Sections, Student Chapters, and universities throughout the world. The lecturers have been well received by the various groups they visited. The Microwave Theory and Techniques Society is pleased to provide this service to its members and is deeply appreciative of these men for their superb service and outstanding presentations.

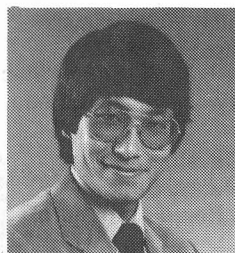
Distinguished Microwave Lecturer

1985/86

The 1985/86 Distinguished Microwave Lecturer, Mr. Kenneth Carr, is busy preparing his lecture, "The Application of Microwave Technology to the Detection and Treatment of Cancer," for presentation starting this fall. Mr. Carr has done pioneering work in this field and his lecture will be of utmost interest to all. Mr. Carr is encouraging attendance by spouses and is planning to tailor his lecture to the backgrounds and interests of various audiences. MTT-S Chapters, IEEE Sections, and Student Chapters should make requests now for Mr. Carr by contacting him as follows:

Mr. Kenneth Carr
M/A-COM, Inc.
South Avenue
Burlington, MA 01803
(617) 272-3000, Ext. 1650

FEEDBACK



by Kurtis L. Kurisu

The MTT-S Newsletter editorial staff solicits responsible opinions and feedback from MTT-S members regarding topics of interest and importance to our members. This "Feedback" column is designed to respond to readers' comments by providing a forum in which we can share our thoughts regarding pertinent and current issues. The MTT-S International Microwave Symposium is just around the corner. Perhaps some of you would like to share with us your fulfilled or unfulfilled expectations regarding this important event? This is your opportunity to be heard!

If you have an opinion you would like to express in this column, please contact the feedback editor, Kurt Kurisu, TRW, One Space Park, Redondo Beach, California 90278.

DIVISION IV DIRECTOR'S REPORT MARCH 1985



by Kiyo Tomiyasu

The support given by the MTT Society to elect me Director of Division IV for 1985 and 1986 is deeply appreciated. Due to my long association with microwave activities I am rather familiar with the history and evolution of the MTT Society. As your new Director, I welcome any opportunity to support your interests at the TAB and IEEE levels.

As some of you probably know, the 1985 IEEE Medal of Honor will be awarded to Professor John R. Whinnery of the University of California at Berkeley. In 1977 Prof. Whinnery received the Microwave Career Award from MTT Society in San Diego. The Medal of Honor is the most prestigious award within the Institute. The award consists of a gold medal, bronze replica and an honorarium of \$10,000. The award is given for a particular contribution which forms a clearly exceptional addition to the science and technology of concern to the Institute. The award shall normally be given within a few years after the recognition of the exceptional nature of such contribution. The citation for Prof. Whinnery's award reads, "for seminal contribution to the understanding and application of electromagnetic fields and waves to microwave, laser, and optical devices." The medal will be presented to Prof. Whinnery at a special IEEE awards ceremony in Philadelphia on June 2.

The IEEE Board of Directors announced that 17 members of MTT Society were elected to the Fellow Grade effective January 1, 1985. Some of these individuals will request that their Certificates be presented to them at the MTT Banquet in St. Louis on June 4. Congratulations to these MTT members.

Last October I had the opportunity and privilege to attend the IEEE Centennial Convocation held in Philadelphia. There were many papers presented having historical significance. There was a paper by Prof. John G. Linvill of Stanford University who gave his perspective on electrical and computer engineering education

as the IEEE enters its second century. It was his opinion that the average age of this faculty increased by one year, annually. Further, many graduates enter other fields and thus, are lost to the profession. In order to perpetuate the MTT Society and the microwave profession, I would suggest that the MTT Society consider the possibility of establishing two new awards. One award would be for a **young** engineer making a significant contribution to the microwave profession. The second award would be for a **young** educator who has shown pedagogical skills, presented an important paper at a MTT Symposium and published a meritorious paper in the MTT TRANSACTIONS.

One of my early functions as Director was the appointment of many representatives to various TAB Committees and other IEEE Boards. Those representatives appointed for 1985 who are MTT Society members are:

Name & Committee:

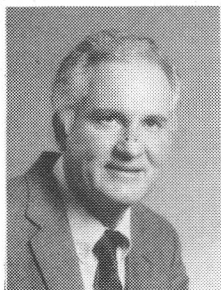
Dr. Don Parker; TAB Awards and Recognition
Dr. Reinhard H. Knerr; TAB Periodicals
Mr. Richard A. Sparks; TAB Transnational Relations
Dr. John Osepchuk; Social Implications of Technology Society
Mr. Robert B. Hicks; Educational Activities Board, Corresponding Member
Prof. Saul W. Rosenthal; USAB Committee on Man and Radiation
Mr. Helmet E. Schrank; USAB Professional Activities Committee for Engineers
Prof. J. Leon Shohet; USAB Research and Development Committee
Dr. Arthur R. Sindoris; USAB U.S. Technology Policy Committee

The IEEE Board of Directors plans to examine and review the structure of the Institute and its operation for the purpose of determining its effectiveness in serving its membership. We are looking forward to the improvements within the Institute under the leadership of IEEE President Charles A. Eldon.



St Louis Missouri

SPECIAL ARTICLES SOLICITED FOR THE MTT NEWSLETTER



by J.B. Horton

Recently, the MTT Newsletter staff began a new feature for the Newsletter, publication of special articles dealing with current topics in the technical and professional areas of interest to MTT Members.

I would like to emphasize that these special articles will cover topics in a broad, general sense. The idea is to provide the members with a general understanding of the topic and its significance in current and future activities in the microwave field. Specific design techniques and applications will be covered in papers appearing at the MTT symposia and in the Transactions.

If you know of a topic that is current and you are willing to contribute an article to the Newsletter, please contact John Horton (213/535-8491) or Reynold Kagiwada (213/536/2402) at TRW, One Space Park, Redondo Beach, CA. 90278.

The feature article for this issue focuses on a unique application of microwave technology where current technology is certainly welcome and is applied quite readily, but only if the application is truly cost effective. The small radar industry has been well established for many years and its products, the navigation radar, weather radar, and radio altimeter, are used extensively in aircraft and missile applications. Our feature author, Gerald Schaffner, provides us with a first hand view of the technology involved in the small radar industry and some of the concerns an engineer in this field has, particularly the application of new microwave technology. This article provides an overview of a mature industry that uses and continues to apply microwave technology, but with a major design consideration for new technology applications, product cost.

AIRCRAFT SMALL RADARS



by Gerald Schaffner
Teledyne Ryan Electronics
San Diego, CA.

For nearly 30 years, microwave technology and aircraft radar were nearly synonymous. Helped by the impetus of this relationship, the microwave industry has been able to grow beyond the aircraft application into such diverse fields as communications, food and chemical processing and many forms of transportation control. Even with this growth to other fields, much remains to be done for aircraft with small radars. This in itself should provide a challenge to the microwave community for years to come. This paper reviews both the microwave accomplishments and future prospects for small radars used in aircraft.

The principal subject of this paper is small solid state radars, specifically those used mainly for aircraft navigation and identification. Brief mention will be made of other aircraft applications, but the general topic of airborne radar is too extensive for this paper (see references).

The number of functions radar performs in aircraft is indeed impressive. These include the following for both military and commercial aircraft:

1. Velocity sensing and navigation in military helicopters, ASW (anti-submarine) planes, military cargo planes, strategic bombers, and geophysical survey planes;
2. Altitude sensing for almost all military aircraft and commercial airliners;
3. Landing aides for the larger military and commercial aircraft;
4. Weather sensing for commercial airliners;
5. Remote resource sensing usually for small aircraft used in surveying or monitoring soil condition;
6. Terrain following and terrain avoidance for low flying aircraft as diverse as small helicopters and the B1 bomber;
7. Surveillance and tracking for military aircraft used in combat;
8. Target illumination and fire control in air to air, air to ground, and air to sea situations involving military fighter planes.

Many of these functions are accomplished in large multifunction radars. These usually require many kilowatts of power from a tube or complex phased array. The need for this power can be seen from the search radar example given in the next section. However, the

small solid state radar offers a viable, inexpensive alternative for many of these functions. The following examples are typical of these applications.

Transmitter Power Requirements

In this section, power will be calculated for two typical radar designs to determine whether a small, solid state radar can be used. The first is for a search radar in which the required power is too high to be achieved in a small system. The second design for Doppler Radar, on the other hand, shows that a small radar is practical.

Starting with the Search Radar, power is calculated from the basic range equation:

$$PT = \frac{(4\pi)^3 SMIN R^4}{G^2 \lambda^2 \sigma} \quad (1)$$

where PT = radar power in Watts

SMIN = minimum detectable signal in Watts

R = range in meters

G = antenna gain

λ = wavelength in meters

σ = target reflectivity in square meters (about 20 square meters for a small aircraft and 80 square meters for a mid-sized aircraft.)

Power needed to detect a typical mid-sized aircraft is obtained by substituting the following values in the range equation:

SMIN = -126 dBW (based on a 10 MHz bandwidth, 6 dB noise figure, and 2 dB losses.; SMIN = -204 (kT/Hz) + 70 (10 MHz) + 6 + 2 = -126 dBW)

R = 64,374 meters (20 miles)

G = 27.5 dB, typical for a 2 foot parabolic dish

λ = .032 meters for 9375 MHz, a common radar frequency

Then PT = $30 \log (4\pi) + 10 \log (SMIN) + 40 \log (R) - 20 \log (G) - 20 \log (\lambda) - 10 \log (\sigma) = 55.2 \text{ dBW. or } 331 \text{ kilowatts.}$

This is not a small solid state application although it might be achievable with a complex assembly of solid state amplifiers.^{1 2}

It is important to realize that several of the above terms are quite complex in nature. Furthermore, they can be manipulated by the system designer in various ways. For example, SMIN is a function of IF bandwidth, which is a strong function of the type of modulation used in the radar. Gain, G, can also be increased by using a larger antenna; however, this is often undesirable for aircraft. The term σ is quite variable depending on the target size. All these topics are discussed extensively in the literature (references).

In the Doppler Radar application, the earth intercepts the entire beam, and the radar range becomes a

function of R^2 . In this case, target size is increased by a factor of four for the same power. Therefore, power required is less. The range equation becomes approximately:

$$PT = \frac{(4\pi)^3 SMIN R^2}{GT GR \lambda^2 \beta \eta_0^{\sigma} \cos \theta} \quad (2)$$

and the general parameters are changed to:

where GT = the transmit antenna gain-assumed to be 28 dB

GR = the receive antenna gain-assumed to be 28 dB

β = E-plane 2 way 3 dB beamwidth = .038rad. = 14.2 dB

η = H-plane 2 way 3 dB beamwidth = .068rad. = -11.7 dB

σ_0 = ground back scattering cross-section = -35 dB

θ = the incident angle of antenna to ground = 15°

λ = .0225 meters for 13.3 GHz

R = 24384 meters (80,000 feet)

SMIN = -157 dBW for a 1260 Hz Doppler Tracker bandwidth, 11 dB noise figure, and 5 dB losses.

Then PT calculates to be 1.7 dBW or 1.5 W, which is in the solid state power oscillator or amplifier range. Although somewhat arbitrary, up to about 10 W transmitted power can be considered in the small radar range at X-band or higher. If one operates at L-band with today's transistor technology, 1000W could still be considered in the small radar range. For S-band, the limit can be about 100 W and for C-band about 20W.

The following sections will be devoted to four solid state radar applications: Doppler Radar, Altimeters, Weather Radar, and Radar Beacons.

