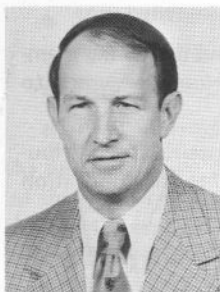




EDITOR: Nat Pelner

Hughes Aircraft Co., Missile Engineering Labs, Canoga Park, California 91304

Number 81, Winter 1976



## ADCOM HIGHLIGHTS

by Pete Rodrigue

The December ADCOM meeting, originally set for Washington on Dec. 2, was held instead in New Orleans on Wednesday, Dec. 3. The change was made at Dick Emberston's request to prevent a conflict with a TAB meeting and a TAB workshop on Monday and Tuesday. The IEEE Board was also meeting in New Orleans to work out the '76 budget. The meeting in New Orleans facilitated some give and take between ADCOM members and the IEEE "power structure" and resulted in generally improved understanding all around.

One major understanding by all concerned is that MTT's financial position continues to deteriorate. This situation will not be helped by the recent IEEE dues increase. The proposed budget shows that Groups and Societies will get none of that increase, and furthermore they will be charged additional overhead expense amounting to somewhere between \$200,000 and \$300,000. Director Bob Rivers outlined these points to our ADCOM, and subsequently led a successful move to block Board of Director's approval of that budget. At this writing the final budget has not yet emerged.

George Oltman, Finance Chairman, noted that calendar year 1975 will no doubt show MTT/S operating at a deficit of between \$4,000 and \$16,000, and our reserve, while positive, will be vanishingly small. The proposed IEEE budget projected a 1976 deficit for MTT/S of between \$20,000 and \$30,000, which would leave us with a sizable negative reserve. Several steps were taken at the ADCOM meeting to ease this financial problem.

ADCOM unanimously approved a motion to reduce the MTT-Transactions page budget for 1976 from 1200 pages to 1000 pages. ADCOM also approved at this meeting a proposal to establish, on an experimental basis, a "quota"

system for "free" pages in the Transactions. Once the quota for free pages in each issue have been met, papers whose page charges are not honored will be placed on a waiting list for the next issue with space available in the quota. This policy is modeled after that used by the American Institute of Physics. At the September meeting ADCOM approved a mandatory overlength paper page charge system. These new page charge systems will be implemented immediately, and should provide a better financial base for the Transactions.

Possible means of reducing the cost of publication of the Transactions were discussed, such as publishing six issues/year rather than the current twelve issues/year.

The ADHOC Committee on professional exhibits management submitted a set of recommendations that ADCOM unanimously approved. In essence these recommended that ADCOM contract with a professional manager to take over responsibility for continuing industry interaction — including exhibits, coffee breaks, and digest listings. It was further proposed that a three year contract be developed that assures MTT/S of appropriate financial returns.

A subcommittee chaired by Larry Whicker, and additionally composed of Ken Button, Steve Adam, Warren Cooper and George Oltman was appointed to develop such a contract for ADCOM approval in late January.

Louie Moose reported on preparations for the 1976 Microwave Symposium at Cherry Hill and on the revised budget for that meeting. Steve Adam presented the final report on the 1975 Symposium which shows a net profit of \$12,001.

Ken Button, Meetings and Symposium Chairman, gave reports on tentative arrangements for the 1977 (San Diego) and 1978 (Ottawa) Symposiums as well as the 1976 Submillimeter Wave Conference. This last meeting is scheduled for December 6-10, 1976, in Puerto Rico. Jim Gallagher (Georgia Tech) is in charge of arrangements.

Bill Guy (Seattle) and Lamar Allen (Florida West Coast) both indicated interest by their chapters in hosting the 1979 Symposium.

Bob Beatty, outgoing Standards Coordinating Committee Chairman, reported on the painstaking activity in that area, and Bill Guy described on COMAR Activity.

