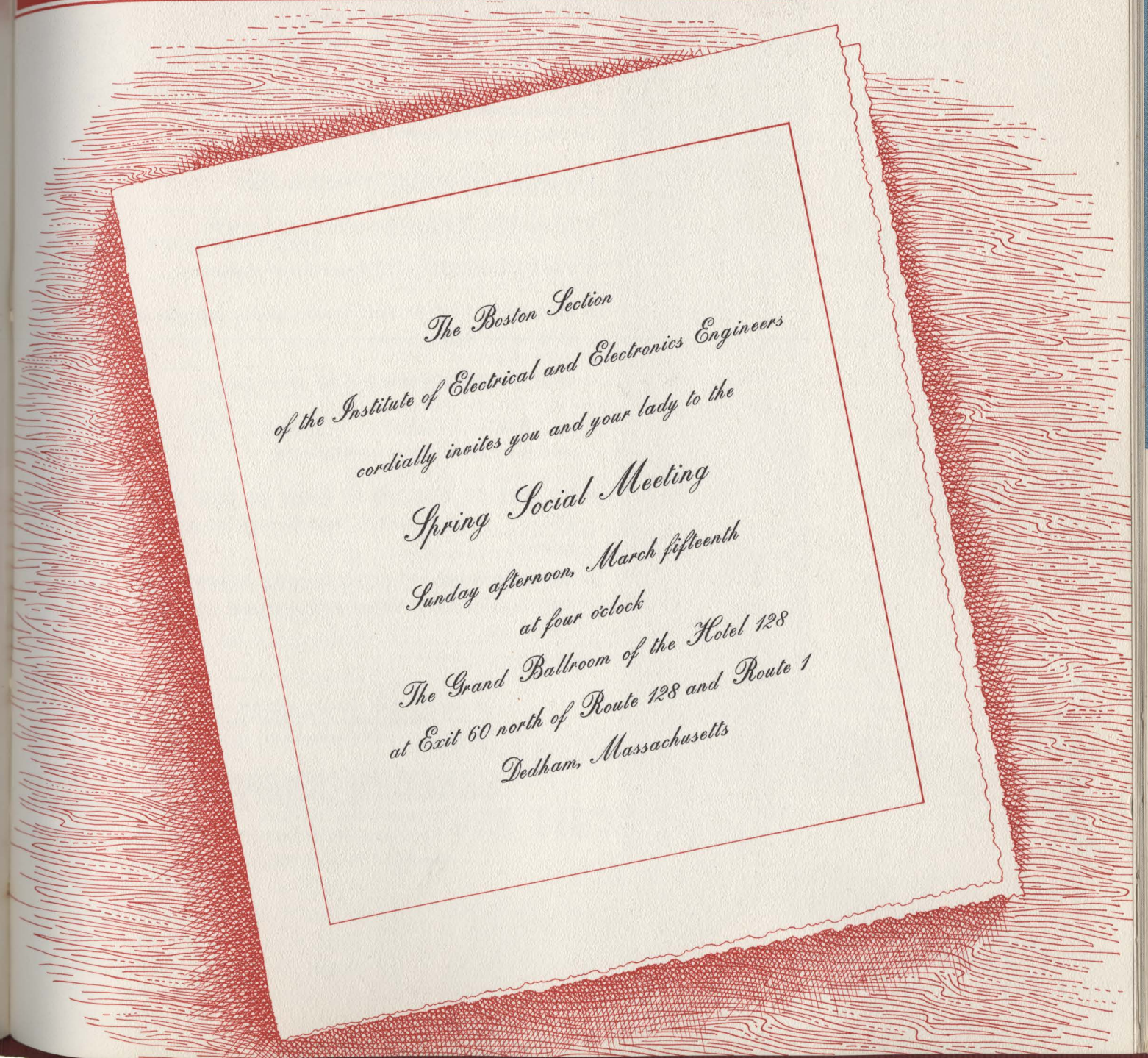
MARCH 1964
VOLUME 12, No. 7

The Reflector

PUBLISHED BY THE BOSTON SECTION OF THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

SPRING LECTURE SERIES

See pages 6 & 7



The Reflector

MARCH 1964

Volume XII, No. 7

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INDEX TO ADVERTISERS

IEEE FLIGHT TO LONDON CANCELED

Because the new fare structure for transatlantic flights makes a very inexpensive 14-21 day excursion available to individuals, a group flight such as the one we had planned for London is no longer as attractive as it used to be. Therefore, our plans for a group flight, which was to have left Boston on June 22, have been dropped.

The ECPD and Engineering

RONALD E. SCOTT
Chairman — Boston Section

ENGINEERING education is a slightly oscillatory system which gets a step-function input about once each decade through a revision of the accrediting requirements by the Engineers Council on Professional Development.

Prior to 1930 there was little or no humanities in engineering curricula. The Wickenden report of 1930 recommended a change, and since that time approximately 20% of the hours must be devoted to cultural subjects for accreditation. Many schools have exceeded this amount, and sometimes technical and quantitative subjects have suffered.

The Jackson report of 1940 wrestled with the problem of crowded curricula and recommended graduate training in professional areas. As a direct result of this report some schools abolished engineering at the undergraduate level and made engineering a graduate field.

The Grinter report of 1955 recognized that engineering in the 1940s had been too empirical and recommended the inclusion of more mathematics and science. As a direct result of this report many schools have dropped engineering subjects entirely and concentrated on mathematics and physics.

A new study is being conducted at the present time to redefine the goals of engineering education, to revise the undergraduate accreditation requirements, and to consider the accreditation of graduate degrees. Questionnaires are being sent to selected industries and to all the engineering schools. Individual opinions are solicited and should be sent to:

COMMITTEE ON GOALS OF ENGINEERING EDUCATION
Office of the Dean of Engineering
Purdue University
Lafayette, Indiana.

The Committee is interested in the role of the engineer in industry, the number and types of engineers which we will need, the basic training which engineers must have, and the relative number of graduate degrees which are needed. At the level of the undergraduate curriculum it is interested in the relative importance of courses on design, computers, effective writing and speaking, mathematics, physics, and the humanities and the depth of training versus the breadth of training. At the graduate level they are interested in full-time versus part-time graduate study, lecture courses versus thesis work, and on-campus versus off-campus courses.

If you have any strong feelings about engineering education, or any significant data relative to it, be sure to send them in. This is your chance to give the pendulum a little push for the next decade.