Doppler Radar For Navigation

One of the most important navigation radars aboard an aircraft is the Doppler Velocity Sensor. This instrument can accurately measure three-dimensional velocity of the moving aircraft without reference to any outside equipment. Such a capability is important in several situations. For one, independent navigation is possible when coupled to direction indicating devices like a compass. This technique is used on helicopters. Another application is initialization of slower reacting inertial navigation sensors on large transports or bombers. After initialization, the two navigation systems work cooperatively. The Doppler is also an excellent detector of helicopter hovering altitude which is important in anti-submarine applications. The application possibilities extend well beyond these examples to such things as spacecraft landing aides, wind determining sensors for airlines and for the future: aids to Satellite Navigation.

Most all present day Doppler Radars are solid state systems operating in the 13 GHz frequency region. They all use some form of CW system, e.g., pure CW, interrupted CW, FM-CW, or frequency-shift-keyed. Let's discuss microwave front-end designs of some of these systems.

Examples of pure CW systems include the Teledyne Ryan Electronics APN 217 used on the US Navy LAMPS Helicopter and the APN 218 which is the U.S. Air Force Common Strategic Doppler Radar.^{3 4} A block diagram of the microwave portions of the APN 218 is shown in Fig. 1. The radar transmits four beams of 13.3 GHz energy which strike the ground, are Doppler shifted, and sent back to the receiver. The received signals beat with a portion of the transmitted signal to extract the Doppler frequencies in the IF amplifiers. Figure 1 illustrates the inherent simplicity of the pure CW radar. Only one microwave power source is needed, since the mixer local oscillator signal is derived from the transmitter. A typical system installation is shown in Fig. 2. The radar is mounted on the antenna assembly. The IMPATT oscillator is in the lower left side. The beam switch is just to the right of the oscillator. The stripline mixer assembly is on the upper left side. Typical installation on the underside of a helicopter fuselage is illustrated in Fig. 3. Installations on fixed wing aircraft are similar. A photograph of a helicopter with a Doppler Radar is shown in Fig. 4. Because the Doppler antenna is flush with the fuselage and painted the same color it is difficult to locate when observing an aircraft. Doppler Radar operation is illustrated in Fig. 5. Three dimensional velocities from the radar are output to the aircraft navigational computer. The received signal differs in frequency from the transmitted signal by the Doppler Velocity shift obtained when the antenna beam strikes the stationary ground. In the Doppler system, four antenna beams are transmitted, two fore and two aft. In this way, Doppler is increasing on two beams and decreasing on the other two. In a similar manner, two of the beams are port and two are starboard, which allows plus and minus Doppler in the drift directions. Three dimensional velocity calculations are thus possible. On each individual beam the Doppler frequency shift is given by

$$fd = 2(ft/c) vr \cos \theta \quad (3)$$

where fd = doppler shift in Hz

ft = transmitted frequency in Hz

c = velocity of light = 3×10^8 meters/sec.

vr = velocity of the plane relative to the ground

θ = angle of antenna beam to ground

For a typical example using $ft = 13.3$ GHz, $vr = 100$ meters/sec., and 70 degrees beam angle, fd calculates to be 2964 Hz. Herein lies one of the major technical difficulties with CW Doppler Radars-the IF frequencies are in the audio range. The difficulties deal with broadband and microphonic noise emitted from the transmitter, microphonic and acoustic vibration modulation of

leakage signals from the transmitter to the receiver, and microphonic low frequency noise, especially through the antenna broadband mixer and IF amplifier. Compounding these difficulties is the wide operating temperature range of -55 degrees C to + 71 degrees C for most all airborne radars. If these difficulties can be overcome, as they are with the APN 218, then the inherent efficiency of the CW scheme with no modulation loss can make very high altitude operation possible with low cost one device transmitters. As an example, in the APN 218, with a single 2W IMPATT transmitter, operation at over 60,000 feet altitude is possible. It is interesting to note that in spite of more power and efficiency from a GaAs FET oscillator, the IMPATT is better, since its low frequency $1/f$ noise is about 10 dB lower. This is important since transmitter AM noise is converted directly at the IF frequency. The only help, which is important even for the IMPATT, is the AM rejection in the balanced mixer.

While the CW system is best for range and accuracy, it has some disadvantages for certain applications. For one, two antennas are required to reduce transmitter leakage. Secondly, near zone rejection is not possible since a pure CW system cannot distinguish reflections from near or far targets. The solution is to use some form of modulation. This usually is in the form of a varying frequency CW, which could be FM-CW or a digitally shifted frequency. A typical design used on the Teledyne Ryan APN-233, uses a frequency-shift keyed (FSK) signal. Fig. 6 shows how the transmitter energy is alternatively supplied to the antenna and the mixer. Frequency is shifted 1 MHz synchronous with the switching of the duplexer. The received Doppler shifted signal rides on a 1 MHz carrier. This system can operate to quite a high altitude with only one antenna. It is attractive, therefore, for smaller airplanes, at the cost of some added microwave complexity.

Altimeters

Radar type systems have been measuring aircraft altitude for nearly 50 years.⁵ In the early days, VHF and UHF were used; now almost all altimeters operate from 4.2 to 4.4 GHz. Again, as with Doppler, the earth is the target, and R^2 is used in the range equation. All solid state altimeters are the rule now, operating either in an FM-CW or pulse mode. The radar altimeter is used on military fighters, bombers, transports, remotely piloted vehicles (RPV), commercial transports, and on some general aviation vehicles.

A representative block diagram of an FM-CW system is shown in Fig. 7. The system consists of a varactor modulated transistor oscillator. Portions of this signal are used for the local oscillator and a delayed test signal. Delay is obtained via a bulk acoustic delay line. The FM signal is transmitted via a relatively broad beam low gain antenna. A broad beam is needed to handle aircraft pitch and roll so that the shortest vertical range is in the main antenna beam. A separate antenna for the receiver is needed to keep leakage down. The