(continued on page 2)



## REPORT OF DIVISIONAL DIRECTOR

by Bob Rivers

The year 1975 has been a very active one for me. My principal thrust has been to get the Board of Directors, the Officers, and the various entities to address the Member's needs and to effectively serve the members. I have served on the Long Range Planning Committee that has completed a three year task that addressed the needs of the membership. It is hoped that next year will see the implementation of many of the recommendations both as to goals relating to the membership and organization that can direct itself toward the member oriented goals. The goals relate to the continuance of the technical excellence of the Institute's products, and the central theme of enhancing the Lifetime Careers of the members.

With the backing of a number of interested members, I have succeeded in getting the Board to adopt the Statement of Engineers Needs. In addition, after many iterations, the Board adopted the IEEE Position on Age Discrimination. Further work on the U.S. Activities Board resulted in the adoption of a reorganization proposal with a focus on goal orientation rather than simply activities as in the past. Extensive meetings with present and past leaders of the Institute, Professional Activities committeemen, other Directors, and members lead to the development of a number of Goals for the Professional Activities. It is expected that the Goal orientation will lead to more action and less talk.

I have consistently recommended that the other entities review what is being done in order to more effectively deliver valuable services to the member. Early in the year, I detected an attitude of transferring more of the Institute overhead costs to the Groups and Societies. The budget presented to the Board did in fact do just that and was not accepted. It is expected that the budget finally presented will show a continuation of previous levels of support to the Groups and Societies. I am dedicated to maintaining the support of Technical Activities. I am concerned about the responsibility of the Groups and Societies to deliver Applications information to our members and would welcome any suggestions. Is there a cooperative Divisional solution?

In this next year, I hope to be able to promote and have adopted many of the recommendations of the Long Range Planning Committee. One important recommendation is an organizational one recommending a Management by Objective System. If this is implemented, then you as members should be able to see how the Institute is progressing toward the goals. The goals that will be established will be related to the following recognized needs for which the members have banded together in the Institute.

1. Ready access to information about the latest additions to the body of knowledge underlying the profession and the application of this knowledge.
2. Convenient forums for describing and discussing members' contributions to the body of knowledge and to the application of this knowledge.
3. Recognition by one's peers of important contributions to the body of knowledge and to the application of this knowledge.
4. Opportunity to take part in activities of a broad technical, professional or managerial nature.
5. Opportunity to apply one's knowledge and expertise to the solution of problems of broad national or international scope.
6. Opportunity to associate with one's peers on a professional and social level.
7. Recognition of the economic value of the profession to society and of the need for appropriate financial rewards for its practitioners.
8. Strengthening of the prestige of electrical engineering, as a profession, and of its members as practitioners of that profession.
9. Opportunity to pursue a lifetime career in electrical engineering or related fields of activity.
10. Opportunity to influence government decisions about technical matters that affect the quality of life and the public welfare and about professional matters that affect the standing of electrical engineers.

### ADCOM HIGHLIGHTS (continued from page 1)

Lamar Allen reported on progress to date on the project to implement a summarization of microwave knowledge, the microwave encyclopedia suggested during Bob Rivers' term as ADCOM President. Lamar has been in contact with several possible publishers and has worked up a sample chapter for use in a proposal. ADCOM approved in principle that the University of South Florida act as a sponsoring agent, with MTT cooperating, for purposes of submitting a proposal to the National Science Foundation.

ADCOM commended President Warren Cooper for his masterful handling of meetings this year and adjourned the meeting at 4:30.



## CHAPTER ACTIVITES

by Larry Whicker

### Chapters Activity in Symposia —

In addition to running chapter meetings, many MTT chapter host our International Symposia each year. This year the San Francisco chapter held a most successful symposium in Palo Alto. Plans are now underway for our next three symposia:

- 1976 — Cherry Hill, New Jersey  
sponsored by several East Coast chapters
- 1977 — San Diego, California
- 1978 — Ottawa, Canada

