APRIL 1964
VOLUME 12, No. 8

The Reflector

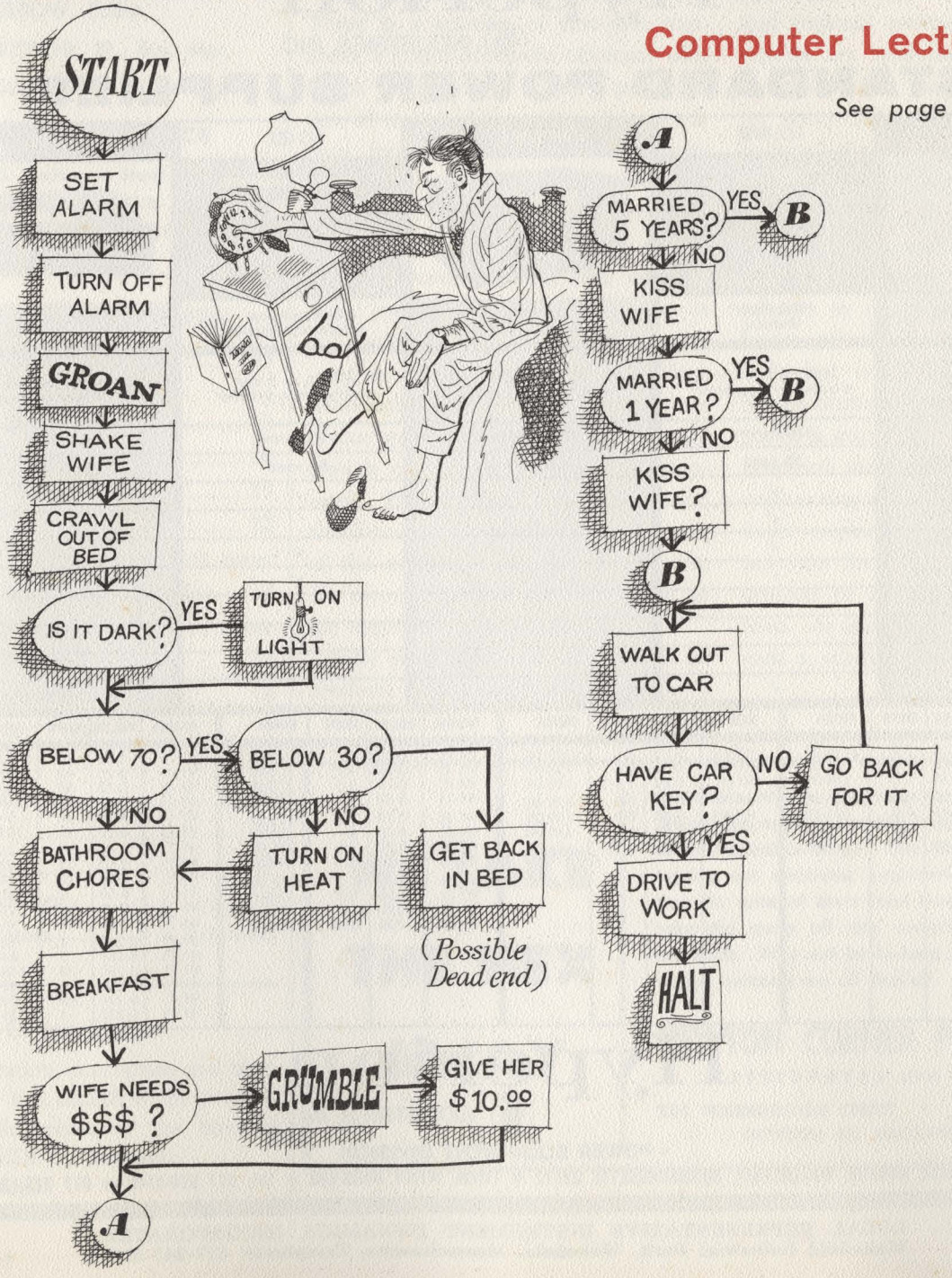
PUBLISHED BY THE BOSTON SECTION OF THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

SPRING LECTURE SERIES

See pages 3, 4 and 5

Computer Lecture Series

See page 3



The Reflector

APRIL 1964

Volume XII, No. 8

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STAFF

BRUCE B. BARROW, *Editor*
ERNEST E. WITSCHI, JR., *Bus. Mgr.*
SHIRLEY M. WHITCHER, *Office Mgr.*

PUBLICATION OFFICE

313 Washington Street
Newton, Mass. 02158
Telephone LAsell 7-5151

INDEX TO ADVERTISERS

Cover Story

The inspiration, conception and birth of the cover this month is the product of the fertile minds of the boys at Honeywell EDP in Newton.

Thanks, boys.

Engineers and Continuing Education

RONALD E. SCOTT
Chairman — Boston Section

IN 1750 there was one electrical engineer, Benjamin Franklin. In 1950 there were approximately a million of them. The curve in between is an almost perfect exponential with a doubling time of ten years. It seems unlikely that this growth rate can continue much longer. In fact if it does, every worker in the country will be an electrical engineer in 1990!

Certain strains are already apparent. There is a scarcity of first-rate engineers, a falling-off in the efficiency with which engineers are used, a proliferation of technical literature, and a tendency for excess specialization perpetuating narrow areas which have lost their usefulness. The curve may never reach a saturation level but the growth rate is bound to drop, and when it does, profound changes will occur in our society.

At the present time there is a direct relationship between the growth rate of our gross national product and the growth rate of research and development. If the growth of research and development slows down, the growth of the economy will also slow down. To recoup the loss we must learn to use engineers more efficiently.

Fifty years ago engineers worked on products which were to be sold in a competitive market. A particular project was justified by its economic value as measured by its profitability. This criterion was a useful one and a combination of free enterprise and engineering built our magnificent industrial plant. Today, sixty percent of our engineers work on projects sponsored by the government, and other criteria are used, such as national security, national prestige, national social goals, and regional economic needs. These criteria are laudable and desirable in themselves but they are not suitable for determining the real priorities of national engineering policy. And furthermore they are too subject to change in the varying political winds of Washington. (Witness the Seattle area.) As engineers become scarcer relative to our needs we must have better criteria for assigning priorities.