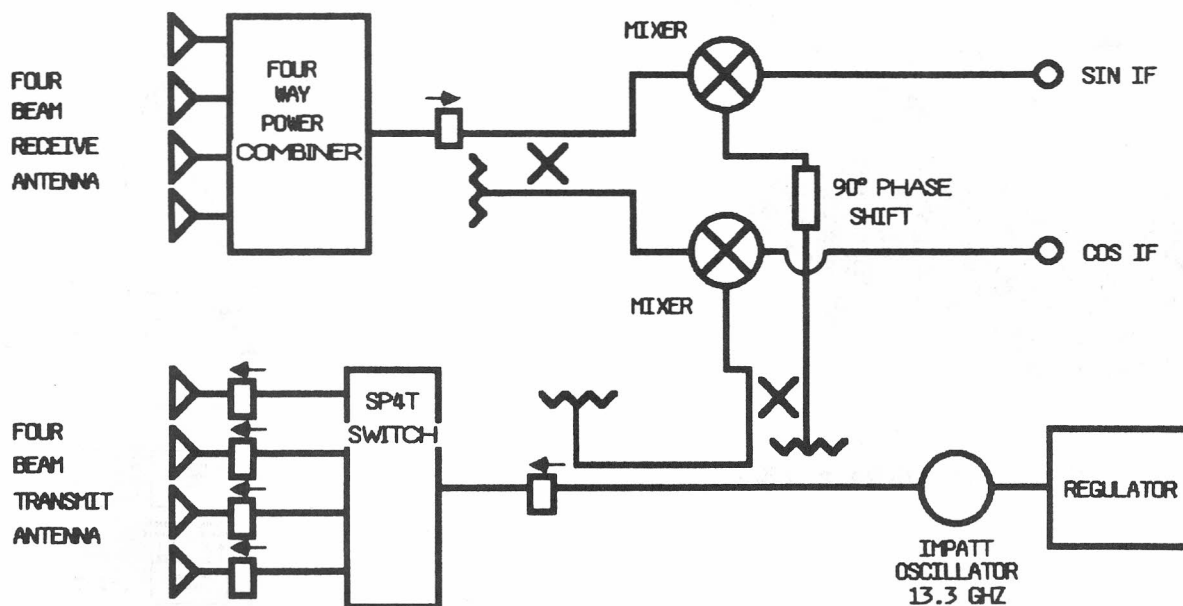


Figure 1 Microwave Portion of APN-218 Strategic-Doppler Radar

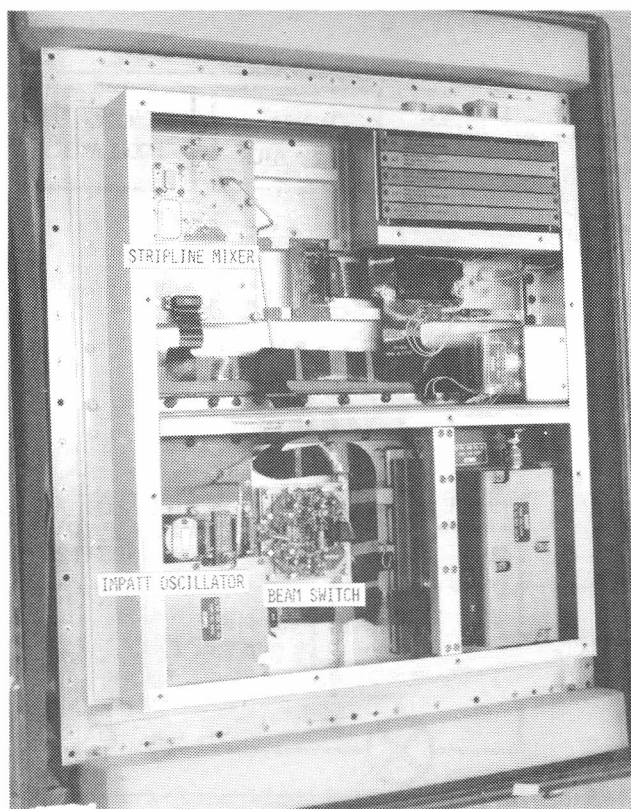


Figure 2 Interior of APN218 Doppler Radar

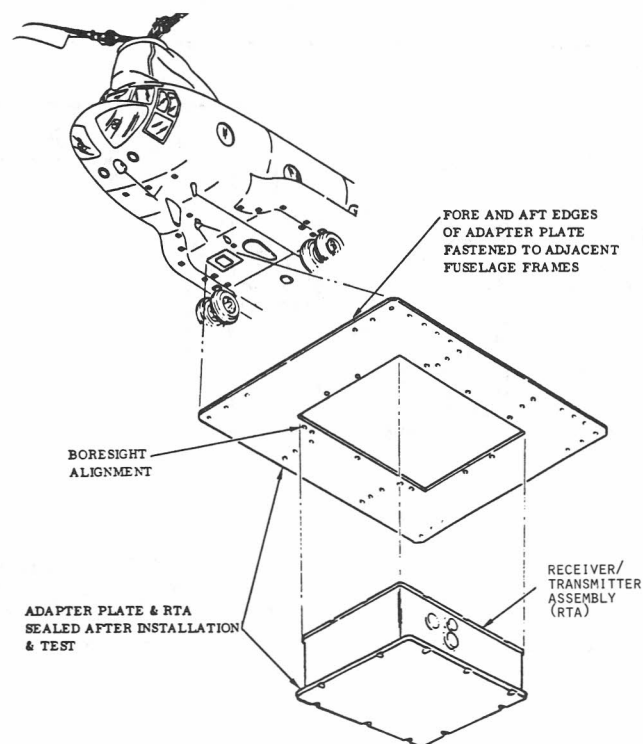


Figure 3 Installation of a Doppler Navigation Radar on a Helicopter



Figure 4 Helicopter With Doppler Radar

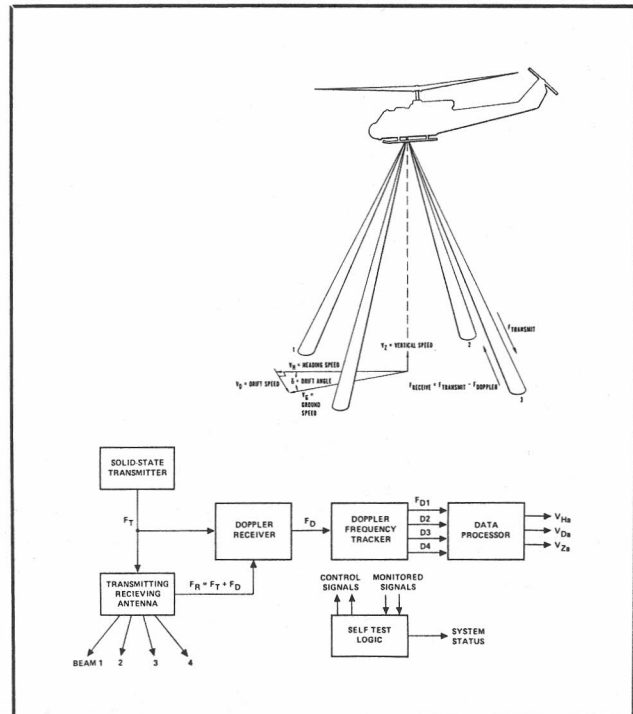


Figure 5 How the Doppler Radar Obtains Aircraft Velocity Data

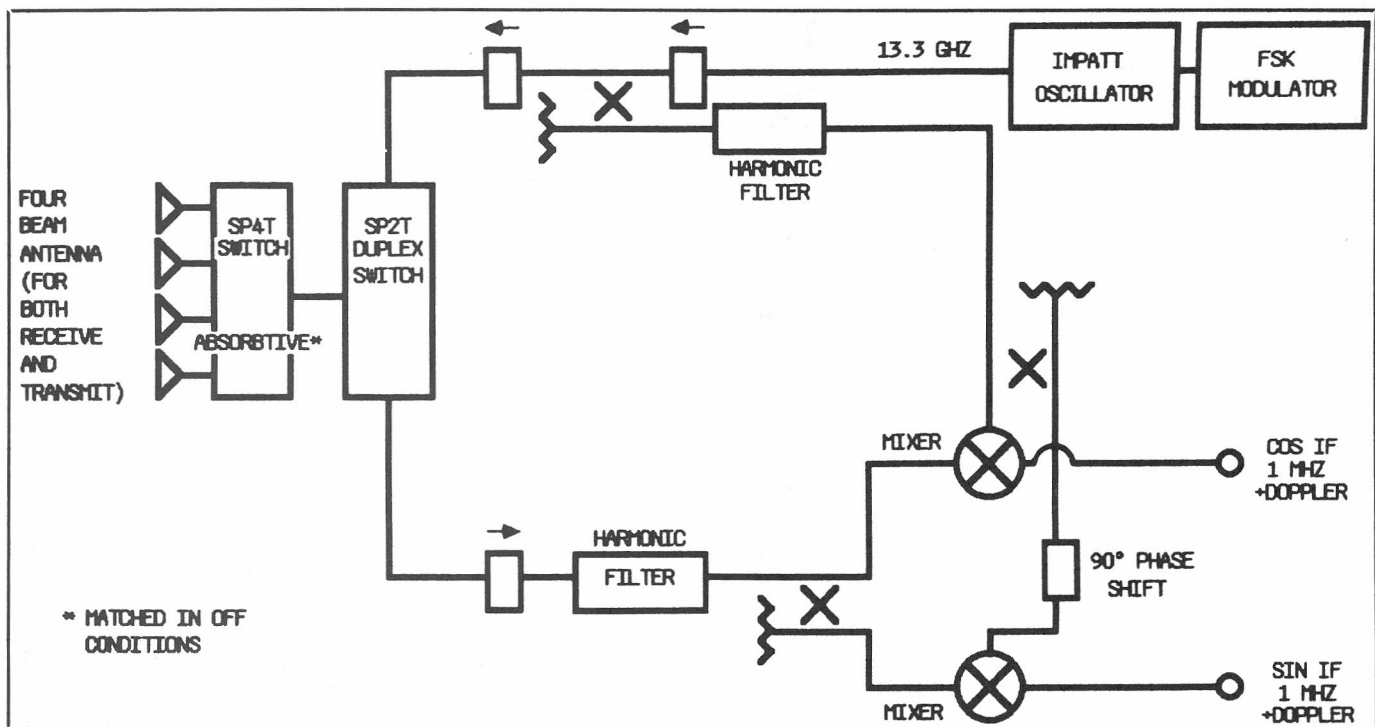
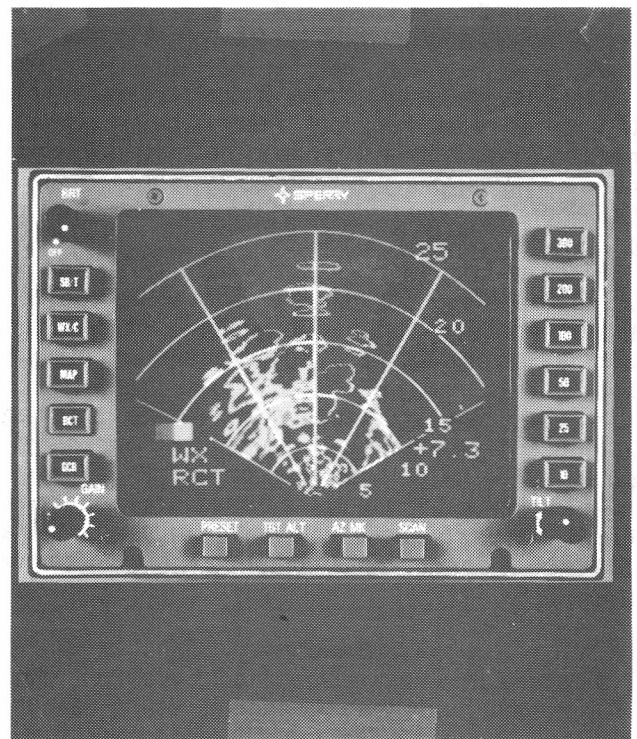
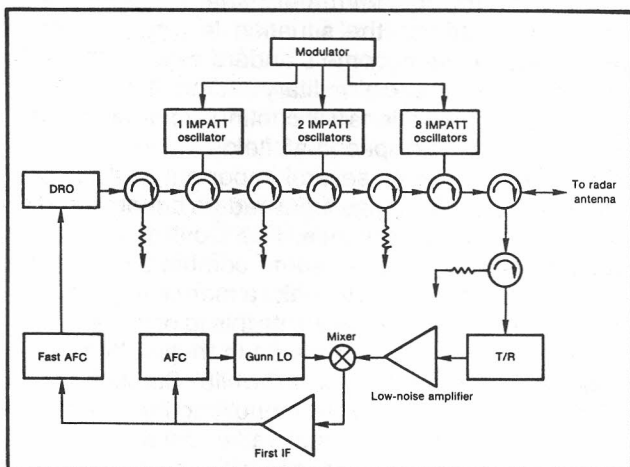
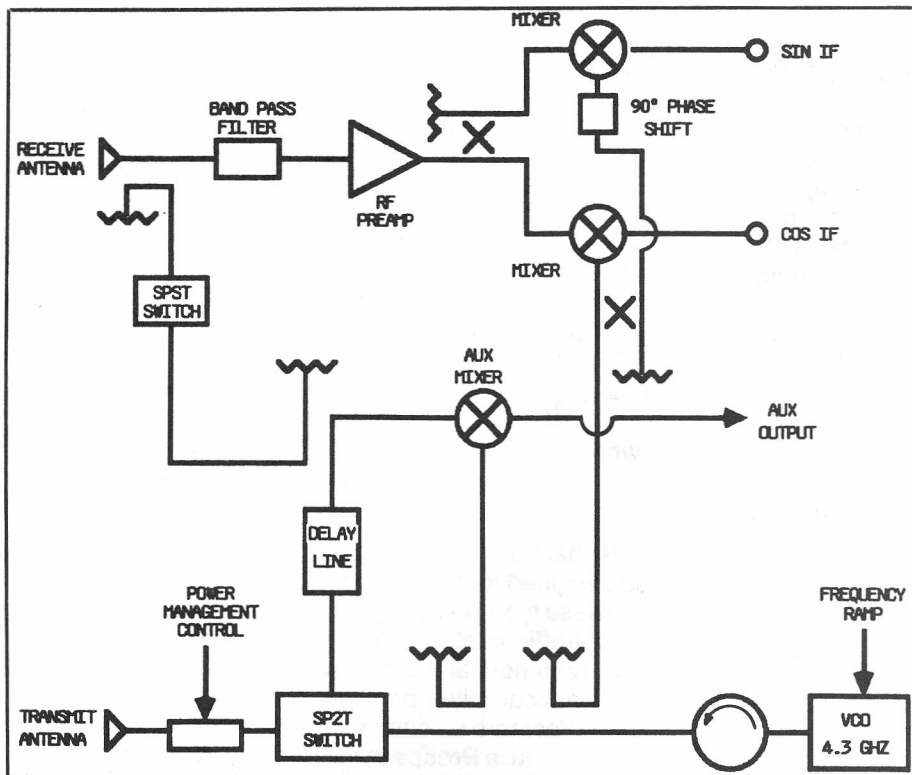


Figure 6 A Typical Doppler Radar With Modulated CW System and Common Transmit/Receive Antenna



receiver itself is relatively simple with a bandpass filter, preamplifier, balanced mixer, and switch to inject the delayed test signal. As shown in Fig. 7, some optional circuitry can be provided to reduce output power on command, and to obtain a delayed auxiliary output which can be used to linearize the frequency ramp.

The received signal is delayed by the round-trip journey to earth at the speed of light. The transmitter is linearly frequency modulated. The difference frequency is a measure of altitude by:

$$R = \frac{cT \text{ fb}}{2\Delta F} \quad (4)$$

where R = range (altitude)

c = velocity of light

T = period of modulation rate

fb = frequency delta between receive and transmit

ΔF = frequency deviation

Radar altimeters are one of the oldest applications of the radar principle and at this writing are still going strong. There is probably no other airborne radar sensor that has such a wide range of applications. Several altimeter systems are described in the literature.^{6 7 8}

Weather Radar

Weather effects almost all radar propagation by the backscattering of radar energy by precipitating particles (raindrops, snow, hail, etc.). This effect is used beneficially in weather radar to help aircraft avoid storm fronts.

The same range principles discussed earlier apply to weather radar. For small weather targets, power needed is proportional to range to the fourth power. For beam-filling targets this reduces to range squared. Consideration must be given to the intervening propagation attenuation, however.

Most weather radars operate from C-band to X-band. These frequencies are a compromise between the antenna high gain and narrow beamwidth at high frequencies and the ability to penetrate rain at lower frequencies.

A new X-band solid state weather radar has been introduced by the Sperry Corporation.⁹ It uses eleven pulsed IMPATT transmitters to generate 100 watts peak power. A block diagram of the transmitter is shown in Fig. 8. Besides the solid state feature, this radar has a color display to distinguish different types of weather (see Fig. 9).

