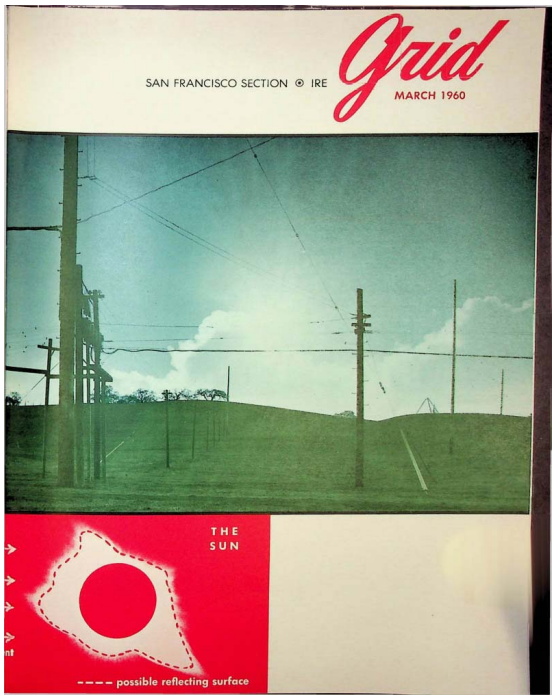
# EDITOR'S PROFILE of this issue

*from a historical perspective …*

with Paul Wesling, SF Bay Area Council GRID editor (2004-2014)

March, 1960:




Cover: An interesting radio experiment – bouncing signals off the surface of the sun and listening for responses 1000 seconds later. This allowed mapping of the radio profile of the sun (lower diagram). Output was 40 kW at 25 Mc (MHz), and the estimate was that 100 W hit the sun. Received echoes were 40 to 50 dB below the noise level – very tricky. Note the rising structure of "The Dish" on the hills behind this array of four rhombic antennas covering 14 acres.

Page 9: Bob Noyce (the leader of Shockley's "traitorous eight") and his staff talk about the rapid growth of Fairchild, and lead a plant tour of their new Whisman Road facility, for the Engineering Management group. Fairchild has grown to 1,400 employees and 100,000 square feet of space (being doubled this year). The staff doubles every four months. There's a photo of Noyce with some of his background on pp. 13-14.

Page 9: It's official! The IRE rents space in the Whelan Building at 701 Welch Road, Palo Alto, where they'll stay for many decades (until Stanford "re-farmed" this land for higher density). It also serves as the San Francisco chapter of WEMA (Western Electronics Manufacturing Association) and the IRE office for our Region 7 director.

A new group is in formation: Circuit Theory. There may also be an attempt to form a group on Information Theory.

Page 12: The Electron Devices group has speaker Robert Norman of Fairchild, discussing the development of logic devices that can be implemented as micrologic elements (today, ICs). He describes monolithic flipflops, adders and shift registers running at 20 Mc (MHz), and gives results of 1000-hour life tests. These developments were made possible by the invention of the planar process patented by Jean Hoerni (one of Shockley's "traitorous eight") several years before.

On the same page, the Reliability and Quality Control group has a meeting discussing "Transistor Reliability", with speaker Julian Hilman of Fairchild. Again, these transistors use the new planar process, which gave a quantum leap in reliability.

Page 16: It is noted that IRE Headquarters is at 1 East 79th Street in Manhattan, NY. It moves in 1961 to the new United Engineering Building at 345 East 47th Street (across from UN Plaza – shown at right), where the five "founding societies" relocated upon its completion. This building, funded by the Carnegie Foundation, was demolished in 1997 to make way for the residential Trump World Tower. I had meetings there several times, usually for EPS Board meetings.