At last year's Spring Social of the Boston Section, Arthur Kantrowitz suggested a solution for this problem. He proposed the formation of a national engineering academy composed of eminent engineers who would set the priorities for our national engineering projects on a long-range and national basis. As each year passes the need for such a solution increases.

NEREM Names Chairmen for 1964 Electronics Meeting

BOSTON, MASS—The New England Sections of the IEEE have elected Dr. Carl E. Faflick, Director of Advanced System Planning of Sylvania Electronic Systems, as Chairman of the NEREM Board of Directors, and Dr. W. Crawford Dunlap, Director of Solid-State Electronics Research at the Raytheon Company, as Chairman of the General Committee for the 1964 NEREM.

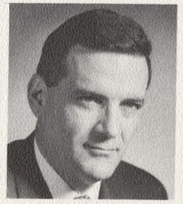
C. E. FAFLICK
Sylvania

As Chairman of the NEREM Board Dr. Faflick and his directors will have responsibility for establishing and coördinating NEREM policies and objectives. Dr. Dunlap and his committee will direct the planning and operation for the 18th Annual Meeting and Exhibition, which will be held in the Commonwealth Armory and the Somerset Hotel, Boston, Mass., on November 4, 5, and 6, 1964.

Dr. Faflick, who lives at 28 Moon Hill Road, Lexington, Mass., received his BA in Physics from Oberlin College in 1943, and his PhD from Harvard in 1953. He was a Teaching Fellow from 1948 to 1950, a Research Assistant from 1951 to 1953, and spent 1950 to 1951 in Europe under a Sheldon Traveling Fellowship from Harvard. During his industrial career, he has been responsible for development of airborne antennas, for design of elements for large electronically scanned arrays, and for microwave work in the fields of directional filters, electronic frequency storage, and microwave beam steering techniques.

Dr. Dunlap, who lives at 126 Prince St., West Newton, Mass., received his BS in Physics and Chemistry from the University of New Mexico, and his PhD in Physics from the University of California at Berkeley. During subsequent years his work has been devoted mainly to the study of solid state devices, first at the Research Laboratories of General Electric in Schenectady and Syracuse, and later with the Bendix Corporation and Raytheon. He has presented about fifty papers on his research work before various technical societies and conferences, has written and contributed to numerous books, and is editor-in-chief of the international technical journal, *Solid-State Electronics.*

The 1964 NEREM meeting will represent a major milestone in NEREM's history. Starting as a small regional session in 1946, the meeting has grown until it now attracts over 20 000 scientists and engineers from all sections of the country and abroad. The technical program historically has consisted of over 100 invited and contributed papers of international importance in the field of electronics, automatic controls, microwave techniques, and associated subjects. The exhibition features displays of over 400 companies, and because of space limitations, has been on a waiting list basis for several years.



W. C. DUNLAP
Raytheon

Indicative of NEREM's growth, and of the importance of the New England area as a center of the nation's electronic research, is the fact that the 1965 exhibit will be held in the new Municipal Auditorium in the Prudential Center.

Spring Lecture Series on Computer Fundamentals

ASIDE from influencing the method of one's rising in the morning and going to work (see cover), "no other technical innovation has changed so many human activities in so short a time. An extension of man's brainpower, it is transforming science, medicine, government, education, defense, business. It may transform man himself." [1]

According to *Business Week,* "The vastness of the changes already brought about by computers can be judged, in part, from the fact that electronic data processing has:

Created a whole new set of conditions for running business and government.

Changed the basic techniques of much of scientific research and engineering.

Affected education and brought into use new methods of both teaching and learning.

Speeded the evolution of technology and the development of products.

Provided new weapons and changed military strategy.

Begun subtly to alter the structure of power within many businesses by placing the men who understand and control computers closer to policy-making and decision-making positions." [2]

Quoting from the same article of *Fortune* again, "One of the characteristics of the computer that make it unique among technical achievements is that it has forced men to think about what they are doing with clarity and precision." [3]

With these facts in mind, the Boston Section IEEE Executive Committee decided to present a lecture series on computers. The basic purpose of this lecture series is to introduce people to computer fundamentals and to show them how a simple program is run on a modern computer.

[1] Gilbert Burck, "The Boundless Age of the Computer," *Fortune,* LXIX, No. 3 (March 1964) 101.
[2] "New tool, new world," *Business Week* (February 29, 1964) 70.
[3] Burck, *Fortune* (March 1964) 101.

Instructor - M. J. CARRABES, Northeastern

FIVE CONSECUTIVE WEDNESDAYS
7:00 to 9:00pm

NEW ENGLAND POWER COMPANY HALL
441 STUART ST., BOSTON

APRIL 15 — NUMBERING SYSTEMS
Binary, octal and digital systems explained. The differences between Binary and Boolean Arithmetics discussed.

APRIL 22 — A TYPICAL DIGITAL COMPUTER
A discussion of control units, storage units, and computer hardware. Functions of input/output controls and magnetic tape explained.

APRIL 29 — INTRODUCTION TO PROGRAMMING
A discussion of the concepts of single address and the stored program. Uses of accumulators and quotient registers and mention of symbolic programming.

MAY 6—INDEXING FOR ADDRESS MODIFICATION
Looping networks for repetitive operations.

MAY 13 — FORTRAN CODING

PROFESSOR M. J. Carrabes of Northeastern University received his BSEE at Northeastern in 1950 and his MS in Math-Physics also at Northeastern in 1953. He was Assistant Professor in Mathematics at Northeastern from 1950-1955 and Associate Professor in the Department of Electrical Engineering from 1950 to the present. He is currently Faculty Advisor, IEEE Student Branch and is a Past Secretary and Vice Chairman, District Student Activities Committee, AIEE. He is giving graduate courses at Northeastern in Analog and Digital Computers and Switching Circuits (Combinational and Sequential). Professor Carrabes is the current Vice Chairman of PTG Audio of the IEEE and a member of the Boston Section IEEE Membership Committee.