Beacons

Beacons are a unique type of radar. While operating in a different mode than the normal radars, beacons are radar-like in circuitry, the difference being that a second radar is in the complete radar link. A beacon, or radar called an interrogator, which could be ground based, initiates a chain of coded transmissions. These are intercepted by the transponder, usually on the aircraft, and answered by another transmission to be received by the interrogator.¹⁰

Beacon applications began during World War II for IFF (identification friend or foe). The IFF transponders transmit pulsed signals at 1090 MHz in response to interrogations at 1030 MHz. A modern example of such an IFF beacon is the AN/APX 92 made by Teledyne Electronics. Using high power bipolar transistors, this beacon generates 500W of peak power. On the receive side, sensitivity is -77 dBm. Taking the reply link with 500W transmitted, -77 dBm sensitivity (SMIN), zero cable loss (L), and unity gain for both antennas, range calculates to be:

$$R = \frac{\lambda}{(2\pi)} \sqrt{\frac{P_t GTGI}{(SMIN)(L)}} = \frac{0.903}{2\pi(6080)} \sqrt{\frac{500}{2 \times 10^{-11}}} = 120 \text{ nmi} \quad (5)$$

where GT = gain of the transponder antenna

GI = gain of the interrogator antenna

λ = wavelength, = 0.903 feet at 1090 MHz

Note that the interrogator and transponder links should be designed for the same range to be optimum.

These types of transponders have found application in air-traffic control systems, where they are used in both commercial airliners and general aviation. The 120 nautical miles provides adequate separation for aircraft/centers for safe operation.

Future Prospectives For Small Radars

The future appears very solid for these small solid state radars. On the navigation side, they offer inexpensive position location and velocity sensing in a stand-alone fashion. This is especially important in military situations. Even in peacetime their low cost and quick response would be valuable as an accuracy improvement method and backup to the Global Navigation System (GPS). For the altimeter, weather radar, and beacon applications, the situation is similarly good. These radars have become standard systems in most larger commercial and all military aircraft. It is expected that all these applications will continue to grow with the aircraft, missile, and spacecraft fields.

There are, however, several important questions to ponder. For one, will these small radars become part of larger ones like Surveillance, Fire Control, or Terrain Avoidance radars or even some combinations of the small radars themselves to make a more integrated aircraft? The end user always wants this to occur, but until now the sacrifice in performance in these attempts at integration have not been worthwhile. Secondly, how will the impact of microwave monolithic integrated circuits (MMIC) affect these small radars? It appears that the volume of radar applications will have to increase, and/or the development and production cost of the MMICs will have to come down substantially to make economical sense to use this technology in these small radars. Furthermore, since MMICs are based on GaAs FET technology where oscillator 1/f noise is high, their application to zero frequency IF systems poses a problem in sensitivity. For the future, both small radar system's engineers and system manufacturers are faced with some interesting technical challenges but always bound by the ever present cost factor.

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Acknowledgements:

The author wishes to thank the personnel of Sperry Corporation, Teledyne Electronics and Teledyne Ryan Electronics for their contributions to this paper.

BIOGRAPHY

DR. GERALD SCHAFFNER

Dr. Schaffner is presently Senior Group Engineer for Microwaves, Antennas, and Microelectronics at Teledyne Ryan Electronics at San Diego, California. He is responsible for development and design of solid state radar microwave assemblies. He has been affiliated with Teledyne Ryan Electronics since 1969.

From 1963 to 1969 Dr. Schaffner was with the Motorola Semiconductor Division in a variety of positions including Operations Manager for microwave devices. From 1957 to 1962 he was with the Motorola Government Division developing microwave systems. From 1951 to 1957 he was with Stewart Warner, Inc. in charge of R. F. development. From 1950 to 1951 he was a transformer development engineer for Thoranson Electric.

Dr. Schaffner received his Ph.D. in Electrical Engineering from Northwestern University in 1956. He received his BSEE and MSEE degrees from Purdue University in 1949 and 1950 respectively.

Dr. Schaffner is author of numerous technical papers on solid state microwave applications. He also has several patents in the same field. Dr. Schaffner is currently a member of the MTT Systems Committee. He was San Diego and Phoenix Chapters Chairman for the MTT and was Technical Program Chairman for the 1977 International Symposium. He has been editor of an issue of the Microwave Systems News devoted to Radar and an issue of the MTT Transactions.

MEMBERSHIP MATTERS



by P.A. Green

FANTASTIC! That is precisely how well MTT-S membership expanded last year. We have exceeded our expected growth of 4.5 percent (7766 active members), to a new record high of 8064 active members, or 8.5 percent. MTT-S ranked fourth out of 32 Societies as of December 31, 1984.

New incentives have been given to Chapters to expand their members. **Free** MTT-S membership will be given to current IEEE members that are not already in the MTT-S. **Free** MTT-S membership will also be given to those who have yet to join the IEEE. **Free** MTT-S membership will be valid only for the first year in MTT-S. This is a golden opportunity to have a friend join MTT-S. Encourage others to join, and let them know the advantages and resources of MTT-S.

Chapters, please use the Technical Society Tracking Code and Section tracking Codes when filling application forms. This may enable your Chapter to receive \$5.00 for each new IEEE member.

CHAPTER CONGRATULATIONS

Congratulations are in order to the Milwaukee and Ottawa Chapters for their outstanding efforts in promoting MTT-S membership for 1984. The representative from each Chapter, will receive membership recognition (\$200 plus plaque) at the 1985 Microwave Symposium Chapter Chairmen's Dinner. Milwaukee did exceedingly well in its efforts and had the highest growth rate (45 percent) from Regions 1 through 6. Ottawa's rate of 31.25 percent was the highest, for the second year in a row, from Regions 7 through 10.



St. Louis Missouri



1986 INTERNATIONAL MICROWAVE SYMPOSIUM BALTIMORE, MARYLAND



by Edward C. Niehenke

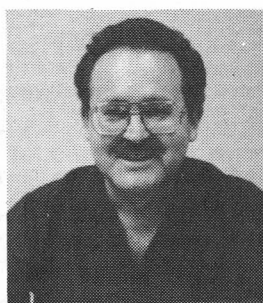
The convention facilities and hotels at the Inner Harbor, Baltimore, Maryland, are booked exclusively the first week of June 1986 for the 1986 International Microwave Symposium. This week will be busy with an excellent technical program coupled with exciting special events. The Microwave Symposium will be held Monday, June 2, through Wednesday, June 4, 1986. The Monolithic Symposium will be held jointly with the Microwave Symposium Wednesday afternoon and will continue all day Thursday. Workshops including ARFTG will be held Thursday, June 5, and Friday, June 6. Plan to arrive in time for the opening cocktail reception Sunday evening sponsored by the exhibit manager, Howard Ellowitz.

The technical talks and exhibits will take place in the modern Baltimore Convention Center located at the Inner Harbor. The six hotels for our sleeping accommodations are conveniently located within a few blocks from the Convention Center. The symposium site of the Baltimore Inner Harbor will provide direct access to planned sail and motor excursions of the Inner Harbor and Chesapeake Bay. This Inner Harbor also contains the National Aquarium, and Maryland Science Center and Planetarium, the World Trade Center, and Harborplace. Baltimore's new dual pavilions that house a never-ending festival of food and fine shops.

The program committee of 25 strong are working hard to make this a pleasurable event to be remembered for years to come. The logo for this symposium shown here for the first time, depicts the Baltimore Inner Harbor with the numerous flags of nations. The theme, "Microwaves Linking Nations," was selected due to the importance of microwaves in international communications and is appropriate for Baltimore since this city is center for people of all nations.

Plan to stop at the 1986 Baltimore Symposium Booth at the 1985 St. Louis Symposium Convention Center to pick up your unique reminder gift.

ARFTG HIGHLIGHTS



by Mario A. Maury, Jr.

The Automatic RF Techniques Group (ARFTG) is a professional society that is affiliated with MTTs. It is primarily concerned with computer-aided microwave measurements and design. The following is a summary of its recent activities.

24th ARFTG CONFERENCE

The Fall 1984 ARFTG Conference was held at the Columbia Inn, Columbia, Maryland (near Baltimore) on December 6 and 7, 1984. The Conference's main topic was "Large Automated Test Equipment (ATE)" and was chaired by Barry Perlman of RCA Laboratories, Princeton, New Jersey. The local host was Jim Manning, Westinghouse, Baltimore, Maryland, who did an excellent job of arranging a smooth running and well organized conference.

Lee Saulsbery of NBS, Boulder, Colorado and President of ARFTG opened the meeting and introduced Mario Maury of Maury Microwave, Cucamonga, California. Mario welcomed the attendees, particularly the new members, and provided activities and a brief summary of ARFTG history. Some of the highlights of his talk were, "in 12 years, ARFTG has become a truly professional society which is international in scope with approximately 500 members," "being a member of ARFTG can be of considerable benefit in your work and career by helping you stay current with the state-of-the-art in the dynamic area of microwave automated measurements" and "become an active member, participate with your peers and make your contribution to the society."

The technical program chairman was Jonathan Schepps of RCA Laboratories, Princeton, New Jersey, who put together an excellent program consisting of 15 technical papers. The following is a partial summary of the papers presented:

— AUTOMATED RF TEST TECHNIQUES: DESIGN CONSIDERATIONS, Cliff Fitterer, Watkins-Johnson, ATE Div., San Jose, CA

— AUTOMATED MICROWAVE VCO SUBASSEMBLY TEST SYSTEM, Alan Carlson and Richard Hoft, M/A-COM ATE Group, Burlington, MA

—AUTOMATIC TELEMETRY RF TEST AND CALIBRATION SYSTEM, Dan Meeks, Pan Am World Services, Patrick Air Force Base, FL

— COMPUTER-CONTROLLED PULSE PHASE MEASUREMENT SYSTEM, Michael Little, Leon Stevens, Thomas McEwen and Edward Jones, RADC, Rome Air Development Center, Griffiss AFB, NY

— A HIGH PERFORMANCE MILLIMETER WAVE VECTOR NETWORK ANALYZER SYSTEM, Jeff Caufield and Roger Pollard, Hewlett-Packard, Santa Rosa, CA

— SOFTWARE ENGINEERING FOR SEMI-AUTOMATED PHASE NOISE MEASUREMENTS, Robert Ashley, Sperry Corporation Electronic Systems, Clearwater, FL

— PLAN A/2.1 — ENHANCED NETWORK ANALYZER CONTROL SOFTWARE, Ben Epstein, Dave Rhodes and Jonathan Schepps, RCA Laboratories, Princeton, NJ

— WAVEGUIDE TWO-PORT STANDARDS, Mario Maury and Gary Simpson, Maury Microwave, Cucamonga, CA

ARFTG Awards Banquet

The semi-annual ARFTG Awards Banquet was held the evening of the 6th and the following awards were presented by Lee Saulsbery, ARFTG President:

Best Paper Award, 23rd Conference: Roger Pollard, Leeds University, Leeds, England.

Automated Measurements Career Award: Bruno Weinschel, Weinschel Engineering, Gaithersburg, Maryland.

Automated Measurements Technology Award: Bruce Donecker, Hewlett-Packard, Networks Measurement Division, Santa Rosa, California.

Distinguished Service Award: Ed Stevens, RCA, Bath, Maine.

Entertainment for the banquet was provided by "Temporarily Yours", a fine barber shop quartet.

Following the banquet, several ARFTG members were treated to our own personal brand of entertainment in the lounge by the fine singing of our own ARFTG member, Algie Lance, which was enjoyed by all present.

ANNOUNCEMENT 25th CONFERENCE

The Spring ARFTG Conference will be held as a workshop as part of the 1985 MTTs International Microwave Symposium in St. Louis, Missouri. The Conference will start at 12:00 p.m. on Thursday, June 6 and end at 4:30 p.m. on Friday, June 7; it will be held at the Sheraton Hotel in St. Louis. Advance registration is recommended utilizing the symposium registration form, although attendees can register directly preceding the Conference.