Archive of available SF Bay Area GRID Magazines is at this location:
**https://ethw.org/IEEE_San_Francisco_Bay_Area_Council_History**

SAN FRANCISCO SECTION ⊙ IRE

# Grid

MARCH 1960

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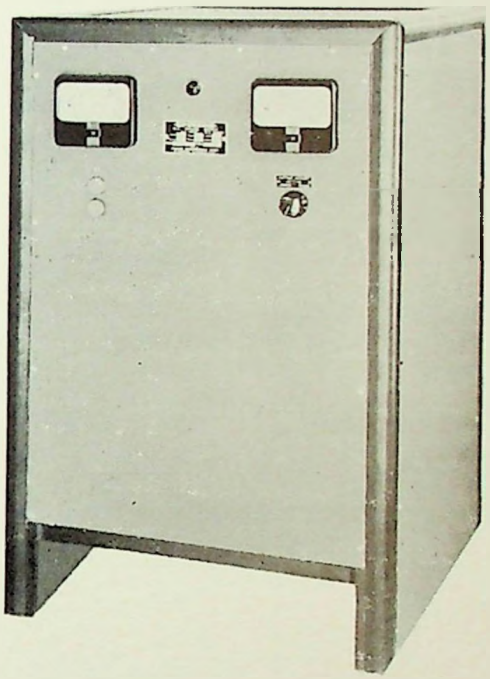
VANGUARD AND LA CROSSE

MISSILE PROGRAMS



## SPECIFICATIONS

**A.C. INPUT:** 208/230/460 volt ±10%, 3 phase, 60 cycle.

**RIPPLE:** Less than 1% RMS.

**RESPONSE TIME:** A special control internally mounted in the Power Supplies handles adjustment of response time. The "load on" response time is adjustable from 20 to 200 milliseconds, and the "load off" from 40 to 400 milliseconds. An important advantage of this adjustable response is when used with inductive loads, such as inverters; recovery can be adjusted to avoid interaction between inductive load and power supply.

**RATINGS AVAILABLE:**

| Model Number | D.C. Output | | Regulation | | Dimensions W" x H" x D" | Weight Lbs. |
|---|---|---|---|---|---|---|
| | Volts | Amps | Static-Line or Load | Dynamic-Load* | | |
| MRST28-100 | 24-32 | 100 | ±0.1% | ±6V | 22"x36"x22" | 430 |
| MRST28-200 | 24-32 | 200 | ±0.1% | ±6V | 22"x36"x22" | 550 |
| MRST28-300 | 24-32 | 300 | ±0.1% | ±6V | 22"x46"x22" | 700 |
| MRST28-400 | 24-32 | 400 | ±0.1% | ±6V | 28"x58"x24" | 1250 |
| MRST28-500 | 24-32 | 500 | ±0.1% | ±6V | 26"x68 ½ x32" | 1650 |
| MRST28-600 | 24-32 | 600 | ±0.1% | ±6V | 26"x68 ½ x32" | 1650 |
| MRST2440-250 | 24-40† | 250 | ±0.1% | ±2V | 26"x68 ½ x32" | 1650 |

* For Full Load Change

† In 2 Ranges

## TECHNICAL DESCRIPTION

These units use silicon power rectifiers for increased reliability and efficiency. Silicon rectifiers provide constant efficiency and exhibit no aging characteristics as is more common in other type rectifiers. Magnetic components utilize grain oriented silicon steel and Class B insulation for compact design and efficient operation. The power section consists of a 3 phase magnetic amplifier with extremely high gain. Preamplifier is fully transistorized and utilizes silicon zener diodes as a reference element.

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*For additional data contact factory or sales offices below:*

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SAN FRANCISCO SECTION

# Grid

VOLUME 6 MARCH 1960 NUMBER 7



*(Continued on page 8)*



## IN THIS ISSUE



## ABOUT THE COVER

### Helios: Equinoctial Target

April 7, 10, and 12, 1959, were the occasions of the first known round-trip earth-solar message. On the cover we show the appearance of the disk rising through the Stanford University four-rhombic antenna array which sent and received the messages on those three mornings during the 30 minutes the rising sun was in the antenna pattern.