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
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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

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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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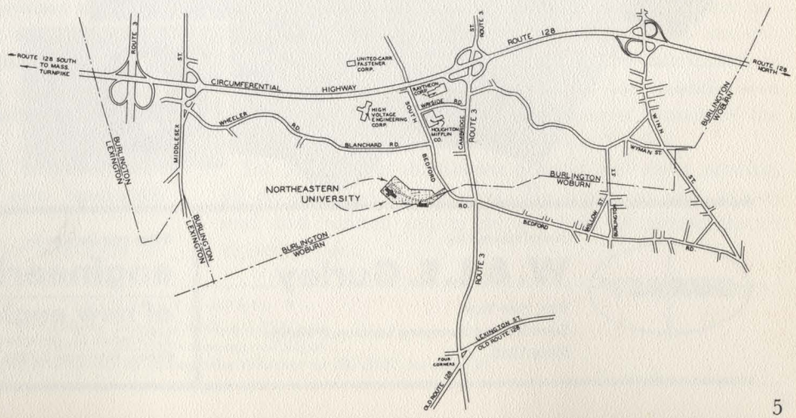
REGISTRATION AT THE DOOR WILL COST YOU $2.00 MORE



Solid State Devices for Power Servos

N. F. CVENGROS — *Allis Chalmers*

HIGH-PERFORMANCE electric drives for power servos have become more common in the past few years due to rapid advances in the field of solid state devices. The inherent reliability and life of static circuits plus the high current capacity of the newly developed silicon controlled rectifiers makes the electric drive an attractive choice for the servo designer. Mr. Cvengros of Allis Chalmers will discuss applications of semi-conductors in adjustable speed drivers. Typical uses for such electric drives are on steerable antennas, steel rolling mills and centrifuges.

Mr. Cvengros has had several years' experience in the development of power drives as a member of the Regulators and Variable Speed Driver Group at Allis Chalmers in Milwaukee. He is a graduate of Marquette University and a member of the IEEE.

TUESDAY, APRIL 7
Pillar House, Routes 16 and 128
Dinner — 6:00pm — Meeting — 8:00pm

PTG
ELECTRON DEVICES
ANNOUNCES A

CALL FOR PAPERS for Boston Laser Conference

Thursday and Friday
August 6 & 7
Northeastern University

PRELIMINARY announcement: Call for Papers—contact Professor R. G. Seed, E. E. Dept. at Northeastern University. Sessions are tentatively planned on Tutorial and Review, Diode Lasers, Design Theory, Fabrication and Technology, Biological Effects—also displays and demonstrations.

With the considerable expansion of laser interest and effort in the New England region, it will be interesting to hear currently from representative speakers from many of these groups.

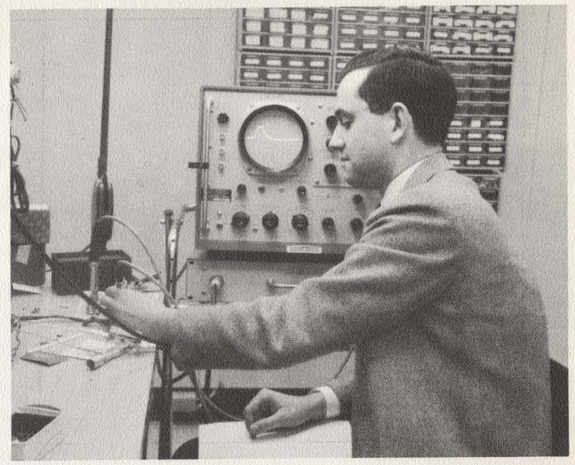
Double Meeting — Microelectronics: Single or Double Chip?

A Chip and Wire Approach to Ultra High Speed Computer Logic

E. EDELSON — *Mitre Corp.*

WITH a great deal of emphasis being placed on integrated circuits for computer applications, the author will present some of the advantages and disadvantages of this technique. Integrated circuits have many serious drawbacks with nanosecond computers, some of which can be avoided by the use of what is known as the chip and wire approach. This paper will discuss the application to high speed circuitry of discrete transistors and diodes in chip form with thermal compression bonded leads. In particular, the nanosecond digital logic system under development at Mitre will be used as a model to illustrate the advantages of this technique.

Mr. Elihu Edelson is a member of the Technical Staff in the Computer and Display System Department of the Mitre Corporation in Bedford. For the past two years he has been involved in the circuit design and packaging of high speed digital computer circuitry. Mr. Edelson holds a BE from Carlton University, Ottawa, Canada and an MS from the Carnegie Institute of Technology in Pittsburgh. He is a member of the IEEE.



Integrated Circuit Linear Analog Amplifiers

A SERIES of single chip semiconductor integrated circuit linear amplifiers for precision electromechanical rotating components covering the power range to 6-watts were developed for the Bureau of Naval Weapons.

The semiconductor integrated circuit 6-watt servo amplifier contains eighteen transistors, eleven zeners, three metal oxide semiconductor capacitors, and sixty-six diffused resistors for a point count of ninety-eight elements excluding twenty-two taps. The amplifier circuit is of such complexity as to require the use of a digital computer for circuit synthesis and analysis. The topology was uniquely specified by morphological algorithms. These rules prescribed a planar arrangement of elements without any crossovers. The amplifier is contained within a stud mounted ⅜ x ⅜ inch flat package, 0.060 inches thick.

As examples of algorithm designs a set of precision signal amplifiers will be discussed. These include:

1. A two-stage feedback differential amplifier with emitter-follower output having a gain bandwidth product of 1000 Mc/s.
2. Both single and double strobed sense amplifiers for reading core, thin film, drum, and delay line memory systems.
3. An error amplifier for use in regulated power supplies (0.01%). The crystal includes automatic short circuit and overload protection circuitry.

M. W. AARONS
Norden

Dr. Aarons received his BS from Brooklyn College in 1949 and his MS and PhD degrees in Physics from Carnegie Institute of Technology.

Since joining Norden in October 1960 as Chief of the Applied Physics Branch, Dr. Aarons has the direct administrative and technical responsibility for all research and development programs related to the fabrication of molecular circuit devices. Dr. Aarons has recently been made Chief of Research and Development Branch of the newly formed Solid State Engineering Section.

Dr. Aarons has six patents granted and eight pending, all on semiconductor devices. He has given over twenty oral and written papers in the field of semiconductor device physics.

THURSDAY, APRIL 9
Raytheon Executive Offices — Cafeteria
Dinner — 6:00pm — Meeting — 7:30pm
Please make dinner reservations by calling Miss Whitcher at 527-5151 by April 7.

Engineering Management for a Profit

MR. Benoit will compare and contrast management goals and techniques as they apply to the engineering of equipment for different markets. It is recognized that profit is the motive of the electronics industry, but the methods of achieving this end will vary according to the product (a component, an instrument, a system) or service (research, design, development, engineering, test, repair) according to the type of customer (consumer, commercial, industrial, governmental, military, institutional) and according to the type of contract appropriate to the sale. He will attempt to shed some light on the question, "To what extent can the lessons of one type of technical enterprise be applied to another?"