The theme of the Conference will be "Automated Active Devices Measurements." Papers are solicited on recent hardware and software developments on this topic, as well as other computer-aided RF design and testing topics. Technical presentations will be informal

25 minute talks using viewgraphs or 35mm slide illustrations, Manufacturers are also encouraged to discuss or demonstrate new products that have been developed for RF design and testing, a separate exhibits area will be available for demonstrations.

Manufacturers interested in exhibiting their products, contact the Exhibits Co-ordinator (EC):

Mr. M.A. Maury, Jr.
Maury Microwave Corporation
8610 Helms Avenue
Cucamonga, CA 91730
(714) 987-4715, X21

For further information, contact the ARFTG Conference Chairman (CC):

Mr. Robert Nelson, Div. 724
National Bureau of Standards
325 Broadway
Boulder, CO 80303
(303) 497-5736



THOUGHTS FOR FOOD

By Stephanie Winston

□ **Best decaffeinated coffees.** *The richest, most full-bodied brews come from Arabic beans that you buy in specialty shops to grind yourself or have ground to order. Chemically treated varieties hold more flavor and aroma than water-processed beans. Best vacuum-packed decaffeinated coffees:* Those labeled 100% Colombian coffees. *Best instants:* Freeze-dried.

□ **Exotic fruits may soon gain wider distribution.** *Cherimoya:* Only 27 calories per ounce. Tastes like creamy vanilla sherbet. Good for pies, cakes and souffles. *Asian pear:* Juicy as a pear, crunchy as an apple. *Blood orange:* Very juicy, low in acid but full in flavor. *Plantain:* The cooking banana, 34 calories per ounce. *Red banana:* Stores much longer than the yellow variety. *Tamarind:* Tastes like apricots or dates, with a bit of lemon. *Carambola:* Looks like a star-shaped cucumber, tastes sweet as an orange.

□ **Diet myth: Spirulina,** a blue-green algae, contains amino acids that suppress the appetite. *Fact:* The amino acids in question are found in *all* high-quality proteins. There is no medical evidence that they reduce hunger. *Better appetite curb:* A large glass of water before meals.

(Continued on page 42)

1989 INTERNATIONAL MICROWAVE SYMPOSIUM LONG BEACH, CALIFORNIA



by Chuck Swift

I used to have a neighbor who was a musician, actually an arranger. He was a meticulous, thorough sort of person. I remember one time he worked three weeks on an arrangement . . . and then his wife didn't leave town.

If you're thinking of an arrangement for the 1989 MTT-S International Microwave Symposium, you might want to start now. Hopefully, you'll have a better success rate. The site (Long Beach, Ca.) and the dates (Wednesday, June 14 through Friday, June 16) have been picked. Long Beach offers excellent scenic views, plus an opportunity to stay aboard the Queen Mary and visit the Spruce Goose, Howard Hughes fabulous sea-plane.

I do hope the 1989 Symposium will be able to offer some novel approaches and ideas. Therefore, let me issue our "First Call for Papers." No other Symposium has ever issued one this early! I do this with some trepidation, knowing at least one of my acquaintances will submit a roll of Scot Tissue. It, of course, will be rejected "out of hand", an appropriate means of disposal.

One thing ADCOM has chosen to do is extend the time between site selection and the date of the Symposium. Elsewhere in this Newsletter you will read that Boston has already been selected for the 1991 Symposium. This is brought about because as the attendance and the exhibits have grown, it becomes increasingly difficult to find a site which can handle our requirement for space (three large halls for technical sessions, over 70,000 square feet for exhibits) and hotel rooms (1700-2000 rooms). It's like scheduling Notre Dame or USC's football teams, one can't wait until two years before the event. So, even though four years seems like a long time away, I am choosing to view it as ONLY four years. In this regard, anyone who would like to work with the 1989 Committee can contact Chuck Swift at (818) 989-1133. In the meantime, I'll leave you to ponder: "What do you call a boomerang that doesn't come back"? Answer in the next issue.



(Continued from page 41)

☐ **Diet therapy** may be a first-line treatment for people with angina (chest pain caused when not enough oxygen reaches the heart). Recent studies suggest that a low-fat, low-calorie diet makes the heart work more efficiently. *Other benefits:* Weight loss, cholesterol reduction and the toleration of strenuous exercise.

☐ **Age and male fertility.** A group of healthy men between the ages of 60 and 88 had the same testicular volume, ejaculate volume, sperm count or appearance, and testosterone levels as males under the age of 40. And sperm from older men doesn't appear to increase the risk of birth defects. *What matters:* When health deteriorates, sexual function and fertility will also deteriorate.

☐ **A potentially dangerous drug combination:** Cimetidine (Tagamet), the biggest-selling ulcer drug in the US, and theophylline, a drug commonly used for asthma. They have often been prescribed together for patients with asthma and ulcers. But recent studies show that the drugs interact, causing the body's theophylline levels to build up. This can lead to potential toxicity, irregular heart beats and irritability. *Safer:* Renitidine (Zantac). It has the same results as Tagamet, but doesn't cause the theophylline buildup.

☐ **Serious heart trouble** can be diagnosed much earlier with an ultrasound scanning machine that shows up such problems as muscle damage, valve disease and malfunctioning, clots and other abnormalities. Anyone facing heart surgery should be screened with ultrasound first. It helps doctors more accurately diagnose and prescribe treatment. Most hospitals now have the equipment.



St Louis Missouri

DISTINGUISHED MICROWAVE LECTURER INTERIM REPORT



by Sander Weinreb

Dr. Sander Weinreb is one of the 1984/1985 Distinguished Microwave Lecturers. Dr. Weinreb's lecture "Radio Astronomy-A Challenge to the Microwave Engineer" has already been presented to several groups. Chapters and Sections should contact Dr. Weinreb to make his lecture available to MTT-S membership. Remember, Dr. Paul T. Greiling is the other 1984/1985 Distinguished Microwave Lecturer. His lecture is entitled "High Speed Digital IC Performance Outlook." Dr. Weinreb's lecture schedule is as follows:

Date	Chapter/Section
10/15/84	Chicago Chapter
10/16/84	Cedar Rapids Section
10/16/84	Central Iowa Section at University of Iowa
10/17/84	Milwaukee Chapter
10/18/84	Urbana Section
11/15/84	Piedmont Section
11/16/84	New Jersey Chapter
1/22/85	Phoenix Chapter
1/23/85	San Diego Chapter
1/24/85	Denver Chapter
2/11/85	University of Florida, Gainesville
2/18/85	Central Georgia Section
2/19/85	Atlanta Chapter
2/20/85	Austin Section
2/21/85	Dallas Chapter
2/21/85	University of Texas, Arlington
4/8/85	Utah/Salt Lake City Chapter
4/11/85	Santa Clara Valley Chapter
4/16/85	Susquehanna Section
4/17/85	Lehigh Valley Section
4/18/85	Philadelphia Chapter
4/24/85	Baltimore Chapter
5/1/85	Syracuse Chapter
5/2/85	Buffalo Chapter

Requests received but lectures not yet scheduled:

Melbourne Section, Alamogordo/Holloman Section, St. Maurice Section, Karechi Section, Sao Paulo Section, Taipei Section, West Germany Chapter,

Sweden Chapter, Madrid Section, Helsinki Section, University of Queensland, University of Western Australia, University of Auckland, and University of Canterbury.



GaAs IC SYMPOSIUM

by Ronald B. Lundgren

1985 GaAs IC Symposium Chairman

The 1985 Gallium Arsenide Integrated Circuit Symposium will be held at the Monterey Conference Center in Monterey, California, 12-14 November 1985. Papers are invited on topics related to gallium arsenide integrated circuits, including: monolithic digital integrated circuits, monolithic linear and power integrated circuits, electro-optical integrated circuits, processing technology, device physics, modeling and simulation, radiation effects and reliability, packaging and testing, materials considerations and advances, and systems applications and affordability.

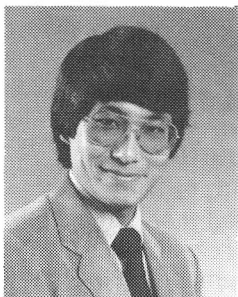
The object of the meeting, which is sponsored by the IEEE Electron Devices Society and cooperatively sponsored by the IEEE Microwave Theory and Techniques Society, is to accelerate the successful development of gallium arsenide and related III-V compound integrated circuits by providing a forum for the interchange of technical information relative to the design, fabrication, and application of such ICs. Attendees should be prepared to discuss the technical aspects of these topics.

Authors wishing to submit abstracts for consideration by the technical program committee should mail the original, plus twenty-five (25) copies, of a one-page abstract to: Dr. James A. Hutchby, Research Triangle Institute, P.O. Box 12194, Research Triangle Park, NC 27709. The abstract should clearly state the purpose of the work, how it advances the art, and what specific results have been obtained. Additional supporting material may be submitted at the discretion of the author(s). Please indicate the specific area (as listed in the first paragraph) to which the abstract applies. The deadline for receiving abstracts is May 24, 1985. For further information, Dr. Hutchby can be contacted at (919) 541-5931.

Persons wishing to receive the advance program and registration material for this year's Symposium or be placed on the mailing list for future symposia should send name, organization, mailing address and telephone number to: Melissa Widerkehr, GaAs IC Symposium, 655 15th Street, N.W., Suite 300, Washington, DC 20005.

For additional information, you may also contact the Symposium Chairman, Dr. Ronald E. Lundgren, at (213) 317-5335, or the Publicity Chairman, Dr. Richard Koyama, at (503) 627-6773.

SHORT COURSES



by Kurtis L. Kurisu

A number of organizations are offering short courses this Spring which will be of interest to some members of the Microwave Theory and Techniques Society.

The following selected short courses will be offered by the UCLA (University of California at Los Angeles) Extension during May, June, July, and August of 1985:

Adaptive Antenna Signal Processing for Interference Rejection, May 13-17, course number 867.52, \$945 per pupil, Instructors to include E. Mendelovicz and T.W. Miller.

Applied Interactive Computer Graphics, May 13-17, course number 819.53, \$945 per person, Instructors are S.H. Chasen, L. Hatfield, and C. Machover.

The Techniques and Technology of the Application of Kalman Filters and Nonlinear Filters, May 13-17, course number 881.78, \$945 per pupil, Lecturers are W.M. Bowles, A. Brown, V.B. Gyls, K. Kessler, J.L. LeMay, D.F. Liang, J. Lukesh, P. Maybeck, R.C. Thrasher, and J.H. Vincent.

Modern Telecommunications Networking: Electronic Messaging, Local Area, Packet Radio, and Satellite Communication Networks, May 20-23, course number 885.84, \$945 per attendee, Lecturers are I. Rubin and M. Gerla.

The Technical Manager in a Dynamic Environment, May 28-31, course number 885.92, \$845 per pupil, Lecturer is M. Silverman.

Fundamentals of Electro-Optical Systems Analysis, June 3-7, course number 823.10, \$945 per person, Lecturers are G.L. Clark, G.J. Hoover, and R.A. McClatchey.

Electro-Optical Workshop, June 3-14, course number 823.23, \$1,740 per student. Individuals interested in attending both Fundamentals of Electro-Optical Systems Analysis (June 3-7) and Advanced Electro-Optical

Systems (June 10-14) may do so at a reduced, combined fee of \$1,740.

VLSI-MOS Device Modeling, June 10-12, course number 881.55, \$745 per student, Lecturers are C.R. Viswanathan, J.R. Brews, and W. Fichner.