As our bylaws are now written, ADCOM will select the site of the 1979 symposium at its June meeting in Cherry Hill. At the December 3 ADCOM meeting, it was decided that the 1980 symposium site should be selected in June also (provided bylaws can be amended in time). This will provide local chapters more time to obtain suitable accommodations. The Seattle AP/MTT chapter has indicated that it will propose a Joint MTT/AP Symposium for 1979. Additionally, the combined Florida West Coast-Orlando chapters have indicated that they are preparing a proposal for the 1979 symposium. Other chapters are encouraged to bid for the 1979 or 1980 symposium. You can obtain further information on how to prepare a proposal for holding a symposium by contacting:

Ken Button, Chairman  
Meetings and Symposia  
MIT-National Magnet Laboratory  
Bldg. NW-14  
Cambridge, MA 02139  
Phone (617) 253-5561

### New Membership Services Chairman —

In 1976 I will be assuming other duties on MTT ADCOM and Dick Sparks will be taking over Membership Services. I would like to express a debt of gratitude to the Chapter Officers and to the other Membership Services Committee members who have worked so hard over the past few years. They include:

Newsletter:	Nat Pelner
Chapter Records:	Gene Chao Barry Spielman
National Lecturers:	1972 — Ted Saad 1973 — John Allen 1974 — Si Okwit FY1976 — Bob Beatty FY1977 — Fred Stertzner
Membership:	Dick Sparks Dave Wait



## EDITORS NOTES

by Nat Pelner

The IEEE presidential election is over, the balloting is complete, the votes have been counted, and the new president for 1976 has been elected. This is the first election I can recall where two presidential candidates were on the ballot. We had a choice. (This editorial is not concerned with who won, but how many members voted.)

In past years, when we had no choice on the ballot, approximately one-third of the membership took the time to vote — a poor turnout. One could have argued that with one candidate on the ballot, the final result was preordained, so why bother to vote. This year we had a clear choice and still only about one-third voted. Approximately 51,000 out of 155,000 members voted with the winner receiving about 31,000 votes. 31,000 votes decided the election for 155,000 members. This is sad commentary. Is it that we are disinterested, apathetic, or just too lazy to read a paragraph about the candidates, check a box, seal an envelope, stamp and mail it? This means that a very small minority has elected the top officers of the Institute who influence the direction that our professional society moves.

Your responsibility as a voting member of IEEE is to be informed about the candidates. Review what they have done for the IEEE. Review their experience that would help them lead IEEE. Evaluate the value of their own careers in providing IEEE with the leadership it needs. Finally, your duty is to cast your ballot for the candidate of your choice.

# CALL FOR PAPERS

## FIRST ANNOUNCEMENT

### SECOND INTERNATIONAL CONFERENCE AND WINTER SCHOOL ON SUBMILLIMETER WAVES AND THEIR APPLICATIONS

San Juan, Puerto Rico, December 6 - 10, 1976

The 1976 Submillimeter Wave Conference and Winter School will be held with the joint sponsorship of the Optical Society of America and the IEEE Society on Microwave Theory and Techniques and with the cooperation of the International Commission for Optics.

Any work concerned with submillimeter wave and far infrared theory, techniques, devices, system spectroscopy, and applications will be considered. The wavelength range of interest is loosely defined as 25 micrometers to one millimeter. The following subject areas are particularly appropriate:

#### APPARATUS

**Coherent sources, tunable and fixed frequency:** Discharge lasers, optically pumped lasers, difference frequency mixing, electron-beam devices, parametric oscillators, semiconductor sources, harmonic generators, spin-slip lasers, IR and visible lasers to optical pumping.

**Detectors, all types, including:** Photoconductor, bolometer, heterodyne, Josephson junction, pyroelectric, diode.

**Modulators:** Electro-optic, magneto-optic, ferrite.

**Instruments and Devices:** Spectrometers, interferometers, filters, integrated optics: waveguides.

#### MEASUREMENTS

**Spectroscopy:** Laser, Fourier, magnetic resonance, double resonance, cyclotron resonance, lattice dynamics, impurities and imperfections.

**Astronomy and Astrophysics:** Cosmic background, line emission

**Nonlinear Optics; Radiometry; Plasma Diagnostics:** Laser interferometry. Ellipsometry: Atmospheric Propagation; Standards: Frequency standards, radiation standards.