G. F. BENOIT
Sanborn Co.

In his engineering career Mr. Benoit has had an opportunity to observe and participate in many facets of this management problem. His engineering career began as a research and development officer in the Aeromedical Laboratory of the United States Air Force designing human centrifuge instruments and evaluating high altitude oxygen instruments and systems. For six years he then managed a small electronics company which custom designed production line equipment for the watch and clock industry, and automatic training and scoring equipment for weapons training of municipal police force, F.B.I., and military use. Over an eight year period he held the positions of project engineer, systems manager, program manager and surface radar department manager at the Raytheon Wayland laboratory. He is currently Director of Engineering at Sanborn Company whose products are measurement instruments and systems for industrial and medical use.

TUESDAY, APRIL 14
Dinner — 6:30pm — Charterhouse Hotel, Waltham
Meeting — 8:00pm — Sanborn Co., 175 Wyman St., Waltham

Electrical Control of Rapid Heart Action

DISTURBANCES of the heart rhythm are a common manifestation of heart disease. These arrythmias impair heart function and occasionally have serious consequences. Recently, methods have been introduced to stop the arrythmia using an electrical shock discharge across the intact chest of the lightly anesthetized patient.

B. LOWN
Harvard

Dr. Lown and his coworkers have examined this problem in great detail. They have noted that varying types of waveforms of electrical discharge result in varying heart rhythm responses. A simple capacitor discharge will cause complete disruption of the normal heart rate, while an impulse consisting of a decaying oscillation will cause depolarization without this serious sequela. This group has also observed that within the duration of the cardiac cycle, there exist temporal zones during which external electric shock causes complete irregularity of the rate and can result in immediate death. There are other temporal zones during which external electric shock is much less hazardous and more effective.

Based on this experience, Dr. Lown and coworkers have developed a new methodological and therapeutic approach to the treatment of a diversity of abnormal heart rhythm. This approach has been designated as cardioversion.

Dr. Lown holds his BS (1942) from the University of Maine and his MD (1945) from John Hopkins. At the present time, he is an Assistant Professor of Medicine, Department of Nutrition, Harvard School of Public Health and a Senior Associate in Medicine, Peter Bent Brigham Hospital. He has written numerous articles dealing with digitalis, electrolytes, arrhythmias and congestive heart failure and is the author of two books in this area.

THURSDAY, APRIL 16
Dinner — 6:00pm — MIT Faculty Club
Meeting — 8:00pm — MIT, Room 4-231

April IEEE Meetings

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

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PLEASE REMOVE AND INSERT ON BULLETIN BOARD

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

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

APRIL 7
Tuesday, 8:00pm
Pillar House
Rtes. 16 & 128
Newton

AUTOMATIC CONTROL - See page 6
SOLID STATE DEVICES FOR POWER SERVOS
N. F. Cvengros, Allis Chalmers
Dinner - Pillar House, Newton - 6:00pm

APRIL 9
Thursday, 7:30pm
Raytheon Executive Offices
Lexington

ELECTRON DEVICES AND PRODUCT ENGINEERING & PRODUCTION - See page 7
INTEGRATED CIRCUIT LINEARS AND ANALOG AMPLIFIERS
M. W. Aarons, Norden
A CHIP AND WIRE APPROACH TO ULTRA HIGH SPEED COMPUTER LOGIC
E. Edelson, Mitre Corp.
Dinner - Raytheon Executive Offices - 6:00pm
Reservations must be made with Miss Whitcher prior to April 7 - Tel. 527-5151

APRIL 11
Saturday, 9:30–11:30am
Danvers Nike Site
(D Battery, 3rd Missile Battalion)

LYNN SUBSECTION
INSPECTION TRIP
FIRE CONTROL CENTER (NIKE-HERCULES MISSILES)
For further information, call Mr. Suminsky
Lynn 8-6000, ext. 7387 or 7388

APRIL 14
Tuesday, 8:00pm
Sanborn Company
175 Wyman St.,
Waltham

ENGINEERING MANAGEMENT - See page 8
ENGINEERING MANAGEMENT FOR A PROFIT
G. F. Benoit, Sanborn Co.
Dinner - Charterhouse Hotel, Waltham - 6:30pm

APRIL 16
Thursday, 8:00pm
MIT, Room 4-231

BIOMEDICAL ELECTRONICS - See page 8
ELECTRICAL CONTROL OF RAPID HEART ACTION
B. Lown, Harvard School of Public Health

APRIL 20
Monday, 7:30pm
Merrimack Valley Motor Inn
Rte. 125, N. Andover

MERRIMACK VALLEY SUBSECTION - See page 12
SUBMARINE CABLE SYSTEMS
R. D. Ehrbar, Bell Telephone Labs.
Dinner - Merrimack Valley Motor Inn - 6:30pm

APRIL 21
Tuesday, 8:00pm
Sylvania
40 Sylvan Road
Waltham

INFORMATION THEORY - See page 14
THE STATE-OF-THE-ART IN PATTERN RECOGNITION
G. Sebestyen, Litton Systems
Dinner - Charterhouse Hotel, Waltham - 6:30pm

APRIL 21
Tuesday, 7:30pm
MIT, Room 10-275

UTILITY SYSTEMS - See page 13
E.H.V. SWITCHING SURGES
D. D. Wilson, General Electric

APRIL 21
Tuesday, 6:00pm
Thomson Club
North Reading

LYNN SUBSECTION - See page 12
ANNUAL DINNER MEETING
Charles Pierce, U. S. Weather Bureau
For reservations call R. Grady, G. E., LYnn 8-6000, 3843

APRIL 23
Thursday, 8:00pm
Sylvania Electronic Systems
100 First Avenue
Waltham — Room 1A1

DOUBLE MEETING
AEROSPACE AND NAVIGATIONAL ELECTRONICS & ANTENNAS AND PROPAGATION - See page 15
THE STRAWBERRY HILL MULTIPLATE ANTENNA
P. R. Franchi, AFCRL
NAVIGATION AND THE APPLICATION OF RADIOMETRY
H. Koumjian, Nortronics
Dinner - Charterhouse Hotel, Waltham - 6:00pm