Power Group Forming

THE Utility Systems Technical Discussion Group of the Boston Section of IEEE has recently petitioned the IEEE Executive Committee to establish a PTG-P Chapter in Boston.

The first question may well be, "What is the PTG-P?" To some of us who came into IEEE from AIEE, it may appear something quite new. It really isn't. Spelled out, it is a Professional Technical Group on Power. This is actually akin to the AIEE Power Division, expanded to provide personal association and participation by every interested IEEE member.

The vital unit of the PTG-P organization is the Chapter. We are in the process of organizing a Chapter in the Boston Section. The PTG-P Chapter contributes to the Section program by organizing meetings and carrying on other activities representing the interests of the PTG-P members.

The PTG-P will also produce a monthly publication. Beginning with the January 1964 issue, "Power Apparatus and Systems" will appear monthly as the magazine of PTG-P entitled "IEEE Transactions on Power Apparatus and Systems." Membership in the PTG-P will carry an annual fee of $6.00, including the subscription to the monthly PA&S.

The Section Technical Group on Utility Systems, organized for the 1963-64 year, has the basic organizational framework to become a PTG-P Chapter. We plan on holding elections for a new slate of officers in April 1964. Any member of IEEE wishing to participate and help reorganize some of the old AIEE members, should come forward and get into the group.

After a year of not quite knowing which way old AIEE members were heading, we are now emerging from the fog. This year will be the year to get Power and the "kW people" back into action.

W. F. HAMM, *Chairman*
Section Technical Group
on Utility Systems
Boston Section IEEE

MERRIMACK VALLEY SUBSECTION

Annual Ladies' Night

THE annual Ladies' Night of the Merrimack Valley Subsection will be held at the Treadway Inn in Lawrence. Our speaker will be Cecilia Payne-Gaposchkin of Harvard College Observatory. Professor Payne-Gaposchkin, an authority on variable stars, was Phillips Astronomer at the Observatory before she became a professor in 1956.

C. PAYNE
Harvard

A native of England, she received the PhD degree from Radcliffe College in 1925. In 1957, Professor Payne-Gaposchkin received the Annual Achievement Award of the American Association of University Women.

Tickets for the pre-meeting dinner may be obtained from Mrs. R. A. King, Bell Telephone Laboratories, 1600 Osgood Street, No. Andover, Mass., telephone 686-0600, ext. 2233, or Mr. J. F. Russell, Western Electric Co., (same address and telephone number — ext. 3575).

MONDAY, MARCH 9
Treadway Inn, So. Broadway (next to Falls)
Lawrence, Mass.
Dinner — 6:30pm — Meeting — 7:30pm

High Power Applications of Silicon Controlled Rectifiers

A. S. NADROWSKI — *Westinghouse*

THE development of high power silicon controlled rectifiers in recent years has brought about a radical change in the approach to controlling electrical power. These solid state devices are rapidly usurping roles traditionally played by electromagnetic machinery, performing their tasks with unprecedented reliability and efficiency. The virtually unlimited life of a well-designed SCR circuit plus its compact, silent operation makes it the logical choice for a wide variety of electric power control applications. Two particularly interesting uses for SCRs, to be discussed at this meeting, are DC servo controls and AC motor starters.

One of the most commonly used power servos is the armature-controlled DC motor system. The servo designer has long sought a high-gain, fast-response power amplifying device to take full advantage of the DC motor's capabilities. Unfortunately, he has been hampered by the inherent gain-bandwidth limitations of the various types of rotating amplifiers. The SCR has ideal characteristics for a power amplifier and the development of high current types permits the replacement of many rotating amplifiers with static circuits. In medium power systems, the designer can drive a motor armature directly from a high speed, high gain SCR amplifier, thus obtaining maximum performance from his servo. In the case of higher power servos, a generator must be used to drive the motor armature, but the fields of both machines can be excited by SCR amplifiers.

Static starters or contactors utilize silicon controlled rectifiers and other semi-conductors as an ac power switch thereby providing high reliability and fast response. They are presently made for motors up to 100 hp, 600 volts and in general are designed for applications beyond the capabilities of conventional devices.

Arthur S. Nadrowski, senior design engineer for Westinghouse Motor and Control Division, will show, with slides and demonstrations, the development and application of SCRs to motor starters. Mr. Nadrowski received his BS in Mechanical Engineering from the University of Buffalo and has been with Westinghouse for fourteen years. He is a registered professional engineer in New York and a Senior Member of IEEE.

MONDAY, MARCH 9
Meeting — 7:30pm — MIT, Room 4-231

JOINT MEETING
PTGs ON INFORMATION THEORY AND COMMUNICATIONS SYSTEMS

Diffuse Threshold Decoding for Real Data Channels

A. KOHLENBERG — *Codex Corp.*

DIFFUSE Threshold Decoding, a convolutional error-correcting coding system, will be described. This coding system permits the designer to choose a mixture of random and burst error-correction capability to match to the characteristics of an actual channel. The basic technique will be explained and systems designed for use on telephone circuits, tropospheric scatter circuits, and HF radio links will be described. Slides of equipment will be shown and some test results reported.

Arthur Kohlenberg received his PhD in Physics from Harvard in 1950. Since then he has taught at Boston University and done research at Harvard Observatory, Lincoln Laboratory, and Melpar, Inc. Currently, he is Vice President of Codex Corporation. For some years he has been Editor of the IEEE Transactions on Information Theory.

TUESDAY, MARCH 10
Dinner — 6:15pm — MIT Faculty Club
Meeting — 8:00pm — MIT, Room 4-231

Capacitive and Inductive Transducer Systems

K. S. LION
MIT

THE author will present an outline of the principal capacitive and inductive transducer systems for the solution of a variety of physical, engineering, and biomedical problems. A new method for the conversion of capacitances and inductances into voltage and current signals greatly simplifies the solution of measurement problems, increases the reliability of the operation and reduces space and accessory requirements. Several problems that arise in the application of such transducers will be discussed.

Kurt S. Lion is currently associate professor at MIT. He received his engineering degrees in Germany. Dr. Lion's principal interest is in the field of physical research methodology and instrumentation; his publications are in the field of electronics, gas discharges, high voltages, high frequency, photography, image intensification, and general instrumentation.

He is a member of the American Physical Society, Sigma Xi, and a senior member of the Instrument Society of America.