#### APPLICATIONS

**Communications; Radar; Pollution Detection; Analysis; Plasma Interactions; Isotope Separation.**

Authors of contributed papers must submit a 35-word abstract (for publication in the preliminary program) to the Program Chairman, (K.J. Button, MIT) by August 2, 1976. A summary of 500 to 1000 words with up to 4 illustrations must also be submitted on special camera-ready paper for publication in the Conference Digest of Technical Papers. The special paper may be obtained from the Publications Chairman (S. Perkowitz, Emory) and the summaries should be returned to him by October 1, 1976.

Authors may also wish to submit a manuscript for publication in the Conference Proceedings. These must be restricted to less than 4 journal pages and should be sent to the program chairman by November 1, 1976. Accepted manuscripts will be collected and published in Applied Optics or in the IEEE Transactions on Microwave Theory and Techniques.

The contributed-paper sessions and the tutorial review seminars will be held during the mornings and evenings of the five days. Panel discussions are directed discussion groups will convene in parallel sessions in the open air during the afternoons. Hotel reservations must be made through the office of the General Chairman (J.J. Gallagher, Georgia Tech.).

#### Program Chairman

Kenneth J. Button  
Massachusetts Institute of Technology  
National Magnet Laboratory  
Cambridge, Massachusetts 02139 USA

#### General Chairman

James J. Gallagher  
Engineering Experiment Station  
Georgia Institute of Technology  
Atlanta, Georgia 30332 USA

#### Publications Chairman

Prof. Sidney Perkowitz  
Physics Department  
Emory University  
Atlanta, Georgia 30322 USA

## BOOK REVIEW

THEORY OF WAVEGUIDES, by L. Lewin  
Halsted Press, 1975

Waveguides have provided theoreticians with a very fertile area of research for many years now. This endeavor has produced a substantial body of rather mature work which has been documented in a number of books the latest of which is this excellent one by Professor Lewin. Those who are deeply into direct numerical techniques may be disappointed to find that the book contains not one computer program or flow chart. Professor Lewin very ably defends this omission in his introduction while recognizing the importance and power of numerical techniques. The book is, rather, an exposition of analytical methods applied to waveguide problems. Indeed, it is the methods that are emphasized throughout the book rather than results. The practicing microwave designer will search in vain for graphs and charts of results of the type found in the "Waveguide Handbook." What will be found though are many useful formulas from which the data for graphs can be obtained. Also included are equivalent circuits of various waveguide probes (coaxial cable to waveguide transition) and junctions. Professor Lewin's occasional references to methods of device construction will certainly be appreciated by those who design microwave components. It will also be an important lesson for the student; namely, that some 'nuts and bolts' knowledge of microwave devices is essential to the modeling process if useful results are desired.

The author's deference to the design engineer gives the book but a tinge of engineering application. The real substance of the book is analytical methods. To get the full message from this text one must have a substantial and rather sophisticated mathematical background. More so, I suspect, than that possessed by the average microwave engineer. For those who do have such a background and are serious students of microwave theory the book provides an excellent vehicle for study although it is highly specialized. It is a well organized book. At the beginning of each of the chapters which contain a particular mathematical method the author has included a compact description or derivation. This is followed by applications. The examples are carried through until a relevant formula is obtained. As one might expect of an advanced text the reader should be prepared to study not only the text but many of the references as well.

The first two chapters are rather short and contain much that is standard. In Chapter 1, for example, he begins with Maxwell's equation then introduces the Hertzian vector, curvilinear coordinator, scalar and vector solutions of the wave equation, etc. The so-called 'bicomplex' functions are introduced in Chapter 1. These are used in a number of places throughout the book. Chapter 2 is concerned with propagation in straight waveguides (rectangular and circular types). Included also is a treatment of waveguides with lossy walls in which he discusses briefly the coupling of modes.