Advanced Electro-Optical Systems, June 10-14, course number 823.18, \$945 per person, Lecturers are K. Seyrafi, E. Dryden, H.R. Lusenberg, D.A. Pinnow, H.T. Yura, and O.M. Stafsudd Jr.

Microwave Circuit Design I - Linear Circuits, June 17-21, course number 881.39, \$945 per student, Lecturers are L. Besser, S.L. March, and R. Wenzel.

NAVSTAR Global Positioning System (GPS): Operation, Implementation, and Applications, June 17-21, course number 867.62, \$945 per pupil, Lecturers are A.K. Brown and M.A. Sturza.

Secure Communication Systems, June 17-21, course number 885.103, Lecturer is K. Bakhru.

Synthetic Imaging: Wavefront Reconstruction and Computerized Tomography, June 24-28, course number 819.123, \$945 per person, Lecturers are K. Moore, J. Winter, and W.L. Taber.

Microwave Circuit Design II — Nonlinear Circuits, June 24-29, course number 881.65, \$975 per person, Lecturers are L. Besser, K.C. Gupta, E.C. Niehenke, R.A. Pucel, and F.N. Sechi.

Reliability, Maintainability, and Availability Engineering — Their Implementation, Management, and Cost Benefits, July 15-19, course number 885.97, \$975 per attendee, Lecturer is D. Kececioglu.

Adaptive Signal Processing, July 15-19, course number 881.81, \$975 per student, Instructors are B. Widrow and R. Gitlin.

Reliability and Life Testing, July 22-26, course number 885.80, \$975 per student, Instructor is D. Kececioglu.

Advanced Scattering Analysis of Guided and Unguided Waves, July 29-August 2, course number 881.61, \$975 per person, Lecturers are R. Speciale and P. Wacker.

Introduction to Automatic Testing and ATE Engineering, July 29-August 2, course number 881.74, \$975 per attendee, Lecturer is L. Ungar.

Advanced Topics in Automatic Test Equipment, August 5-7, course number 881.79, \$775 per person, Instructor is L. Ungar.

Mechanical Reliability and Probabilistic Design for Reliability — The Stress/Strength Interference Approach to Designing a Desired Reliability Into Components and Equipment, August 5-9, course number 885.82, \$975 per pupil, Instructor is D. Kececioglu.

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PROFESSIONAL ACTIVITIES COMMITTEE FOR ENGINEERS



R.A. Moore

MTTS PACE Committee Chairman

Has the capricious nature of many of the strong influences on our profession affected your career? How often has some shift in government funding either caused "Lady Luck" to go your way or undermined a project for which you had invested months or even years of effort? Have you ever seen technical emphasis go in directions that couldn't be predicted and had either a positive or serious negative effect on your career? Is the professional status of microwave engineers in your company what it should be?

Wouldn't it be nice to know where our profession is going so we could make better decisions for ourselves? Obviously, anyone who could completely predict the future would be making his/her fortune — most likely outside the microwave field. However, some people are closer than most to the point at which many of the decisions affecting the above questions are made.

If you are coming to the International Microwave Symposium in St. Louis, June 4-6 this year you are in luck. The conference will feature an extended Plenary Session with a super panel to share views on the above questions. The title of the extended Plenary Session is, "The Future of the Microwave Engineer." The first part of the session will be from 8:00 to 10:00 with the second from 12:00 to 1:30 p.m. There will be a sandwich buffet convenient to the second session just before 12:00 noon so that attendees can pick up and take their lunches to the noontime session.

The early portion of the Plenary Session will include talks by: Dr. Merril Skolnik, Naval Research Laboratory; Dr. David Leeson, President, California Microwaves; Dr. Stephen Honickman, President, STG Electrosystems, Inc. who will address, respectively, the Technical, Professional and Financial Future of the Microwave Engineer.

The noontime session will feature: Dr. Leo Young, The Pentagon; Dr. H.C. Nathanson, Westinghouse

Research & Development Center; Dr. Stephne Honickman, President, STG Electrosystems, Inc.; Dr. George Gamota, University of Michigan.

Dr. Young will provide an overview of DoD sponsored R&D funding with Drs. Nathanson, Honicknam and Gamota, addressing the impact of DoD sponsored funding on large and small companies and academic institutions, respectively.

All speakers from both portions of the Plenary Session will be available as panelists for audience questions and discussion after the noon hour presentations. This should be an outstanding set of presentations and an opportunity to present your views on important influences on our profession. You should plan to attend both parts of the Plenary Session. The Conference is providing an outstanding session and a lunch arrangement which makes it convenient to attend. The quality of the speakers deserve your attention and attendance.

Trying to summarize USAB activities in one column is difficult. We will be covering activities in future columns. In the meantime, please call with your concern to (302) 765-4027 or write me at Westinghouse DEC, P.O. Box 746, MS 335, Baltimore, Maryland 21203.



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Multi-target Tracking, August 12-16, course number 839.46, \$975 per student, Instructor is Y. Bar-shalom.

Surface Analysis: Fundamentals, Techniques, and Applications, August 12-16, course number 893.7, \$975 per person, Instructors are G. O'Clock, C. Evans, and M. Zeller.

Growth Technologies for Semiconductor and Insulating Films Using Molecular Beam Epitaxy (MBE), Chemical Vapor Deposition (CVD), and Liquid Phase Epitaxy (LPE), August 19-23, course number 893.8, \$975 per student, Lecturers are G. O'Clock, A. Cho, P. Dapkus, and L. Dawson.

Kalman Filtering: August 26-30, course number 881.38, \$975 per person, Instructors are J. LeMay and W. Brogan.

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For further information on these short courses, contact Nonie Watanabe at UCLA, Engineering Short Courses, 10995 LeConte Avenue, Room 637, Los Angeles, CA 90024, (213) 825-1047.

The Continuing Education Office of George Washington University is offering the following courses which may interest MTT-S members. These courses are to be held in Washington, D.C. except when noted. They are:

Global Positioning System — Principles and Practice, May 13-15, course number 1081DC, \$730 per attendee, Instructor is R.C. Dixon.

Radar/Weapon Systems ECCM, May 13-17, course number 686DC, \$920 per attendee, Instructors are S.L. Johnston and V.G. Hansen.

Digital Transmission Systems Engineering, May 13-17, course number 535DC, \$920 per attendee, Lecturers are D.R. Smith and J.L. Osterholz.

Spectrum Estimation and Digital Signal Processing, May 13-17, course number 1174DC, \$920 per participant, Lecturers are C.L. Nikias and A.N. Venetsanopoulos.

Microwave Systems Planning, May 13-17, course number 832DC, \$920 per person, Lecturer is A. Schneider.

Fiber and Integrated Optics, May 20-24, course number 378MN, \$920 per attendee, Lecturer is L. Bergstein, location is Minneapolis, Minnesota.

Radar System Analysis, May 20-24, course number 1136MN, \$920 per participant, Instructor is D.K. Barton, location is Minneapolis, Minnesota.

Military Communications Systems, May 20-24, course number 806DC, \$920 per person, Lecturer is D. Wiggert.

Advances in Communications-Electronics Technology: Microprocessors, Satellite Communications, Robotics, Fiber Optics, and Solid-State Technology, May 20-24, course number 336DC, \$920 per attendee, Lecturers are B.E. Keiser, K.L. Doty, L. Bergstein, and D.D. Zimmerman.

Fundamentals of Communications Satellite Systems, May 20-24, course number 503DC, \$920 per student, Instructor is W. DeHart.

Systems Engineering and Analysis, May 22-24, course number 1110DC, \$730 per student, Lecturer is R.C. Hu.

Millimeter-Wave Engineering and Applications, May 28-31, course number 1148DC, \$835 per attendee, Lecturers are P. Bhartia, W.J.R. Hoefer, and H. Meinel.

Introduction to Modern Radar Technology, May 29-31, course number 1038DC, \$730 per student, Instructors are D.K. Barton, P.W. Johnson, and C. Julio-Torres.

Introduction to Receivers, June 3-4, course number 1125DC, \$650 per student, Instructor is R.C. Dixon.

Integrated Circuit Engineering with Emphasis on VLSI, June 3-7, course number 915DC, \$920 per student, Instructor is G.E. Subak-Sharpe.

Public and Private Packet Switched Networks — The X.25 Protocol, June 4-5, course number 863DC, \$650 per student, Instructor is R.D. Rosner.

Modern Receiver Design, June 5-7, course number 1079DC, \$730 per person, Instructor is R.D. Dixon.

Technical Control and Diagnostics of Telecommunications Networks: The Challenges of a Post-Divestiture Era, June 8-10, course number 1161DC, \$730 per participant, Lecturer is R. Swanson.

Introduction to Techniques for Information Extraction from Remotely Sensed Data, June 10-14, course number 1032DC, \$920 per participant, Instructors are A. Singh and H.L. Heydt.

Fiber and Integrated Optics, June 10-14, course number 378DC, \$920 per attendee, Lecturer is L. Bergstein.

Wideband Communications Systems, June 10-14, course number 537DC, \$920 per pupil, Lecturer is B.E. Keiser.

Modern Communications and Signal Processing, June 10-14, course number 945SD, \$920 per participant, Instructors are T.R. Lapp and F.P. Kaiser, location is San Diego, California.

High Frequency Spectrum: New Concepts and Technologies, June 10-14, course number 893DC, \$920 per attendee, Instructors are J.M. Goodman and D.R. Uffelman.

Frequency Synthesis, June 17-19, course number 1080DC, \$730 per participant, Instructor is R.C. Dixon.

Monopulse Principles and Techniques, June 24-26, course number 1005DC, \$730 per student, Instructors are S.M. Sherman and D.D. Howard.

Communications ECM Principles and Techniques, June 24-28, course number 426DC, \$920 per pupil, Instructor is R.H. Pettit.

Foundations of Modern Telecommunications Systems, July 8-12, course number 1017DC, \$920 per person, Instructors are R.C. Dixon and G.D. O'Clock.

Modern Digital Signal Processing: Analysis, Synthesis, and Applications, July 8-12, course number 852DC, \$920 per student, Instructor is A.N. Venetsanopoulos.

Data Compression Techniques and Applications, July 15-18, course number 1194DC, \$835 per participant, Instructor is T.J. Lynch.

Digital Image Processing of Earth Observation Sensor Data, July 15-19, course number 307DC, \$920 per pupil, Instructors are R. Bernstein, F.C. Billingsley, and S.W. McCandless Jr.

Digital Communications Techniques, July 22-25, course number 1181DC, \$785 per student, Instructor is W.J. Melvin.

Microwave High-Power Tubes and Transmitters, July 22-26, course number 1037DC, \$920 per pupil, Lecturers are A.E. Acker and W.R. North.

Introduction to Command, Control, and Communication (CCC) Systems, July 22-26, course number 1095DC, \$920 per participant, Instructors are R.C. Dixon and R.H. Pettit.

Introduction to Command, Control, and Communications (CCC) Systems, July 22-26, course number 1095DC, \$920 per student, Lecturers are R.C. Dixon and R.H. Pettit.

Integrated Circuit Design With Applications to Switched Capacitor Techniques, July 23-26, course number 1121DC, \$835 per attendee, Lecturers are E. Sanchez-Sincencio and R.L. Geiger.

Satellite Communications Networks: Planning/Spacecraft Operations/Earth Station Operations, July 29-August 2, course number 1144DC, \$920 per person, Lecturers E.J. Collins and M.J. Downey.

For additional information contact: Merril Ann Ferber, Continuing Engineering Education, George Washington University, Washington, D.C. 20052, (202) 676-6106, Toll free: (800) 424-9773.

The following courses of interest have been announced by Georgia Institute of Technology:

Fundamentals of Electronic Defense, May 21-23, \$700 per person.