TUESDAY, MARCH 10
Dinner — 6:00pm — MIT Faculty Club
Meeting — 8:00pm — MIT, Room 4-370

The Use of Data Processing Equipment as an Aid to Publication

L. F. BUCKLAND — *Inforonics*

THE advance of graphic arts techniques has immensely aided technical publication. These graphic arts advantages are soon to be accompanied by data processing techniques which will help the publisher prepare copy, set type, and control layout and scheduling of publications.

The most important benefit of the application of data processing, however, is that it provides a means to solve problems of secondary use of information at the time of primary publication. Using these techniques, authors and editors can contribute immensely to problems which have heretofore been left to abstractors, librarians, documentalists, and the like.

The presentation will consist of a description of the requirements of a scientific publishing system and the potential use and limitations of present day equipment in satisfying these requirements.

The use of punch card and tape typewriters, copy editing devices, such as the Editor I, and general purpose computers in publishing systems will be discussed.

Lawrence F. Buckland is President of Inforonics. His present interests are in the application of digital computers, coupled with photographic and electronic display techniques, to problems of reporting, compilation, editing, storage, and retrieval of textual and graphic information. Mr. Buckland received his BSME at MIT in 1952. He has also attended summer sessions at MIT and studied computer programming at Boston University.

TUESDAY, MARCH 10
Charterhouse Motel, Waltham
Dinner — 6:00pm — Meeting — 8:00pm

Improvement in Doppler Navigator Performance through Spectral Compression

OPERATIONAL Doppler navigation radars are capable (currently) of providing ground speed information at velocities and altitudes in the region of 2500 ft/s and 60 000 ft, respectively. A Doppler navigator capable of operating from a boost glide or lunar landing vehicle would have to provide velocity information from altitudes and velocities of the order of 100 nautical miles and 25 000 ft/s. For these two space applications (boost glide and lunar landing), a system technique which compresses the Doppler spectrum, and reduces terrain bias error, fluctuation error, and transmitter power, without appreciably increasing system complexity, is being scrutinized at Raytheon. The technique is that of linear plus parabolic frequency modulation of the transmitter.

J. C. RAND
Raytheon Co.

In normal Doppler navigator operation, the ground return signal is not a single defined frequency, but is actually a spectrum of frequencies whose power density is approximately Gaussian. Processing a spectrum instead of a single frequency requires more transmitter power, techniques to reduce terrain bias error, and some smoothing time in order to provide an accurate estimate of velocity. Linear plus parabolic frequency modulation of the transmitter substantially reduces the spectrum width (and, therefore, transmitter power requirements), essentially eliminates terrain bias error, and reduces fluctuation error.

Since the antenna beam has some finite width, the spectrum of frequencies is obviously associated with the infinity of elements throughout the antenna beam. Theoretically, linear frequency modulation for a one-dimensional antenna pattern will, to a first order approximation, result in a single, constant frequency throughout the antenna beamwidth. The actual (but much reduced) spectrum is the result of second and higher order effects.

Physical descriptions and mathematical treatments of the modulation technique have been generated, the shape of the compressed spectrum has been determined, and the elimination of terrain bias error has been proven theoretically. Flight test results have further validated the analytical treatments generated during the program.

James C. Rand received a BSEE from the University of Maine in 1954 and has done graduate work at Northeastern University.

In 1954 he joined the Sperry Gyroscope Company where he participated in the design and development of semi-automatic system test equipment and an analog range-height multiplier. From 1956 to 1959, he was a Senior Engineer at the Raytheon Company where he designed a data stabilization computer for a Doppler navigator and airborne instrumentation for Doppler navigator flight tests. Mr. Rand was also a systems engineer for Doppler navigator design.

During 1959, as a staff member of the Mitre Corporation, he designed and evaluated improvements to air defense radars. After rejoining Raytheon, Mr. Rand was selected to lead a special group investigating advanced Doppler radar techniques. He was assigned as project engineer on the ADVS program from which the material for this paper originated.

Ralph G. McManus received a BSME from the Bradford Durfee College of Technology in 1956 and has done graduate work at Syracuse University. From 1956 to 1960 he worked in the research and development of stellar inertial guidance systems for the Federal Systems Division of IBM, concentrating on leveling and gyrocompassing techniques. Mr. McManus joined Raytheon in January of 1960 as a systems engineer on Doppler navigation systems; was subsequently assigned to the Advanced Systems Techniques Group; and in June 1960, began work in the "Active Doppler Velocity Sensor" program where the work for this paper was performed. He is currently engaged in the theoretical analysis of advanced Doppler radar techniques and in the formulation of physical phenomena pertaining to Doppler. Mr. McManus is jointly responsible for the analysis and theoretical formulation of the spectral compression techniques presented in the paper and is currently engaged in laser radar design.

R. G. McManus
Raytheon Co.

WEDNESDAY, MARCH 11
Sylvania — 100 First Ave.
Waltham — Rooms 1A1 and 1A2
Meeting — 8:00pm

Spring Lecture Series On Reliability/Maintainability

THE importance of reliability and maintainability has been established. Strict requirements are now being placed by the military and different government agencies on contractors to the effect that equipments and systems meet certain numerical reliability and maintainability indices set forth in the contract or equipment specification. As a result, over the past several years, a reliability/maintainability discipline has evolved that begins with the design concept, continues through final testing, and stays with the product, analyzing field data through its operational life.

Industry too has started to adopt the tenets and techniques of R/M engineering. The savings that result from guaranteeing, replacing and servicing "unreliable" equipment, more than pay for an R/M effort in the engineering plant.

As a means of acquainting the Boston area with the requirements, disciplines, techniques, and management methodology of this expanding technology, the PTGR of the Boston Section IEEE is planning six meetings for the Spring Lecture Series. Each speaker was selected for his thorough knowledge of the subject and his ability to present it. The meetings are planned to interest those new to the subject, those engineers involved with it, and management.

WEDNESDAY, APRIL 15, 7:30pm

Customer R/M Requirements

The military and government agencies first recognized the need for calling out reliability and maintainability as an engineering effort distinct from other types of engineering. As a result, this series of meetings starts with a group of men instrumental in initiating and continuing the guiding documents and specifications of R & M. Since most of the audience will want to know where R/M stands, where it is going, what the government wants of it, and what it will want of it, these matters will be discussed by the distinguished panel of government officials before opening up the meeting to audience participation. Everyone involved with Mil R/M requirements will want to attend.