Chapter 3 is entitled "Propagation in Corrugated and Loaded Waveguide." The author thoroughly treats the cases of particle loaded media (spherical particles in a cubic lattice), longitudinally loaded waveguides including transversely magnetized ferrites, corrugated and helically anisotropic circular waveguides. Of special interest is the inclusion of an analysis of the shielded microstrip line. A detailed treatment of propagation in curved, twisted and tapered waveguides is given in Chapter 4. Here the author treats both the E-plane and H-plane bends, as well as, twists in rectangular waveguide. To facilitate the handling of curved waveguides a procedure is presented for the development of an orthogonal coordinate system about an arbitrarily smooth curve which represents the waveguide axis. This procedure is then used in the treatment of curved circular waveguides. The chapter is ended with the analysis of the tapered waveguide.

The remainder of the book is concerned with obstacles in waveguides. In Chapter 5 cylindrical rods, posts and probes in rectangular waveguides are treated (including tilted rods, tuned posts and coax-to-waveguide transitions). Diaphragms in rectangular waveguides are treated in Chapter 6 and multiple diaphragms and gratings in Chapter 7. Chapters 8 and 9 are concerned with waveguide junctions with changes of shape treated in 8 and changes of media treated in 9. In both cases junctions which also have single or multiple diaphragms are considered. In an appendix the radiation from curved surface wave structures (dielectric slabs and rods) is treated.

A variety of analytical methods are introduced in Chapters 5 through 9. Included are quasi-static, variational, conformal transformations, Wiener-Hopf and singular integral methods. The singular integral solution was pioneered by Professor Lewin and this is certainly the most extensive presentation of the method to appear in a single volume to date.

Professor Lewin has made many contributions to the solution of waveguide problems over the years. He has chosen to write this book, in part at least, as an active researcher presenting the state of the art within his field, displaying recently developed techniques along with older ones. He points out limitations of the various methods and some of the unresolved theoretical problems which point the way for further research. This gives the book a freshness and immediacy not usually found in texts. But this is done with some sacrifice on his part because as these problems become resolved the book becomes somewhat dated.

The educator will no doubt be disappointed at the absence of problem sets. This will discourage some from adopting it as a text for a course. However, the trend recently has been away from such highly specialized courses where this book might be used. It would, however, be an excellent choice for an independent study or directed study course.

This book should find its way into the personal library of all who have a serious interest in waveguide problems.

Reviewed by Professor Edmond S. Gillespie  
California State University, Northridge

## SHORT COURSES

**TITLE:**

Microwave Semiconductor Devices, Circuits,  
and Applications

**DATE:**

July 19-23, 1976

**LOCATION:**

George Washington University, Washington, D.C.

**CO-CHAIRMAN:**

George I. Haddad  
Peter J. Khan

**DESCRIPTION:**

This course provides a basic understanding of operating principles and design techniques for microwave devices and circuits utilizing solid-state elements including varactors, pin diodes, detectors, mixers, avalanche diodes, Gunn devices and BARITT devices. Recent advances in these various areas will be discussed.

**FEE:**

\$375

**TITLE:**

Microwave Remote Sensing of the Earth, Ocean,  
and Atmosphere

**DATES:**

March 8-12, 1976

**LOCATION:**

George Washington University, Washington, D.C.

**DESCRIPTION:**

This course is designed for engineers, scientists, and managers in both government and industry who need to keep abreast of the latest techniques for the measurement of the physical properties of our planet through the use of microwave remote sensing. The objective of the course will be to define fundamental relationships of the earth, ocean and atmosphere to be derived at great distances with microwaves. Secondary emphasis will be placed on the description of the instrumentation. There is no prerequisite for the course; however, some familiarity with the concepts of electromagnetic theory would be helpful.

**FEE:**

\$415

For further information, please write to the Director, Continuing Engineering Education, George Washington University, Washington, D.C. 20052, or call (202) 676-6106.