APRIL 27
Monday, 8:00pm
Charterhouse Hotel
Waltham

ENGINEERING WRITING AND SPEECH - See page 16
CRITIQUE OF THE IEEE SPECTRUM AND OTHER IEEE PUBLICATIONS
Panel: R. E. Scott, D. Van Meter, F. K. Willenbrock, and H. F. White - F. Van Veen, Moderator
Dinner - Charterhouse Hotel - 6:00pm

APRIL 28
Tuesday, 8:00pm
Raytheon Executive Offices
Lexington

ELECTRONIC COMPUTERS - See page 18
SOLENOID ARRAY
G. Pick, Sylvania
Dinner - Charterhouse Hotel - 6:30pm

APRIL 30
Thursday, 8:00pm
Raytheon Executive Offices
Lexington

GENERAL SECTION MEETING
See page 18
NASA AND DEPARTMENT OF DEFENSE SPACE PROGRAMS
D. Brainerd Holmes, Raytheon Co.

Call for Papers NEREM '64

TECHNICAL papers describing significant original advancements in research and development are invited for presentation at the 1964 Northeast Electronics Research and Engineering Meeting (NEREM). The meeting will be held in the Commonwealth Armory and the Somerset Hotel, Boston, Mass., on November 4, 5, 6, 1964 and will include both invited papers from recognized authorities and contributed papers on new developments.

Among the subject categories recommended for contributed papers are the following:

Antennas
Automatic Controls
Biomedical Electronics
Coherent Propagation
High Frequency Solid State Techniques
High Power Solid State Techniques
Microelectronics
Microwave Techniques
Microwave Links
Plasma Electronics
Quantum Electronics — Generation
Quantum Electronics — Modulation
Transistor Technology

Speakers are requested to furnish 600-1000 word condensed versions of their papers in triplicate, plus 35-40 word abstracts for an advanced program mailing. The condensed papers should be accompanied by finished inked drawings of all curves and artwork; this material will be used for the NEREM Record, a printed, 200-page conference report which is furnished, free of charge to all IEEE members registering at the meeting.

In addition, both the abstract and summary should include the following information: Author(s) name(s), affiliation(s), business and home address, and telephone contact(s). Any necessary military or company clearance of papers must be obtained before submission of the paper. All material must be mailed on or before June 30, 1964 to the NEREM 64 program chairman:

313 Washington St.
Newton 58, Mass.

Complete, printed instructions for authors are also available, on request, from the program chairman.

Authors will be notified of paper acceptance or rejection by July 30, 1964.

JAMBORUPTION

A NIGHT TO REMEMBER

TUESDAY, MAY 19th
6:30pm
SIDNEY HILL COUNTRY CLUB
(in back of Valle's Steak House)
Route #9, Brookline

A NIGHT TO REMEMBER

★ Delicious Roast Prime Rib of Beef Preceded by your Favorite N.E. Clam Chowder

★ Many Many Door Prizes

★ Outstanding Comedy

★ Spectacular Entertainment!

★ Exotic Dancers

CAMILLE LAWRENCE

One of the many many talented acts of the spritely show your committee has booked, Camille is a popular singer a la Connie Francis with a song routine of yesteryear. This girl really belts out her songs.

Tickets may be obtained from the Boston IEEE Office, 313 Washington St., Newton, Mass. 02158
Member $7.00
Non Member $8.00

WATCH YOUR MAY *REFLECTOR* FOR FULL DETAILS!

Submarine Cable Systems

MR. Ehrbar's talk will review existing submarine systems and those planned for the future. The problems encountered in efficiently laying a cable system will be discussed with illustrations from the new Bell System Cable Ship, *C.S. Long Lines*. A short movie will follow, showing *Long Lines* at work in the Atlantic in 1963.

Mr. Ehrbar graduated from Johns Hopkins University in 1937, receiving his BSEE. He joined Bell Telephone Labs. in 1937 and is currently Head of the Submarine Cable Systems Department. He has been associated with various submarine cable projects and laboratories development work on cable laying equipment and cable ships. Mr. Ehrbar is a senior member of IEEE.

Elections

THE nominating committee of the Merrimack Valley Subsection of IEEE, composed of Messrs. D. D. Sagaser, H. T. Watkinson, and myself, have received the acceptances of the following to serve in the indicated offices.

Chairman—J. Gammie

Vice Chairman—P. J. Kerkhoff

Secretary Treasurer—R. A. King (Mrs.)

We therefore present this slate of candidates for election as officers of the Merrimack Valley Subsection, IEEE, for the 1964-65 year. Election will be held at the April 20th meeting.

M. E. Wright

MONDAY, APRIL 20

Merrimack Valley Motor Inn — Route 125, North Andover

Dinner — 6:30pm — Meeting 7:30pm

For dinner reservations, contact Mrs. R. A. King, ext. 2223, or Mr. A. C. Longton, ext. 3181, of the Bell Telephone Laboratories, 1600 Osgood St., No. Andover, Mass., Tel. 686-0600, or Mr. A. J. Murabito, ext. 2701, Western Electric Co., Inc., same address and telephone number.

Annual Dinner Meeting

THE Annual National Members' Dinner Meeting for IEEE Lynn Subsection will be held at the Thomson Club, North Reading on Tuesday evening, April 21, 1964. There will be a social hour beginning at 6:00pm, followed by dinner. A short business meeting will follow dinner, at which the 1964-65 officers and Executive Committee for the Lynn Subsection will be elected.

Mr. Charles Pierce, Supervising Guidance Forecaster, United States Weather Bureau, East Boston Airport Station, will be the guest speaker. Mr. Pierce was born in Ontario, California but is a native New Englander, having moved to Springfield, Massachusetts at the age of four. He is a graduate of Boston University and studied meteorology at MIT.

Mr. Pierce first worked for Trans-World Airlines in 1934 and since 1937 has been employed by the U. S. Weather Bureau at the Washington, D. C., Kansas City, and Boston Offices. Since 1953 he has been at the Boston Office.

His talk will concern the modern electronic advances being used in today's meteorology. Weather satellites, high-speed data acquisition, and data analyses are only a few advances that will be covered.