WEDNESDAY, APRIL 22, 7:30pm

Mathematics of R/M Engineering

The mathematics of R & M involves a great deal more than counting up part failure rates or determining the probability of zero failures during a mission. Starting with basic concepts, Mr. Bosinoff of Sylvania will develop the mathematics used for simplex and redundant models, the application of probability to reliability, simulation models, maintainability, diagnostic procedures, and methods of optimizing and allocating spare parts. He will conclude with a discussion of system effectiveness and Markov processes. Examples will be liberally used throughout.

WEDNESDAY, APRIL 29, 7:30pm

R/M Activities During the Design-Development Phase of a Typical Military/NASA Program

The success of an R/M design effort depends upon the logical step-by-step progress along with the equipment design. Probably the most effective technique for doing this is the design review. (This is attested to by the Air Force's insistence on a Design Review Program.) Mr. Dertinger of Raytheon will consider at least three basic formal reviews that should be held during the progress of a program.

a. Concept reviews: basic decisions re: Systems, design choices, environmental considerations, high-level redundancy considerations, early quantitative reliability predictions.
b. Interim (or Electrical) Reviews: parts and/or material selections, vendor data and selections, parts application, stress analyses, follow-up quantitative reliability predictions.
c. Final (or Mechanical) Reviews: black box designs, materials and structures analyses, environmental protection or isolation, produceability, tolerances, maintainability, follow-up quantitative reliability predictions.

IEEE MEMBERS $10.00
NON-MEMBERS $15.00
Registration At The Door $2.00 Extra

MAKE CHECKS PAYABLE TO
BOSTON SECTION IEEE
313 WASHINGTON STREET
NEWTON, MASS. 02158

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ENCLOSED IS MY CHECK FOR _____

Six Consecutive Wednesday Sessions at Northeastern's 128 Burlington Campus

WEDNESDAY, MAY 6, 7:30pm

R/M Activities During the Manufacturing and Operational Phases of a Typical Military/NASA Program

WHEN the hardware that results from a design effort does not live up to the paper design (R&M), there are techniques and procedures to determine what went wrong and how to get back on the right track. Many times the use of these same procedures early in the program will prevent disappointing results later on. These techniques include:

a. Reliability engineering follow-up
b. Failure reporting, operating time data accumulation, quantitative reliability measurement, use of confidence limits, etc.
c. Corrective action feedback and implementation
d. Vendor control
e. Use of correlation (damage) factors
f. Reliability improvement—quantitative measures

The participation of two men from the same company, Mr. Margoshes of Sylvania and Mr. Fasano of Sylvania, affords the audience a chance to compare the techniques of their company.

WEDNESDAY, MAY 13, 7:30pm

R/M Demonstration Testing

R/M TESTING is the means by which the R/M engineer checks the results of the design and is the means by which the contractor demonstrates whether or not he meets his R & M requirements. For this session, three men who have had considerable experience in different test areas, will cover the subject from the piece part to systems; from ground type testing to space type testing. Testing is costly and much depends upon it. There is much to be derived from this session.

C. Gadzinski, Reliability Dynamics Institute
  a. Component parts reliability (failure rate) testing
  b. Component parts reliability (accelerated stress) testing
  c. Use of acceleration factors

B. Smith, RCA
  d. AGREE type of testing (long-life products)
  e. Missile type of testing (short-life products)
  f. Space type of testing (long and short life products)

G. Grant, Dunlap Associates
  g. Maintainability testing (in-plant and operational)

The speakers will then form a panel and open the meeting to a discussion with the audience.

WEDNESDAY, MAY 20, 7:30pm

R/M Program Management

WHILE the R/M design engineers perform their tasks, management has its R/M tasks to do if the program is to be successful. Mr. Rothstein of Avco will discuss management's tasks which include:

a. The technical proposal
b. Costing
c. Budgets
d. Manpower
e. Schedules
f. Use of PERT and similar controls.

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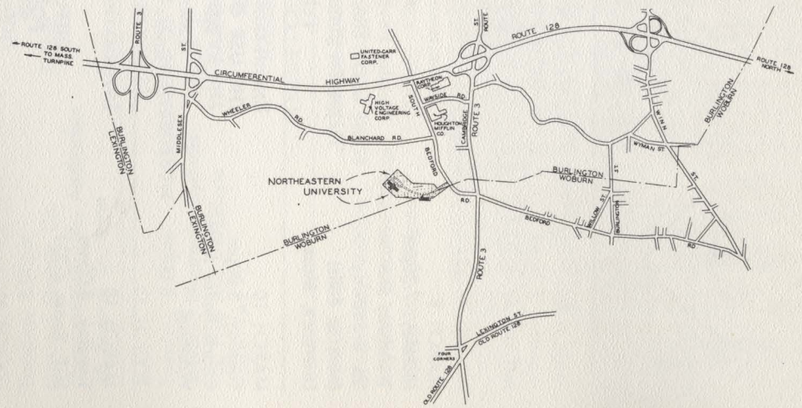

March IEEE Meetings

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

NON-MEMBERS AS WELL AS MEMBERS INVITED — PLEASE MAKE ALL DINNER RESERVATIONS WITH MISS WHITCHER AT THE BOSTON SECTION OFFICE — LAsell 7-5151

PLEASE REMOVE INSERT AND POST ON BULLETIN BOARD

MARCH 9
Monday, 7:30pm
MIT, Room 4-231

INDUSTRIAL POWER SYSTEMS - See Page 3
HIGH POWER APPLICATIONS OF SILICON CONTROLLED RECTIFIERS
Arthur S. Nadrowski, Westinghouse

MARCH 9
Monday, 7:30pm
Treadway Inn
So. Broadway
(next to Falls)
Lawrence, Mass.