Techniques of Radar Relectivity Measurement, August 6-8, \$645 per attendee.

Radar Cross Section Reduction, September 17-19, \$550 per attendee.

Additional information can be obtained from Trish Stolton at G.I.T. Department of Continuing Education, Atlanta, Georgia 30332, (404) 894-2547.

The Continuing Education Institute offers the following short courses:

Semiconductor Silicon Technology, May 10, course number 195.08, Instructor is W. O'Mara, location is Boston, Massachusetts.

Modern Microwave Measurements: Signal and Net-

work Analysis, Microwave Products and Systems Characterization, May 13-16, course number 118.24, \$895 per person, Instructor is S. Adam, location is Alexandria, Virginia.

Microwave Circuit Design: Non-Linear Circuits Design, May 13-18, course number 119.06, \$995 per pupil, Instructors are K.C. Gupta, E.C. Niehenke, R.A. Pucel, and F.N. Sechi, location is Orlando, Florida.

Applications of Discrete and Continuous Fourier Analysis, May 14-17, course number 206.07, \$850 per person, Instructor is H.J. Weaver, location is Austin, Texas.

Modern Spectral Analysis, May 21-14, course number 135.10, Instructors are R. Otnes and Enochson, location is Houston, Texas.

Applications of Discrete and Continuous Fourier Analysis, June 4-7, course number 206.08, \$850 per attendee, Instructor is H.J. Weaver, location is Wakefield, Massachusetts.

Modern Spectral Analysis, May 21-June 14, course number 135.10, Instructors are R. Otnes and Enochson, location is Houston, Texas.

For more information contact: Continuing Education Institute, 10889 Wilshire Blvd., Suite 1000, Los Angeles, California 90024, (213) 824-9545.

The University of Southern California (USC) offers a videotaped short course entitled **Principles of Radar Systems Design**. This short course is available for purchase and/or rental in a variety of video formats. For additional information contact: USC, Instructional Television Program, OHE-214, School of Engineering, Los Angeles, CA 90089-1455, (213) 743-7663.

The Center for Professional Development at the College of Engineering and Applied Sciences of Arizona State University offers short courses which may be of interest to MTT-S members. Information regarding course offerings and enrollment can be obtained from: Center for Professional Development, College of Engineering and Applied Sciences, Arizona State University, Tempe, AZ 85287, (602) 965-1740.

The University of Wisconsin Extension offers the course **Cellular Radio Systems**, June 24-26, \$495 per attendee. For further information contact Mr. Francis Drake, Department of Engineering and Applied Science, University of Wisconsin-Extension, 432 North Lake Street, Madison, WI 53706, (608) 263-7427, (800) 262-6243, or (800) 362-3020 in WI.

The short course **Digital Communications: Satellite/Earth Station and Terrestrial Microwave Systems** is offered May 29-31 in Montreal, Canada. Course fee is \$700. Lecturers are K. Feher, B.

Lusignan, E. Karkar, D. Morais, and M. Olson. Further information may be obtained by contacting: Digtech, c/o Mrs. E. Lepage, 2055 Kent Drive, Los Altos, CA 94022, (415) 965-7634 or (408) 268-4312.

The University of Colorado announces the short course, **Computer-Aided Design of Microstrip Circuits and Antennas**, May 28-31, location is the University of Colorado, Boulder, CO. For information regarding this offering contact: Office of Conference Services, University of Colorado, Campus Box 454, Boulder, CO 80310, 303-492-5151. Academic information regarding the course may be obtained through K.C. Gupta at 303-492-7498 or S.W. Maley at 303-492-7004, Department of Electrical and Computer Engineering, University of Colorado, Campus Box 425, Boulder, CO 80309.

The United States Department of Commerce is offering the short course, **Antenna Parameter Measurement by Near-Field Techniques**, on June 10-14. Location will be at the National Bureau of Standards in Boulder, CO. For additional information contact Richard L. Lewis, Section 723.05, Electromagnetic Fields Division, Boulder, CO 80303, 303-497-5196.

Stanford University offers the following short courses of interest: **Ultra-High Speed GaAs Integrated Circuit Technology**, July 8-12, \$975 per attendee, Instructors are J. Harris, D. Estreich, and S. Long.

VLSI Process Technology, July 15-19, \$975 per student, Lecturers are J.D. Plummer and J.D. Shott.

Process and Device Simulation for IC Technology Design, July 22-26, \$1025 per pupil, Lecturer is R.W. Dutton.

Statistical Signal Processing, July 29-August 2, \$975 per person, Instructors are J.W. Goodman and U.S. Inan.

Chemical Microanalysis of Semiconductor Materials and Device Structures, August 5-7, \$780 per person, Instructors are C.R. Helms and T.W. Sigmon.

Image Processing, August 12-16, \$975 per attendee, Lecturers are J.W. Goodman and L. Hesselink.

Microlithography, Etching, and Interconnections, August 12-16, \$975 per student, Lecturers are F. Pease, K.C. Saraswat, R.H. Bruce, and T. Brunner.

Digital Spectral Analysis, August 19-23, \$975 per person, Lecturers are R.N. Bracewell and U.S. Inan.

For more information on these courses, contact: Irene Miller, Program Manager, Western Institute for Continuing Studies (WICS), 1259 El Camino Real, Suite 284, Menlo Park, CA 94025, 415-854-9719.

If you wish to have your short courses of interest listed in this column, please send pertinent information to Kurt Kurisu, TRW Electronics and Defense, One Space Park, Redondo Beach, CA 90278.

SPECIAL TRANSACTIONS ISSUE ON PHASED ARRAYS FOR HYPERTHERMIA TREATMENT OF CANCER

Hyperthermia has been shown to be effective in treatment of cancer, especially when combined with chemo- and radio-therapy. Its use in combating deep-seated tumors has been restricted by problems associated with noninvasive heating of deep tumors. Recent calculations and experimental measurements indicate the possibility that with proper choice of source and applicator parameters, it is possible to produce therapeutic heating of tumors of different volumes in a variety of anatomic sites.

The **IEEE Transactions on Microwave Theory and Techniques** is planning to publish a Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer in May, 1986. Papers are solicited which describe original work concerned with theoretical, experimental and clinical methods and techniques for improved heating of superficial, accessible and deep-seated tumors. Special emphasis will be placed on state-of-the-art phased array systems and on new technology for the next generation systems. Topics of interest include but are not limited to the following areas:

- Noninvasive ultrasound, RF and microwave techniques
- Interstitial and implanted arrays
- Antennas in lossy media
- Array components and elements
- Optimal architectures and configurations
- Control strategy and excitation schemes
- Thermal field mapping
- Numerical techniques

Authors are requested to submit four copies of the manuscript by October 1, 1985 to guest editor:

Professor James C. Lin
Department of Bioengineering
University of Illinois at Chicago
Box 4348
Chicago, IL 60680
(312) 996-2331

MEETINGS OF INTEREST

The following list of meetings of potential interest to members of the Microwave Theory and Techniques Society covers a period of nearly a year. All efforts will be made to maintain a complete compilation of IEEE-sponsored and non-IEEE-sponsored meetings. Any additions should be sent to the MTT-S Newsletter Editor.

- **Digital Processing of Signals in Communication**
— April 22-25, University of Loughborough, England,
Contact: Conference Department IERE, 99 Gower
Street, London. Tel: 01-388-3071.

- **ELECTRO '85** — April 23-25, Coliseum & Sheraton Centre, New York, N.Y. Contact: Dale Litherland, Electronic Conventions, Inc., 8110 Airport Blvd. Los Angeles, CA. 90045, (213) 772-2965
- **INTERMAG** — April 29-May 2, Radisson-St. Paul, St. Paul, MN. Contact: E.J. Torok, Sperry Univac, P.O. Box 3525, MS U2 P26, St. Paul, MN 55165, (612) 456-2432. Conference Management: Annmarie Pitman, Courtesy Associates, (202) 296-8100.
- **IEEE 1985 Int'l. Radar Conference** — May 6-9, Marriott Crystal Gateway, Arlington, VA. Contact: Robert T. Hill, 2802 Birdseye Lane, Bowie, MD. 20715, (301) 262-8792.
- **Custom Integrated Circuits Conference** — May 20-22, Portland Hilton, Portland OR., Contact: Wesley N. Grant, Sperry Computer Systems, Sperry Park, P.O. Box 43525, MS H2F26, St. Paul, MN 55164-0525 (612) 456-4130.
- **35th Electronic Components Conference** — May 20-22, Capital Hilton Hotel, Washington, D.C. Contact: J.A. Woolley, 3M Company, 3M Center Building Y, 207-1W-10, St. Paul, MN. 55144.
- **CLEO '85** — May 21-24, Baltimore Convention Center, Baltimore, MD. Contact: John W. Roy, Hughes Aircraft Co., 6155 El Camino Real, Carlsbad, CA 92088.
- **National Aerospace & Electronics Conference (NAECON '85)** — May 21-23, Dayton Convention Center, Dayton, OH. Contact: NAECON, 110 East Monument Avenue, Dayton, OH. 45402, (513) 223-6266.
- **39th Annual Frequency Control Symposium** — May 29-31, Marriott Hotel, Philadelphia, PA. Contact: Dr. John R. Vig, Electronics Technology & Device Lab., DELET-MQ, Fort Monmouth, N.J. 07703.
- **1985 Microwave and Millimeter Wave Monolithic Circuits Symposium** — June 3-4, St. Louis, MO., Contact: Dr. William R. Wisseman, P.O. box 225936, M.S. 134, Texas Instruments, Inc. Dallas, TX. 75265, (214) 995-2451.
- **Int'l. Microwave Symposium & Workshops** — June 4-6, Stouffer's Riverfront Towers, Cervantes Convention Center, St. Louis, MO. Contact: Dr. Fred J. Rosenbaum, Central Microwave Co., 12180 Pritchard Farm Road, St. Louis, MO. 63043, (314) 291-5270.
- **1985 Int'l. Symposium on Circuits and Systems** — June 5-7, Kyoto Hotel, Kyoto, Japan. Contact: Toshio Fujisawa, Department of Information and Computer Sciences, Faculty of Engineering Science, Osaka University, Toyonaka 560, Japan, 06-844-1151, Ext. 4820.
- **AFRTG** — June 6-7, St. Louis, MO. Contact: Mario A. Maury, Jr., Maury Microwave Corp. 8610 Helm Avenue, Cucamonga, CA. 91730, (714) 987-4715 ext. 21.
- **6th University/Government/Industry Microelectronics Symposium** — June 11-13, Auburn University, Auburn, AL 36849-3501. Contact: Dr. Yonhua Tzeng, Electrical Engineering Department, 200 Broun Hall, Auburn University, Auburn, AL. 36849-3501, (205) 821-476.
- **6th Biennial University/Government/Industry Microelectronics Symposium** — June 11-13, Electrical Engr. Dept. Auburn University, Auburn, AL. Contact: Richard C. Jaeger 200 Broun Hall, Auburn University, Auburn, AL. 36849, (205) 826-4330.
- **OHMCON-High Technology Electronics Show and Convention** — June 12-13, Cabo Hall, Detroit, MI. Contact: Robert Barba, OHMCON, P.O. box 699, Utica, MI. 48087, (313) 781-4551.
- **1985 North American Radio Science Meeting & IEEE Int'l. AP-S Symposium** — June 16-21. University of British Columbia, Vancouver, B.C. Canada. Contact: Dr. E.V. Jull, Dept. of Electrical Engineering, University of British Columbia, Vancouver, B.C. V6T 1W5, Canada, (604) 228-3282.
- **1985 North American Radio, Science Meeting and International AP-S Symposium** — June 17-21. University of British Columbia, Vancouver, B.C. Canada. Contact: K. Charbonneau, Conference Service Coordinator, Conference Center of the University of British Columbia, Vancouver B.C., Canada.
- **NASECODE IV — The Fourth Int'l. Conference on the Numerical Analysis Of Semiconductor Devices and Integrated Circuits** — June 19-21. Trinity College, Dublin, Ireland. Contact: Professor John Miller, Chairman, NASECODE Conference, Numerical Analysis Group, 29, Trinity College, Dublin 2, IRELAND. Tel: (01) 772941, Ext. 1485.
- **IEEE Int'l. Conference on Communications (ICC '85)** — June 23-26, Palmer House, Chicago, IL. Contact: John D. Johanneson, General Chairman, Midwest College of Engineering, P.O. Box 1147 (ICC '85) Lombard, IL. 60148. (312) 627-6854.
- **Int'l. Conference on Properties and Applications of Dielectric Materials** — June 24-29. Shaanxi Guesthouse, Xi'an, China (PRC). Contact: Kwan C. Kao, Dept. of Electrical Engrg., University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada, (204) 474-9649.
- **Ultrasonics Int'l. '85** — July 2-4. King College, Lon-

don, U.K. Dr. Z. Novak, Butterworth Scientific Lt. P.O. Box 63, Westbury House, Bury Street, Guildford, Surrey GU 25 BH U.K. Tel: 048331261.