TUESDAY, APRIL 21

Tickets may be obtained from Raymond Grady, G.E. River Works, 1100 Western Avenue, West Lynn, phone LY 8-6000, ext. 3843 or Donald Hyer, G.E. West Lynn Works, Federal Street, West Lynn, phone LY 8-6000, ext. 7405 or Charles Twoomey, Sylvania Electric Products, Sylvan St., Danvers, phone SP 4-1640, ext. 239.

EHV Switching Surges

This discussion will cover the following basic points in EHV switching surges:

1. General presentation of switching surges on EHV systems, including the importance of switching surge considerations.
2. Types of switching surges, which can occur on EHV systems.
3. Methods of control and elimination of switching surges.
4. Methods of investigation and prediction of switching surges.

D. D. WILSON
General Electric

This meeting is one of our series on extra high voltage for this year, and anybody who is involved in the subject should plan to attend.

Mr. Wilson is currently Engineer-in-Charge — Transient Network Analyzer, General Electric Company, Schenectady, New York. He received his BSEE from Montana State College in 1959 and also attended Mexico City College.

Mr. Wilson has directed activities of the Transient Network Analyzer and participate in the analysis and study of transient overvoltages pertaining to power systems. His major area of effort over the past three years has been in the field of defining switching surges and sustained overvoltages on proposed EHV systems and analyzing methods of control of switching surges.

He is a member of IEEE and a co-author of several technical papers and articles.

TUESDAY, APRIL 21

Meeting — 7:30pm — MIT Room 10-275

The State-of-the-Art in Pattern Recognition

PATTERN recognition, as a problem of representing inputs by a set of measurements and of partitioning the measurement space into decision regions, will be reviewed briefly. An account will be given of present methods and machines, and the manner in which they "learn" to partition the measurement space will be illustrated. The merits and the disadvantages of present methods will be evaluated in terms of their ability to solve problems, their relative complexity, speed, and cost.

G. SEBESTYEN
Litton Systems

The unsolved problems of pattern recognition will be described, and the constraints within which their solutions can be expected will be outlined.

Dr. Sebestyen received both his BS and MS in 1955 and his DSc in 1959 from MIT. He joined Melpar, Inc. in 1955, where he was engaged in research and development in surveillance systems and in the application of statistical theory of communication systems. Since 1957 he has engaged in research in the field of pattern recognition, taking a decision-theory approach to the solution of classification problems. In 1960 he joined Litton Systems, Inc. where he continued work in the development of classification techniques and their practical applications; he is currently the Technical Director of the Information Sciences Laboratory.

TUESDAY, APRIL 21
Dinner — 6:30pm — Charterhouse Motor Hotel, Waltham
Meeting — 8:00pm — Sylvania, 40 Sylvan Road, Waltham

DOUBLE MEETING

The Strawberry Hill Multiplate Antenna

P. R. FRANCHI — *AFCRL*

THE multiplate antenna technique allows for the economical construction of large aperture antennas. The reflecting area is divided into many smaller reflecting surfaces, each adjustable in height and angle to redirect the incoming energy to a point focus.

A multiple plate antenna test section has been constructed at the Strawberry Hill Site in Concord, Massachusetts. The antenna test section consists of 220 flat plates, five feet on a side arranged within an elliptical aperture that measures 120 by 70 feet.

Radiometric measurements of apparent antenna temperature at 1395 Mc/s have been made for several months. Transits of the radio sources Casseopeia A and Cygnus A have yielded data on the effect of interstices on antenna performance.

Peter R. Franchi received the BA degree in Engineering Sciences from Harvard University in 1959 and the MS in Communications Engineering from Northeastern University in 1961. He has since worked at Air Force Cambridge Research Laboratories in the Radiation and Reflection Section of the Microwave Physics Laboratory. He has worked on line source feeds for spherical reflectors, linear arrays and large aperture antennas.

Navigation and the Application of Radiometry

H. KOUMJIAN — *Nortronics*

THE terrestrial navigator has long desired a means of determining his position on earth which is not subject to the vagaries of weather, i.e., cloud cover, rain, snow, etc., and at the same time is accurate enough for his purpose. The radiometer as a detector of solar and lunar radiation at microwave frequencies has effectively provided a sensor to meet the above requirements. The use of artificial satellites for celestial navigation is also discussed. In the realm of space travel, unique applications of the radiometer for position and direction determination are given.

Mr. Koumjian has more than fifteen years of experience in the field of electronics. As Microwave Navigation Group Chief at Nortronics' Marine Equipment Department, Mr. Koumjian has been responsible for the systems analysis and design of the Mark II Radiometric Sextant and is currently responsible for the test program and system evaluation being performed on the Sextant at MED's test facility.

THURSDAY, APRIL 23
Dinner — 6:00pm — Charterhouse Motel, Waltham
Meeting — 8:00pm — Sylvania, 100 First Ave., Waltham Conference Room 1A1

Critique of the IEEE spectrum and other IEEE Publications

F. K. WILLENBROCK
Harvard

R. E. SCOTT
Northeastern University

D. Van METER
Litton Industries

H. F. WHITE
Jackson & Moreland

ON May 8 of last year, the Boston Chapter of PTGEWS sponsored a program that dealt with the subject entitled "The Role of the Proceedings in the IEEE, An Open Forum." The panel consisted of Dr. Ronald E. Scott, Dr. Paul F. Green, and Dr. Arthur Kohlenberg, with Fred Van Veen serving as moderator. These distinguished gentlemen expressed their opinions on not only the role of the *Proceedings*, and what they thought that role should be, but also the roles played by the other IEEE publications. A transcription of that meeting appeared in the September 1963 issue of the *IEEE Transactions on Engineering Writing and Speech*.

Since that meeting of almost one year ago we have witnessed some major changes in the publications program of the IEEE. *Spectrum* has made its debut and replaced the *Proceedings* as the publication that's distributed to all members; the *Proceedings* is available on a subscription basis only; *Electrical Engineering* has ceased publication; and the *IEEE Transactions on Power Apparatus and Systems* becomes the first of the Transactions to accept advertising. Many of these changes are in keeping with at least some of the opinions voiced by panelists and attendees at the May meeting. Other changes are contrary to views expressed by still others at that meeting.

The primary purpose of the forthcoming panel discussion is to evaluate the new *Spectrum* in terms of its editorial standards, contents, format, function, and related factors. As with the previous panel discussion, the roles of the *Proceedings* and the *Transactions* will also be taken into consideration. At least one panelist, Dr. Ronald Scott, will have the opportunity to appraise the current publications program against his expressed opinions of one year ago. The other panelists will offer their ideas for the first time; one from the point of view of a power-oriented member.