MERRIMACK VALLEY SUBSECTION - See page 2
ANNUAL LADIES' NIGHT
Cecilia Payne-Gaposchkin, Harvard Observatory
Dinner - Treadway Inn - 6:30pm
Tickets for dinner may be obtained from Mrs. R.A. King
Telephone 686-0600, ext. 2233

MARCH 10
Tuesday, 8:00pm
Charterhouse Motel
Waltham

ENGINEERING WRITING AND SPEECH - See page 4
THE USE OF DATA PROCESSING EQUIPMENT AS AN AID TO PUBLICATION
Lawrence F. Buckland, Inforonics
Dinner - Charterhouse Motel - 6:00pm

MARCH 10
Tuesday, 8:00pm
MIT, Room 4-231

INFORMATION THEORY AND COMMUNICATIONS SYSTEMS - See page 3
DIFFUSE THRESHOLD DECODING FOR REAL DATA CHANNELS
Arthur Kohlenberg, Codex Corp.
Dinner - MIT Faculty Club - 6:15pm

MARCH 10
Tuesday, 8:00pm
MIT, Room 4-370

INSTRUMENTATION AND MEASUREMENT AND BIOMEDICAL ELECTRONICS - See page 4
CAPACITIVE AND INDUCTIVE TRANSDUCER SYSTEMS
Dinner - MIT Faculty Club - 6:00pm

MARCH 11
Wednesday, 8:00pm
Sylvania Electronic Systems
100 First Ave., Waltham
Room 1A1, 1A2

AEROSPACE AND NAVIGATIONAL ELECTRONICS - See page 5
IMPROVEMENT IN DOPPLER NAVIGATOR PERFORMANCE THROUGH SPECTRAL COMPRESSION
James C. Rand and Ralph G. McManus, Raytheon Co.

MARCH 12
Thursday, 7:15pm
NCO Club
L. G. Hanscom Field

RELIABILITY - See page 10
SECOND ANNUAL YOUNG ENGINEERS' RECOGNITION NIGHT
Outstanding technical papers on reliability will be [illegible]
Call Ray Barnes, WElls 3-3500, ext. 354

MARCH 16
Monday, 8:30pm
Golding Auditorium
Brandeis University
South St., Waltham

AUDIO - See page 10
THE STORY OF DIRECTIONAL MICROPHONES
Robert Carr, Shure Brothers Inc.

MARCH 17
Tuesday, 8:00pm
Computer Control Co.
Old Connecticut Path
Framingham

PRODUCT ENGINEERING AND PRODUCTION - See page 13
PACKAGING OF PELLET COMPONENTS FOR A HIGH-RELIABILITY SYSTEM
Charles I. Friedman and David R. Robillard
Computer Control Co.
Dinner - Sea & Surf Restaurant
Rte. 9, Framingham - 6:30pm

MARCH 17
Tuesday, 8:00pm
General Electric Co.
Measurements Lab. Auditorium
40 Federal St., Lynn

LYNN SUBSECTION - See page 10
FUSION POWER RESEARCH
David BenDaniel, General Electric Co.

MARCH 17
Tuesday, 8:00pm
Sylvania Electronics Systems
100 First Ave., Waltham
Room 1A1

ANTENNAS AND PROPAGATION - See page 12
MEASUREMENT OF TRANSIENT ELECTROMAGNETIC FIELDS
Hans J. Schmitt, Sperry Rand Res. Ctre.
THE PARANT — AN INTEGRATED PARAMETRIC AMPLIFIER AND ANTENNA
Ronald R. Clark, University of N. H.
Dinner - Charterhouse Motel, Waltham - 6:00pm

MARCH 18
Wednesday, 8:00pm
Raytheon Executive Offices
Spring St., Lexington

SPACE ELECTRONICS & TELEMETRY - See page 13
SOME PROBLEMS OF RESEARCH IN SPACE ELECTRONICS
John V. Harrington, MIT
Dinner - Charterhouse Motel, Waltham - 6:00pm

MARCH 19
Thursday, 8:00pm
Lincoln Lab. Cafeteria

ELECTROMAGNETIC COMPATIBILITY AND MILITARY ELECTRONICS - See page 14
THE ELECTROMAGNETIC COMPATABILITY ANALYSIS CENTER
J. Paul Georgi, Electromagnetic Compatibility Analysis Center

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MARCH 31
Tuesday, 8:15pm
Mitre Cafeteria
Bedford

ELECTRONIC COMPUTERS - See page 15
THE ESD/MITRE SYSTEM DESIGN LABORATORY AND ADAM
James H. Burrows, Information Systems Directorate
Dinner - Hartwell Farms - 6:00pm

MARCH 31
Tuesday, 7:30pm
MIT, Room 10-275

UTILITY SYSTEMS - See page 15
COMPUTER MONITORING OF GENERATING STATIONS
Harold Bloomfield and Richard Dunn
N. E. Power Service Co.

APRIL 1
Wednesday, 8:00pm
MIT, Room 4-270

MICROWAVE THEORY AND TECHNIQUES - See page 16
THE ATOMIC HYDROGEN MASER
Robert F. C. Vessot, Varian Assoc. Bomac Res. Lab.
Dinner - Coach Grille, Harvard Sq. - 6:30pm

Sunday Afternoon Social Gathering

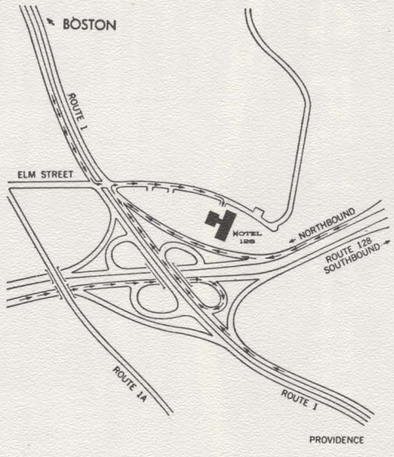
THE gala Boston Section IEEE Social Gathering will be held at 4:00pm on Sunday afternoon, March 15th at the Grand Ballroom of the Hotel 128, Dedham in honor of the section members who were elected to the grade of Fellow.

Primarily a social gathering, a brief announcement from the Nominating Committee will be made.

For your edification, the following slate of candidates for the Boston Section IEEE 1964-65 Executive Committee:

Chairman, H. V. Schmitt;
Vice Chairman, Bruce B. Barrow;
Secretary, Robert Manning;
Treasurer, C. B. Damrell;
Executive Committeemen,
Dean Martin Essigmann &
Charles White.

Additional nominations may be made by a petition signed by at least 25 voting members of the Section and submitted to the Section Secretary on or before March 15th.



After the Fellow Awards are completed, Dr. Harold Goldberg, vice-president of engineering and research at Raytheon Company, *will speak briefly about management problems in Boston's defense electronics industry.*

A native of Milwaukee and the holder of PhD degrees in electrical engineering and physiology from the University of Wisconsin, Dr. Goldberg has [illegible] altimeters for low level flight, automatic landing and automatic flight control systems. Dr. Goldberg holds more than 30 patents in the fields of pulse and CW radar, antennas, microwave components, pulse communications, air navigation systems, proximity fuses and radar altimeters.