**TITLE:**

Laser Technology

**DATE:**

March 22 - 26, 1976

**LOCATION:**

George Washington University, Washington, DC

**CO-SPONSOR:**

Naval Research Laboratory

**DESCRIPTION:**

This course is designed for technical personnel who need a better understanding of the theory and applications of modern laser technology. It emphasizes recent technological advances in the major laser devices and includes present capabilities, specifications, limitations, and near term prospects, along with general theory of various laser devices. Time will be provided for discussion of special problems and a tour of laser laboratories at the Naval Research Laboratory. Topics include: Review of atomic and molecular physics, laser principles, lasers and devices, high power CW laser devices, Tunable dye lasers, isotope separation, non-linear processes, industrial applications of high and low power lasers, integrated and fiber optics, optical communications, direct electron beam excitation of lasers, high power pulsed CO<sub>2</sub> lasers, high power pulsed solid state lasers, laser damage to materials; present status and possible improvement.

**COORDINATOR:**

S. Searles, Project Leader, Laser Physics Branch, NRL

**FEE:**

\$405

For further information, write to the Director, Continuing Engineering Education, George Washington University, Washington, DC 20052, or call (202) 676-6106.

**TITLE:**

Fiber and Integrated Optics

**DATE:**

April 12 - 16, 1976

**LOCATION:**

George Washington University, Washington, DC

**DESCRIPTION:**

This course is designed for engineers, scientists, managers,

*(continued on page 7)*

SHORT COURSES (continued from page 6)

and others who need a better working knowledge of fiber integrated optics technology. Emphasis will be placed on recent technological advances in fiber and integrated optics. Present capabilities, limitations, near term prospects, and a description of current applications for this technology will be included. In addition, the course will be structured so that the participants should acquire a solid understanding of the basic principles, theory, and techniques of fiber and integrated optical communications, as well as an appreciation for future potential applications. Attendees will receive a homework problem each day to be solved on a voluntary basis. The solution will be thoroughly discussed the following morning.

FEE:  
\$395

For further information, please write to the Director, Continuing Engineering Education, George Washington University, Washington, DC 20052, or call (202) 676-6106.

TITLE:  
Satellite Communications Systems

DATE:  
March 29 – April 2, 1976

LOCATION:  
George Washington University, Washington, DC

DESCRIPTION:  
This course is structured for communications engineers, scientists, managers, and others who need the latest information concerning the use of satellites for communications. The emphasis will be on system design and analysis of communications satellites used for long haul telephone transmission. The presentation will cover the concepts unique to communications satellites, such as multiple access, and will place emphasis on the physical understanding of system design.

FEE:  
\$395

For further information, write to the Director, Continuing Engineering Education, George Washington University Washington, DC 20052, or call (202) 676-6106.

TITLE:  
Electromagnetic Wave Propagation for Communication Systems Design

Date:  
April 19 – 23, 1976

LOCATION:  
George Washington University, Washington DC

DESCRIPTION:  
Designed for managers, scientists, and engineers who need a better understanding of the propagation phenomenon affecting the design and performance of communication systems. It will cover the propagation factors governing the performance of space and terrestrial systems. These factors will then be employed for characterizing, modeling, and predicting the performance of digital communication systems.

FEE:  
\$425

For further information, please write to the Director, Continuing Engineering Education, George Washington University, Washington, DC 20052, or call (202) 676-6106.

## NEWLY ELECTED IEEE FELLOWS

MTT/S WINTER 1976

As of January 1, 1976 a total of 112 new Fellows of IEEE were named, eleven of which are MTT members. These members are listed below together with the citation of their outstanding contributions. Congratulations on this well deserved recognition of your professional achievement.