F. Van VEEN
Moderator
General Radio Co.

It is not the intention of the Boston Chapter of PTGEWS to convey an impression that the publications program of IEEE is in need of criticism from its members. On the contrary, those burdened with the responsibility of guiding such a program are deserving of much praise for their dedication and accomplishments. However, since the Boston area is regarded as one of the country's foremost electronic centers, it seems safe to assume that a sampling of opinions from notable engineers in our area can serve a very useful purpose when presented with a constructive spirit.

MONDAY, APRIL 27
Charterhouse Motor Hotel, Waltham
Dinner — 6:00pm — Meeting — 8:00pm

Solenoid Array

A PARALLEL cross-correlator, a megabit permanent digital store, and an associate memory are some of the applications of the solenoid array circuit technique developed at Sylvania.

Long solenoids, both air-cored and ferrite cored, supply open-ended transducers which couple into wired memory printed circuit sheets. For the correlators, the solenoids are driven and the data planes pick up voltages as a function of the stored data. For memory, the data planes are driven and the solenoids serve as sensing elements. Combination of the two methods forms an associative transducer.

G. PICK
Sylvania

The recognition unit of the optical page reader is a cross-correlator based upon the solenoid array principle. This character recognition array simultaneously cross-correlates a 320 bit binary word, the description of an input pattern, against up to 2000 stored weighting functions, each function consisting of 1428 bits. The 2.8 megabit store is accessed in parallel in 2.7 microseconds.

Mr. Pick is currently an Engineering Epecialist at Sylvania's Applied Research Laboratory where he has been since 1956. He received his BEE degree at the Polytechnic Institute of Brooklyn, in 1952. He has worked on a variety of airborne instrumentation problems and a variety of system studies and instrumentation, and in the past years has been active on the Sylvania Page Reader and in particular, the solenoid array devices.

TUESDAY, APRIL 28
Dinner — 6:30pm — Charterhouse Hotel, Waltham
Meeting — 8:00pm — Raytheon Executive Offices
Lexington

GENERAL SECTION MEETING

THURSDAY, APRIL 30
8:00pm
Raytheon Executive Offices
Jct. of Routes 128 & 2, Lexington

NASA and the Dept. of Defense Space Programs

D. BRAINERD HOLMES
Raytheon Company

MR. Holmes will address himself to some of the future problems in integration of the NASA and Department of Defense space programs, particularly those associated with manned space vehicles. He also will discuss some aspects of procurement and industry-government relations.

D. Brainerd Holmes earned a BS in Electrical Engineering in 1943 from Cornell University. In 1943-44, he did graduate study at Bowdoin College and MIT.

Holmes assumed his duties as Director of Manned Space Flight for NASA on November 1, 1961, and was responsible for direct program supervision of the manned space flight activities at NASA centers and in industry. This included eventual manned lunar landings embraced in Project Apollo, the two-man Project Gemini program, and Project Mercury. In October 1962 he was given an added responsibility as a Deputy Associate Administrator in charge of institutional and operational matters at the field centers directly involved in the manned space flight program. These installations are the Marshall Space Flight Center, Huntsville, Alabama; the Manned Spacecraft Center, Houston, Texas; and the Launch Operations Center, Cape Kennedy (Canaveral), Florida.

Prior to his appointment with NASA, Holmes was General Manager of RCA Major Defense Systems Division in Moorestown, New Jersey, providing technical and management direction of advanced military electronic systems in the fields of detection and warning, aerospace and command and control. In this role, he also served as the Ballistic Missile Early Warning System (BMEWS) Project Manager for RCA, the weapons system contractor, and was responsible for coördinating for the Air Force a vast effort involving the Government and some 2900 American companies. His work with RCA included earlier responsibilities as project manager of both the land based system for the Navy's Talos missile and Atlas launch control and checkout equipment development. These are the three largest military systems to be developed by RCA to date.

Holmes was with Western Electric Company and Bell Telephone Laboratories between 1945 and 1953, where he initiated and developed several precision transmission measuring set and other test equipment for the black and white television coaxial system. He assisted in the development of the terminal and repeater amplifier development for the Bell Systems L1 and L3 coaxial system.

In October 1963 he joined the Raytheon Company as Senior Vice President and member of the Board of Directors.

Reflections

Editor

BRUCE B. BARROW

Education — Who Will Pay?

IN a recent column Chairman Scott called attention to an evident disparity in the public support given to education, especially higher education, in California and in Massachusetts. California, through extremely generous state support and enlightened university administration, has managed to achieve an enviable synthesis of mass production and high-quality academic instruction. Massachusetts, on the other hand, has continued with its long tradition of reliance on a large number of privately endowed schools, the best of which can claim in many fields to be the best in the world. It is generally recognized that higher education faces a crisis caused by a rapidly growing population and an increase in the percentage of young people who will seek university degrees. It is also generally conceded that the endowed universities will not be able to meet the demand (and that they should not try). Meanwhile, costs continue to rise, and it will cost $15 000, more or less, to provide a college education for a child now in elementary school. Who will pay?

In *The New Republic* of January 11, Christopher Jencks asks what support might realistically be expected of the U. S. Congress. Despite the fact that President Johnson hailed the last session as "the Education Congress of 1963," Jencks finds little to be sanguine about. Adding up the "expenditures of our accredited schools, colleges, and universities, *not including expenditures for organized research* [Jencks's italics]" he finds that about $28 billion was spent on American education in 1962-63. Only about 4% of this came from Federal aid, and the Higher Education Facilities Act of 1963, if fully funded, will raise this figure to about 7%, which is where it was in 1952-53. Congress will thus "be providing less money for the schools and colleges of all America than either the New York or California legislature provides for its schools and colleges." Jencks argues that the total cost of education will rise to $50 billion by 1970-71, and sees little hope for any significant rise in the percentage of the education bill that will be picked up by the Federal government. He concludes, "Those who want first-rate education for their children in the next decade would be wise to take this to heart and move to one of the areas which already supports education comparatively generously."

At present, Massachusetts as a whole hardly qualifies as such an area, although public education in some of the towns and cities around Boston is excellent. *Time* magazine recently cited the Newton school system as an example for all America, and last fall the Newton Junior College became the first accredited public junior college in New England. But it is unreasonable to expect the cities and towns to continue to bear the major share of the burden, and if the Federal government *will* not and many deserving students *can* not pay the bill, only the states are left. Will Massachusetts lead or be left behind?