At the completion of this portion of the program, the ballroom will be rearranged to accommodate you and your lady for the cocktail hour and dancing to the music of the Larry Cooper Trio.

Free hot and cold hors d'oeuvres will include such items as fried shrimp, fish balls, chicken livers, meat balls, tenderloin tips saute, canape of lobster, shrimp, anchovies, sardines, stuffed eggs, etc. Italian cookies and coffee will also be served. Cocktails may be puchased at special bars conveniently located in the ballroom.

Ample parking is available; if the Hotel parking lots should be filled, free parking is permitted in the lot across the street. A map of the immediate area around the Hotel 128 has been included for your convenience.

Sunday Afternoon Social Gathering

Planned with the Ladies in Mind! Bring Your Wife

Hotel 128 — MARCH 15, 4 - 7:00 P.M.

ROUTE 128 AT ROUTE 1 AT EXIT 60N

FREE Admission and Refreshments

COCKTAILS A LA CARTE

1964 IEEE FELLOW AWARDS

Dancing to the Soft, Pleasant Music of Larry Cooper

Second Annual Young Engineers' Night

THE PTGR Boston Chapter sponsorship of Young Reliability Engineers' Night this year emphasizes technical paper writing and presentation. The roster of speakers includes the following:

Robert P. Berkowitz, Reliability Section Supervisor, Computer Control Co., Framingham—A SEMI-AUTOMATED BURN-IN SCREENING TEST DATA-REDUCTION PROGRAM.

Tin Htun, Reliability Engineer, Raytheon Co., Wayland—A RELIABILITY MATHEMATICAL MODEL FOR A SYSTEM HAVING QUASI-REDUNDANCY.

Tim S. Eller, Reliability Engineer, Raytheon Co., Wayland—THE MANY FACETS OF FAILURE ANALYSIS—SYMPTOM TO CAUSE.

Barney Capehart, Electronic Engineer, USAF Hdqtrs. ESD, Hanscom Air Force Base, Bedford—THE BUIC SYSTEM RELIABILITY THROUGH FUNCTIONAL REDUNDANCY.

Peter Selig, Reliability Mathematician, Sylvania Co., Waltham—SYSTEM EFFECTIVENESS — FROM THE COMPONENT TO THE SYSTEM LEVEL.

James A. Moore, Reliability Engineer, Sanders Associates, Nashua—A PART-VARIABILITY TECHNIQUE.

Vincent Denietolis, Reliability Engineer, Sylvania Co., Waltham—AN APPROACH TO FAILURE-MODE ANALYSIS—FROM THE COMPONENT TO THE SYSTEM LEVEL.

Judges—Prof. Bernard Goldsmith, Northeastern University, Mr. Sidney Greenberg, Mitre, and Mr. Arnold Rothstein, Avco.

The delivery time of each technical paper will be limited to a maximum of 15 minutes. The audience will be permitted to rate the oral presentation of each speaker, and this will count as 25 per cent of the total score. The decision of the judges will be final.

The prime purpose of Engineers' Recognition Night is to encourage the professional growth and technical maturity of young reliability engineers in this area and to permit them to gain additional skills by practicing the art of paper presentation before a sympathetic yet critical audience.

THURSDAY, MARCH 12

NCO Club, L. G. Hanscom Field, Bedford
Dinner — 6:30pm Meeting — 7:15pm
Reservations must be made for dinner by calling Ray Barnes, Sylvania, Woburn, WElls 3-3500, ext. 354. Reservations must be honored unless cancelled on or before March 10. Ladies are invited to this technical session.

Fusion Power Research

D. BenDANIEL — G.E.

A SURVEY of the current status of research in the area of thermonuclear containment will be presented. This will include a discussion of the magnetic mirror, stellerator and theta- and zeta-pinch concepts. The rapid magnetic compression (theta-pinch) experiments being conducted at the General Electric Research Laboratory in Schenectady, New York, will be treated in some detail. These experiments produce plasmas whose temperatures are in the tens of millions of degrees Celsius, with relatively high densities, and evidence of thermonuclear reactions is observed. A discussion of the latest developments in positive gradient static magnetic fields will also be given.

Dr. David BenDaniel received his B.S. in Physics from the University of Pennsylvania in 1952, and his M.S. the year following. He is currently on the staff of the General Electric Research Laboratory working in problems of thermonuclear containment, plasma physics, and gaseous electronics. He also serves as Adjunct Associate Professor of Electrical Engineering at Rensselaer Polytechnic Institute, Troy, New York.

TUESDAY, MARCH 17

Meeting — 8:00pm
Measurements Lab., Auditorium
General Electric Co., 40 Federal St., Lynn

The Story of Directional Microphones

R. CARR — *Shure Brothers Inc.*

A DISCUSSION of the history and evolution of directional microphones will be given with attention to the needs for various different types, how to operate them and their significance in practical applications.

Mr. Robert Carr is currently manager of Professional Products Division, Shure Brothers Inc., Evanston, Illinois. Mr. Carr studied electrical engineering at Iowa State College and the University of Minnesota, as well as business management at the University of Chicago. He has been associated with Shure since 1948 and was formerly Manager of Development Engineering.

Mr. Carr is a member of IEEE, Acoustical Society of America, SMPTE and the American Institute of Physics.

MONDAY, MARCH 16

Meeting — 8:30pm — Golding Auditorium, Brandeis University, South St., Waltham

DOUBLE MEETING

Measurement of Transient Electromagnetic Fields

CERTAIN physical phenomena such as lightning or explosive bursts are associated with large scale electromagnetic radiation. A faithful reproduction of the time sequence of the electromagnetic disturbance may allow the determination of the nature of the physical processes involved and some of their significant characteristics. For the reception of such nonperiodic fields extremely broadband antennas are required.

The responses of various antennas, including electric and magnetic probes, long dipoles and non-resonant distributed antennas to transient electromagnetic signals will be discussed, and some experimental results obtained for the reception and transmission of short pulses with nanosecond duration will be reported. The physical limitations of transient field measurements using probes in dispersive media and the transmission line characteristics of antennas immersed in dispersive media will be discussed. The dependence of the transient response on the material properties of the surrounding medium suggest a potential application of pulsed antennas for rapid diagnostics of ionized media.