- |   |   |
|---|---|
| Professor Kun-Mu Chen<br>Michigan State University<br>Dept. of Electrical Engineering<br>East Lansing, Michigan 48824                       | For contributions to electromagnetics and plasmas.  |
| Professor Alexander Hessel<br>2128 East 14 Street<br>Brooklyn, New York 11229   | For contributions to the theory of periodic structures as applied to phased array antennas.                                       |
| Dr. Takashi Kitsuregawa<br>Mitsubishi Electric Corporation<br>Central Research Laboratory<br>Minami-Shimizu<br>Amagasaki City, Hyogo, Japan | For contributions to the development of high-performance microwave antennas   |
| Professor Yasuto Mushiake<br>Tohoku University<br>Faculty of Engineering<br>Sendai, Japan   | For contributions to linear antennas and self-complementary antennas.   |
| Dr. Elie Roubine<br>University of Paris<br>Ecole Supérieure d'Electricité<br>10 Avenue Pierre Larousse<br>92240 Malakoff, France            | For contributions in teaching and research in the field of electromagnetic theory, communication theory, and applied mathematics. |
| Dr. Karl J. Schmidt-Tiedemann<br>Philips Forschungslaboratorium<br>Vogt-Kolln-Strasse 30<br>2 Hamburg 54 FR, Germany                        | For contributions in management of industrial research.   |

(continued on page 8)

Dr. Martin V. Schneider  
46 Line Road  
Holmdel, New Jersey 07753

For contributions to millimeter-wave integrated circuits and devices.

Mr. J. Paul Shelton, Jr.  
Naval Research Laboratory  
Code 5307-S  
4555 Overlook Avenue  
Washington, D.C. 20375

For contributions to the theory and design of microwave antennas and feed networks.

Mr. Robert L. Slevin  
34 Gilbert Lane  
Hicksville, New York 11803

For contributions to microwave filters and equalizers and to the development of low-noise amplifiers for satellite communications.

Professor William H. Steier  
University of Southern California  
Dept. of Electrical Engineering  
Los Angeles, California 90007

For contributions in the fields of optical and microwave devices.

Dr. William D. Warters  
Bell Telephone Laboratories, Inc.  
Room 2F 335  
Holmdel, New Jersey 07733

For contributions to the understanding of wave propagation in multimode media and to the development of millimeter waveguide transmission systems.

## INSTITUTIONAL LISTINGS

The IEEE Microwave Theory and Techniques Society is grateful for the assistance given by the firms listed below, and invites application for Institutional Listing from other firms interested in the microwave field.

**PRD ELECTRONICS, INC.**  
Subsidiary of Harris Corp.  
1200 Prospect Ave., Westbury, N.Y. 11590  
Microwave Instruments & Components, Electronic Measurement Systems, Automatic Test Equipment

**PHILIP S. CARTER ASSOCIATES**  
221 Iris Way, Palo Alto, Calif. 94303  
(415) 941-5120  
Consulting & Design Services, Filters & Couplers, including Electronically Tuned Oscillators:  
Fixed & Electronically Tuned. Computer Programmed Design Procedures.

**MECA ELECTRONICS, INC.**  
459 E. Main St., Denville, N.J. 07834  
Tel. 201-625-0661 Telex 136495  
Microwave Components, Including:  
Attenuators: Fixed & Variable, Terminations, Directional Couplers, Power Dividers

**WAVECOM**  
An Operating Company of Wavecom Industries  
9036 Winnetka Ave., Northridge, Calif. 91324  
Tel. 213-882-3010  
Microwave Filters/Multiplexers, Directional Couplers, Adjustable Gain Equalizers

An Institutional Listing recognizes contributions to support the publication of the IEEE Transactions on MICROWAVE THEORY AND TECHNIQUES. Minimum rates are \$60.00 for listing in one issue; \$260.00 for six consecutive or alternate issues; \$440.00 for twelve consecutive issues. Larger contributions will be most welcome. No agency fee is granted for soliciting such contributions. Inquiries, or contributions made payable to the IEEE, plus instructions on how you wish your Institutional Listing appear, should be sent to R. M. Emberson, The Institute Electrical and Electronics Engineers, 345 East 47 Street, New York, N. Y. 10017.

## SPEAKERS TRAVELING OVERSEAS

Reciprocal advantages accrue when competent speakers present papers to IEEE Sections in foreign countries. IEEE members in any country, contemplating a foreign trip (transatlantic, transpacific, transcaribbean, etc.) and desirous and capable of making engineering contacts of this type are invited to inform Miss Emily Sirjane at the IEEE Headquarters office in New York, who will furnish the names and addresses of Section Chairmen with whom the speaker may work out arrangements directly.

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