Radioastronomy and TV

In a decision that few of us had dared hope for, the FCC voted to reserve TV channel 37 (608-614 MHz) for radioastronomy for ten years, denying the request of a Patterson, N. J., broadcaster for the allocation. The FCC majority opinion stated, ". . . we do not believe it to be in the public interest to close the door on, or even jeopardize, whatever benefits may be derived from [radioastronomical] operations . . ." The frequency band in question was reserved for radioastronomy by international agreement, but the agreement was advisory only and could have been disregarded for cause by the FCC.

Even more remarkable than the 3-2 vote in favor of radioastronomy were some points raised in the dissent, which gave the opinion that "if science cares to perpetuate itself and make itself attractive to coming generations, it will see to it that the use to which television is put is not wasteful, but rather contributory to an enlightenment of the public." Just how the scientific community is to "see to it" that TV programming is improved was not specified.

We do not for a moment accept the idea that the scientific community has any more responsibility than any other group of intelligent citizens to improve TV programming. However, since WGBH is now making its annual appeal for public support this seems to be an appropriate time to throw a bunch of editorial orchids their way. WGBH–FM and WGBH–TV have contributed deeply and meaningfully to the intellectual and cultural life of Boston (and of the whole country, since many of their programs are rebroadcast in other cities). Section members who wish to contribute anything more concrete than compliments can mail it to WGBH, Cambridge 42.

The Typical G-R Instrument

This is the Type 1806-A Electronic Voltmeter

It includes design features not found in any other commercial voltmeter.

It has been assembled by one craftsman . . . not on an assembly-line.

It has been painstakingly calibrated and tested. It is mechanically sound and built to take abuse. It has convenient controls and a large readout.

It is sensibly housed in a practical, usable case.*

It has a dc-to-1500-Mc range. Basic accuracy is ±2% of reading.

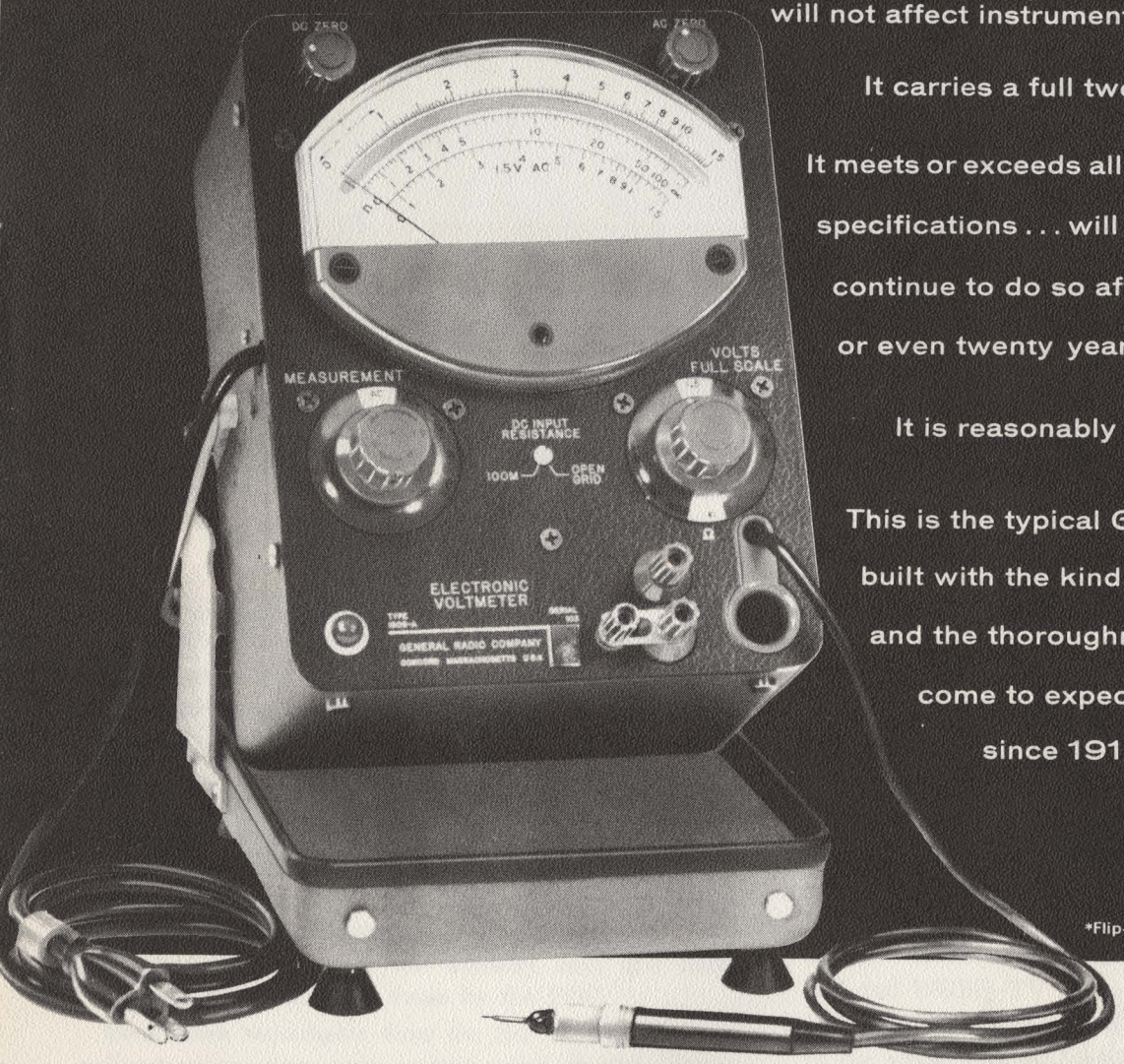
It has so much feedback in its dc circuits that rundown in g_m to half its initial value will not affect instrument calibration.

It carries a full two-year warranty.

It meets or exceeds all of its published specifications . . . will probably continue to do so after five, ten, or even twenty years' use.

It is reasonably priced at $490.

This is the typical GR instrument, built with the kind of thought and the thoroughness you've come to expect from us since 1915.



*Flip-tilt case Patent No. 2,966,257

GENERAL RADIO COMPANY

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