- **1985 Int'l. Symposium on Microwave Technology in Industrial Development** — July 22-26, Sao Paulo, Brazil. Contact: Waldyr Lucato, Chairman, IEEE Sao Paulo Section, Rua Cel. Xavier de Toledo, 23, 01408 Sao Paulo, SP, Brazil. Tel: (011) 239-6239. Telex: 1122582 ET BR.
- **Intersociety Energy Conversion Engineering Conference (IECEC)** — Aug. 18-23. Fountainbleu-Hilton, Miami Beach, FL. Contact: Floyd A. Wyczalek, Engineering Staff Div., GM Technical Center, General Motors Corp. Warren, MI. 48090. (313) 575-1153.
- **Midwest Symposium on Circuits and Systems** — Aug. 19-20, The Galt House Hotel, Louisville, KY., Contact: Dr. P. Aronhime, or Dr. J. Zurada, Electrical Engrg. Dept. University of Louisville, Louisville, KY. 40292. (502) 588-6289.
- **1985 IEEE Int'l. Symposium on Electromagnetic Compatibility** — Aug. 20-22, Colonial Hilton Inn, Wakefield, MA. Dr. Chester L. Smith, The MITRE Corp. P.O. Box 208, Bedford, MA. 01730, (617) 271-7086.
- **Int'l. Conference on Magnetism (ICM-85)** — Aug. 26-30. San Francisco, CA. Contact: J.F. Dillon, Jr., AT&T Bells Labs, 1D-328, Murray Hill, N.J. 07974. (201) 582-3589.
- **5th Int'l. Symposium on Electrets** — Sept. 4-6, Koenigsaal Castle, Heidelberg, FRG. Contact: Dr. Gerhard M. Sessler, Institute of Electroacoustics, Technical University of Darmstadt, Merckstrasse 25, D-6100 Darmstadt, FRG. Tel: 49-6151/16-2869.
- **Electronics & Aerospace Conference (EASCON '85)** — Sept. 9-11. Shoreham Hotel, Washington, D.C. Contact: Dr. Jack W. Hugus, EASCON '85 Gen. Chairman, General Electric Co., Suite 900, 777 14th Street, NW, Washington, D.C. 20005, (202) 637-4243.
- **Electrical and Electronics Conference & Exposition** — Oct. 7-9. Metro Toronto Convention Center, Toronto, Ontario, Canada. Contact: IEEE Canadian Region Office, 7061 Yonge Street, Thornhill, Ontario L3T 2A6. Canada (416) 881-1930.
- **International Geoscience and Remote Sensing Symposium — IGARSS '85.** — Oct. 7-9. University of Massachusetts, Amherst, MA. Contact: Professor Robert McIntosh, Electrical and Computer Engrg.,

Room 16, Engrg. Bldg. East, University of Massachusetts, Amherst, MA. 01003. (413) 545-2591.

- **Int'l. Telecommunications Energy Conference (INTELEC '85)** — Oct. 14-17, Hilton Hotel, Munich, Fed. Rep. of Germany. Contact: Dr. Gunther Vau, Siemens A.G., Postfach 3240, Erlangen 2, Fed. Rep of Germany.
- **1985 Ultrasonics Symposium** — Oct. 16-18, Cathedral Hill Hotel, San Francisco, CA. Contact: W.R. Shreve, Hewlett Packard, 1501 Page Mill Road, Palo Alto, CA. 94304. (415) 857-1501.
- **IEEE Military Communications Conference — MILCOM '85** — Oct. 21-23. Stouffer's Bedford Glen, Bedford, MA. Contact: Frank Gicca, GTE Products Corporation, 77 A St., Needham Heights, MA. 02194. (617) 449-2000, Ext. 595.
- **Western Electronic Show & Convention (WESCON '85)** — Nov. 19-21. San Francisco, CA. Contact: Dale Litherland, Electronic Conventions, Inc. 8110 Airport Blvd., Los Angeles, CA. 90045. (213) 772-2965.
- **Global Telecommunications Conference (GLOBECOM '85)** — Dec. 2-5. Hyatt Regency, New Orleans, LA. Contact: G.A. Ledbetter, South Central Bell, 365 Canal Street, New Orleans, LA. 70140. (504) 528-7350.
- **10th Int'l Conference on Infrared and Millimeter Waves** — December 9-13, American Dutch Resort Hotel, Lake Buena Vista (Orlando) Florida. Contact: Kenneth J. Button, MIT, Box 72, MIT Branch, Cambridge, MA. 02139-0901 (617) 253-5561.

1986

- **1986 Reliability and Maintainability Symposium** — Jan. 28-30. Riviera Hotel, Las Vegas, NV. Contact: V.R. Monshaw, RCA Astro-Electronics Division, P.O. Box 800, MS 55, Princeton, N.J. 08540. (609) 426-2182.
- **Int'l. Solid-State Circuits Conference (ISSCC)** — Feb. 12-14. San Francisco Hilton, San Francisco, Ca. Contact: Lewis Winner, 301 Almeria Avenue, Coral Gables, FL. 33134. (305) 446-8193.
- **5th Annual Phoenix Conference on Computers & Communications** — March 2-5. Phoenix, AZ. Contact: Doug Powell, Motorola, Inc. P.O. Box 2953, Phoenix, AZ. 85062. (602) 244-3965.
- **Int'l. Zurich Seminar on Digital Communications: "New Directions in Telecommunications Switching and Networks"** — March 10-12. Swiss Federal Institute of Technology (ETHZ), Zurich, Switzerland.

Contact: Professor A. Kundig, Institut fur Elektronik ETH-Zentrum, ETZ J87, CH-8092 Zurich, Switzerland. Tel: +41-1-256 51 80.

- **SOUTHCAN '86** — March 11-13. Orange County Convention Center, Orlando, FL. Contact: Dale Litherland, Electronic Conventions, Inc. 8110 Airport Blvd. Los Angeles, CA. 90045 (213) 772-2965.
- **Int'l. Reliability Physics Symposium** — April 1-3. Anaheim, CA. Contact H.C. Jones, Westinghouse, P.O. Box 1521, MS 3664, Baltimore, MD. 21203. Tel. (301) 765-7387.
- **IEEE INFOCOM '86** — April 13-17. Sheraton Bal Harbour, Miami, FL. Contact: IEEE INFOCOM '86. P.O. box 639, Silver Spring, MD. 20901. (301) 589-8142. TWX: 7108250437 IEEECOMPSO.
- **INTERMAG** — April 14-18. Hyatt Regency Phoenix, Phoenix, AZ. Contact: R.J. Fairholme, Motorola, Magnetic Bubbles, 7402 South Price Road, Tempe, AZ. 85283. (602) 897-3005.
- **World Conference on Continuing Engineering Education** — May 7-9. Dutch Inn Resort Hotel, Lake Buena Vista, FL. Contact: Dr. Joseph Biedenbach, University of South Carolina, College of Engineering, Columbia, S.C. 29208. (803) 777-6693.
- **National Aerospace & Electronics Conference (NAECON '86)** — May 18-20. Dayton Convention Center, Dayton, OH. Contact: NAECON, 110 East Monument Avenue, Dayton, OH. 45402, (513) 223-6266.
- **Int'l. Microwave Symposium & Workshops** — June 2-6. Baltimore, MD. Contact: Edward C. Niehenke, Westinghouse Electric Corp. P.O. Box 746, M.S. 339, Baltimore, MD. 21203. (301) 765-4573.
- **Microwave and Millimeter Wave Monolithic Circuits** — June 4-5. Baltimore, MD. Contact: Roger W. Sudbury, L-324, MIT Lincoln Laboratory, P.O. Box 73, Lexington, MA. 02173. (617) 863-5500.
- **AFRTG** — June 5-6. Baltimore, MD. Contact: Mario A. Maury Jr., Maury Microwave Corporation, 8610 Helms Avenue, Cucamonga, CA. 91730. (714) 987-4715. ext. 21.
- **Int'l. Quantum Electronics Conference (IQEC '86)** — June 9-13. Phoenix, AZ. Contact: Meetings Dept., Optical Society of America, 1816 Jefferson Place, NW, Washington, D.C. 20036, (202) 223-8130.
- **Int'l. Conference on Communications — ICC '86** — June 21-25. Sheraton Hotel, Toronto, Ontario, Canada. Contact: Hugh J. Swain, Andrew &

Antenna, Ltd. 606 Beach St., West Whitby, Ontario, Canada L1N 562. (416) 668-3348.

- **Intersociety Energy Conversion Engineering Conference (IECEC)** — Aug. 24-29. Town and Country Hotel, San Diego, CA. Contact: Barbara Hudson, Shirley Blackwell, American Chemical Society, 1155 16th Street, NW, Washington, D.C. 20036. (202) 874-4401.
- **1986 IEEE Int'l. Symposium on Electromagnetic Compatibility** — Sept. 16-18. Town and Country Conference Center, San Diego, CA. Contact: Herbert K. Mertel, EMACO, Inc. 7562 Trade St. San Diego, CA. 92121. (714) 578-1480.
- **Electronics and Aerospace Systems Conference** — Sept. 22-24.
- **Int'l. Telecommunications Energy Conference (INTELEC '86)** — Oct. 19-22, Royal York Hotel, Torontot, Ontario, Canada. Contact: R.C. Byloff, Fincor-Incom International, 3750 East Market Street, York, PA. 17402. (717) 757-4641.
- **IEEE Professional Communication Conference — PCCC '86** — Oct. 23-24. Charlotte, N.C. Contact: Dr. Lois K. Moore, Johns Hopkins University, Applied Physics Laboratory, Room 14-132M, Johns Hopkins Rd. Laurel, MD. 20707. (301) 953-1700, Ext. 406.
- **1986 Int'l. Test Conference (Cherry Hill '86)** — Oct. 28-30. Franklin Plaza Hotel, Philadelphia, PA. Contact: Harry Hayman, P.O. Box 639, Silver Spring, MD. 20901. (301) 589-8142.
- **1986 Ultrasonics Symposium** — Nov. 17-19. Conference Center, Williamsburg, VA. Contact: R. Moore, Westinghouse Electric Co., P.O. Box 756, MS 296, Baltimore, MD. 21203. (301) 765-1000.



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