H. J. SCHMITT
Sperry-Rand

Hans J. Schmitt (A'58-SM'61) received the degree of Dipl. Phys. in 1954 and his PhD degree in 1955, both from the University of Göttingen, Germany. After one year as research associate he became associated with Harvard University, Cambridge, as research fellow. From 1958 to 1963 he served as assistant professor in the Division of Engineering and Applied Physics. In 1963 he joined the Plasma Physics Department of the Sperry Rand Research Center in Sudbury. He has carried out research on dielectric materials, electromagnetic scattering, antenna theory and plasma physics.

THE PARANT

An Integrated Parametric Amplifier Antenna

THE study has been made of the theoretical and applied problems associated with the design of a parametric amplifier antenna in a coaxial dipole form. The requirements necessary to satisfy the parametric amplifier part of the device will be presented along with experimental results obtained for a quarter-wave dipole at 108 Mc/s and a half-wave dipole at 54 Mc/s. Possible applications of the Parant will be considered.

R. R. CLARK
Univ. of N.H.

Ronald R. Clark received a BS in 1956 from the University of New Hampshire, an ME in 1957 from Yale University and a PhD in 1963 from Syracuse University. He joined the staff of the Electrical Engineering Department of the University of New Hampshire in 1957 and became associated with the Antenna Systems Laboratory in 1959. While at Syracuse University he was associated with the Defense Systems Laboratory. He is currently an Assistant Professor in the Department of Electrical Engineering of the University of New Hampshire.

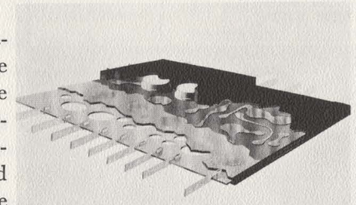
TUESDAY, MARCH 17
Dinner — 6:00pm — Charterhouse Motor Hotel, Waltham
Meeting — 8:00pm — Sylvania, 100 First Ave., Waltham, Room 1A1

Packaging of Pellet Components for a High Reliability System

C. I. FRIEDMAN and D. R. ROBILLARD — *Computer Control Co., Inc.*

THE development of a unique process for integrating pellet components in a miniaturized digital computer for extreme environments will be presented from the standpoint of a packaging engineer. A sequential presentation of the subject will cover the following:

The advantages of using pellet modules in high-reliability systems or other applications where volume savings, reliability, cost, flexibility and availability are essential considerations.



The procedures for establishing the reliability of selected components from the time "raw" components are received from the vendor. This will include serialization, initial test, burn-in and mechanical tests, in-process inspection during fabrication and encapsulation phases, electrical tests, and the family tree method of component traceability.

Fabrication of "envelopes:" (Envelopes are separately formed circuits that are packaged to withstand specified environmental conditions.) Slide illustrations of the significant fabrication steps including encapsulation of discrete pellet components into wafer form, vacuum deposition of the circuit interconnections, insertion of transistors, and final encapsulation will be shown and discussed. Dynamic testing for circuit-parameters will also be mentioned.

Module formation: the bonding of two envelopes and the welding of interconnection pins will be illustrated. The "stick" assembly of several modules and connection considerations, the combining of four sticks and the related external connectors to make a tray-half with three complete trays making up the system will be presented and discussed.

Charles I. Friedman received his BSME from Worcester Polytechnic Institute and is currently an engineer in the packaging department of Computer Control Company, Inc. He has been instrumental in the establishment and documentation of the fabrication process up through the envelope level.

David R. Robillard received his BSEM from Northeastern and is currently employed by the Computer Control Company, Inc. He is a group leader in charge of packaging in the Mechanical Engineering Department where he has done research work on pellet module development, welding of electronic components and conformal coatings.

TUESDAY, MARCH 17
Dinner — 6:00pm — Sea & Surf Restaurant, Route 9, Framingham
Meeting — 8:00pm — Computer Control Company, Old Connecticut Path, Framingham

Some Problems of Research in Space Electronics

AS the national program of space exploration enters its eighth year, the problems posed in many areas of technology by the ambitions of the program become clearer. While developments of large booster and vehicle technology still dominate the program, the problems associated with the development of reliable and sophisticated electronic systems for space craft are not far behind. Some specific description will be given of the growing complexity of electronic payloads in scientific satellites, the demands for improved electronic components in proposed communications satellites, and the future demands for both sophisticated and highly reliable components for long-period, deep-space missions. Some conclusions will be drawn as to the directions that space-related electronics research programs should therefore take.

J. V. HARRINGTON
MIT

Dr. John V. Harrington received the BEE degree in 1940 from the Cooper Union and was awarded the MEE degree by the Polytechnic Institute of Brooklyn in 1948 and the ScD Degree by MIT in 1958. He is a professor in the Departments of Electrical Engineering and Aeronautics and Astronautics, director of the Center for Space research at MIT. He has been a leader in the development of space communications and the application of radar techniques to the study of upper atmospheric and space phenomena. He is a Fellow of the IEEE.

WEDNESDAY, MARCH 18
Dinner — 6:00pm — Charterhouse Rte. 128, Waltham
Meeting — 8:00pm — Raytheon Executive Offices Spring St., Lexington

The Electromagnetic Compatibility Analysis Center

THE Electromagnetic Compatibility Analysis Center, referred to as ECAC, was established to assist the Military Departments in coping with radio interference problems, especially those involving multiple systems and installations.

Mr. Georgi's presentation will cover the background to the establishment of the Analysis Center, the Center's mission, and the technical activities of the Center directed towards accomplishment of mission objectives. In addition, there will be a clear delineation of the services currently available from the Center through the appropriate channels.

J. P. GEORGI
ECAC

Interest in establishing a Radio Frequency Interference (G-27) chapter within the Boston Section led to a recent action of combining RFI with the established chapter on Military Electronics. Mr. Georgi's presentation will be uniquely appealing to both groups.

J. Paul Georgi, Technical Director of the Defense Department's Electromagnetic Compatibility Analysis Center will address PTGMIL-EC. Mr. Georgi has a BS in Physics, an MBA in Weapons Systems Management and has had extensive experience in the fields of radio altimetry, research requirements analysis, bomber missiles and standards and criteria. His original paper on electromagnetic compatibility and his keen interest in this subject led to his selection for his present position when the Defense Department established the Analysis Center in the spring of 1961.

THURSDAY, MARCH 19
Meeting — 8:00pm — Lincoln Lab Cafeteria

Computer Monitoring of Generator Stations

H. BLOOMFIELD AND R. DUNN
New England Electric System

A DESCRIPTION of the RCA-110 digital computer installation at New England Electric System's new Brayton Point Station in Somerset, Mass., will be presented by Mr. Harold Bloomfield and Mr. Richard Dunn. Their discussion will include problems encountered in adapting conventional power plant instrumentation to feed information to the computer, in computer programming and in operating computer hardware in a power plant environment.

Harold Bloomfield received his BSME from Cornell University in 1945. He joined New England Electric System in 1946 and has been with the Mechanical Engineering Department since 1950.

Richard Dunn received his BSME from Brown University in 1958. He joined the New England Electric System as a trainee in 1958 in the Steam Operating Department, then transferred to the Mechanical Engineering Department in 1963.

TUESDAY, MARCH 31
Meeting — 7:30pm — MIT, Room 10-275

The ESD/Mitre System Design Laboratory and ADAM

J. BURROWS — *Information Systems Directorate*

THE capabilities of the ESD/MITRE System Design Laboratory, located at Hanscom AFB, will be presented. This facility is used for studies in support of the design of command and control systems. An IBM 7030 (STRETCH) computer is used for standard off-line simulations, for performance studies of alternate system designs. In addition, the computer is connected to auxiliary equipments and communication lines. On-line, real-time experiments, related to the critical design problems in the man-machine interaction, are performed using this equipment.

To allow this latter type of experiment to proceed with flexibility and to provide capability to study alternate interactions, a flexible program, ADAM, is being prepared. This tool, a generalized data management system, provides a data base and processing structure for the rapid construction of experimental command and control center environments. The design and philosophy of this program will be presented.

TUESDAY, MARCH 31
Dinner — 6:00pm — Hartwell Farms
Meeting — 8:15pm — Mitre Corporation Cafeteria

The Atomic Hydrogen Maser

R. F. C. VESSOT — *Varian Associates*

THE atomic hydrogen maser is the first and, so far, the only microwave oscillator operating between magnetic hyperfine transitions and has provided a means for obtaining signals of very good stability. The long interaction time of the rf magnetic fields and the radiating atoms is made possible by the small interaction of the magnetic coupling giving the hyperfine energy separations and the electric fields that result from collisions. Hydrogen atoms can make many collisions with substances such as teflon, dimethyldichlorosilane, and certain heavy waxes without recombining or serious loss of phase coherence with the rf magnetic field.

Due to the low level of the signal, there is a fundamental limitation imposed by thermal noise and these limitations will be described in terms of the noise properties of the system used to receive the maser signals. The effect of the resonator tuning will be discussed and the method of tuning the resonator will be described.

Data taken from heterodyning experiments between masers will be discussed and time measurements via Loran C signals with the U.S. Naval Observatory will show the feasibility of making time observations of better than one microsecond per day.

Applications of the hydrogen maser to timing and frequency control over short and long periods will be discussed including an application of the hydrogen to perform a gravitational red shift experiment using an earth satellite or a space probe.

Robert F. C. Vessot received the BA in mathematics and physics in 1951 from McGill University, Montreal, Canada. In 1954 he obtained the MSc degree in physics and was awarded the PhD in physics in 1957, both from McGill.

At Varian Associates Bomac Research Laboratory, he worked on frequency standards and operated an experimental maser in August 1961. This work on hydrogen masers is still in progress and with the collaboration of Mr. H. E. Peters, he developed the maser into a stable frequency standard that is now in development as an instrument.

WEDNESDAY, APRIL 1
Dinner — 6:30pm — Coach Grille, Harvard Sq., Cambridge
Meeting — 8:00pm — MIT, Room 4-270

New **20c-20kc**

SOLID-STATE POWER OSCILLATOR

with 200-voltampere output

- √ Wide voltage and frequency ranges for testing equipment at other than power-line frequencies
- √ Isolates sensitive equipment from power-line transients
- √ Plenty of power for driving shake tables and acoustical transducers
- √ Useful for testing magnetic amplifiers, servo systems, transformers, and chokes
- √ Provides low-distortion signal to non-linear loads
- √ Finds many uses as a general-purpose, audio-frequency power source

Type 1308-A Audio Oscillator and Power Amplifier . . . $1150 in U.S.A.

- Multiple ranges match a wide variety of loads.
- Output transformer designed to prevent saturation when dc is passed through secondary.
- Capacitor-tuned, Wien-bridge oscillator combined with a low-distortion power amplifier provides true sine-wave output.
- Power amplifier can be used separately with external signal sources.
- All solid-state circuits.
- No power-factor limitations.
- Output is continuously monitored by an overload sensing circuit that activates whenever safe limits are exceeded. Reset switch restores circuit.

Openings exist for permanent positions in Development and Sales Engineering. If interested, write M. A. Nacey.

OUTPUT: 200 voltamperes, 50 cps to 1 kc. Beyond 1 kc, see plot.

Voltage and Current Ranges

0-4	0-12.5	0-40	0-125	0-400	volts, rms
0-5	0-5	0-5	0-1.6	0-0.5	amps, rms

Output transformer will pass dc equal to rated ac.

Harmonic Distortion: 1% from 100 cps to 10 kc, 2% from 50 to 100 cps.

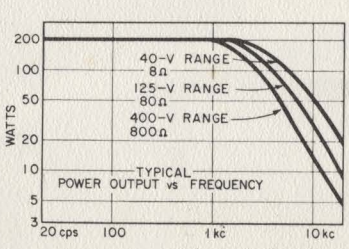
Hum: Better than 50 db below maximum output.

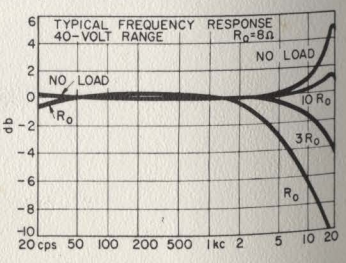
AMPLIFIER:

Input: 10 kilohms.

Sensitivity: Approximately 2 volts needed for full output.

POWER REQUIREMENTS: 105 to 125 or 210 to 250 volts, 50-60 cps, 70 to 500 watts (depending on load).





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