Section members Professor Von R. Eshleman and Dr. Philip B. Gallagher were co-directors of the project which also included Lt. Col. Robert C. Barthle, an Army Signal Corps officer studying for a doctoral degree at Stanford. Work was done in the Radioscience Laboratory and supported primarily by the

*(Continued on page 9)*

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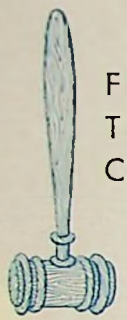

FROM THE CHAIRS

## What Time Is It?

*E. A. Blasi*

During the month of April, PGAP is sponsoring a series of four tutorial lectures on Radio Astronomy. This action on the part of PGAP may cause some perplexity as to why this particular professional group is directing so much attention to Radio Astronomy.

It is universally recognized that space technology is confronted with challenging new and stimulating long-range programs demanding "breakthroughs" in such matters as systems guidance, tracking, and data transmission.

For instance, scientists and engineers of unusual technical breadth and competence are needed if a high degree of space-communications reliability is to be achieved. Further, applicable techniques at the threshold of space exploration are the results of either piercing scientific frontiers or transforming old arts into new sciences.

Space technology presents severe limitations in equipment size, weight, and power as well as problems caused by environmental noise interference emanating from terrestrial or extra-terrestrial sources which in essence collapses the ideals into the realm of practicality.

In addition to such prerequisites and the appraisal of scientific and engineering abilities in the solution of satellite orbiting and attendant space-communications problems, there develops a hiatus which needs to be bridged and its absent component bears a characteristic relationship to the field of astronomy —particularly in the precision of measurements.

There dwells within this relationship an impulsion to transcend euphemistically into the principle of uncertainty. Actually, the electronic communication instrumentation first has to achieve an equivalent status to the astronomer's telescope. This limitation rests on the extent of atmospheric turbulence and further on the ultrasensitive detection techniques which must overcome the problem of reducing comparatively long-time constants which obscure positional accuracy. Problem complications immediately resurrect themselves at the instant of correlating ephemeral or absolute time with events.

The gathering of high-resolution data may not be an immediate accomplishment and awaits the improvement of calibration standards over a period of time. Nevertheless, from a precision standpoint, it is essential that high-quality measurements be obtained whenever possible so that eventually, when correlated and associated by exact knowledge of time of events, high-resolution data results.

Not only has science accustomed itself to the interplay of theory, experimental observation, and application (or, the fact that triumphs in observational techniques create new challenges to the theoretician and similarly that strides in theoretical accomplishments tax the ingenuity in experimental observations demanding higher orders of resolution in instrumentation) but also a definite awareness prevails among scientists of the necessity of interplay between the astronomical laboratory, where experiments have dealt with matter under strange and abnormal conditions, and the terrestrial laboratory. These experiments are associated with large-scale electrodynamic phenomena in astrophysical contexts.

Consequently, blending of fields of sciences adds to our vocabulary such new terminologies as "magnetohydrodynamics" which stems from investigators establishing cross-field work overlapping parts or all of various areas of specialization.

Of significance also is the fact that data accumulated in a single locality and/or specific time, of itself, bears little value when applied to space problems. However, this same data becomes of paramount importance when correlated with other data observed from widely dispersed localities and different time instances whether originating from terrestrial or extra-terrestrial stations. Therefore, this entails a great deal of intercommunication well directed and coordinated.

This, indeed, is a snowballing situation considering problems of data handling, mathematics, computational machinery, etc., culminating in decision machines for space navigation, non-aerodynamic control of space vehicles, artificial gravity techniques, and, not least, the step-by-step probing processes which eventually will place man in space.

The division of interests and knowledge no longer displays definitive boundaries but rather grey areas persist. Their presence gives premonitions that a transmutation is imminent. Eventually new lines of demarkation will engulf combinations and recombinations, forming new syzygial tributaries of knowledge and technologies.

Despite the effervescent growth and fertility of this knowledge of our times amidst a cataclysmic swirl of mass and energy, mankind is still confronted with the simple oddity that as yet one doesn't exactly know where he is nor what time it is.

*E. A. Blasi, chairman, PGAP*

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1355

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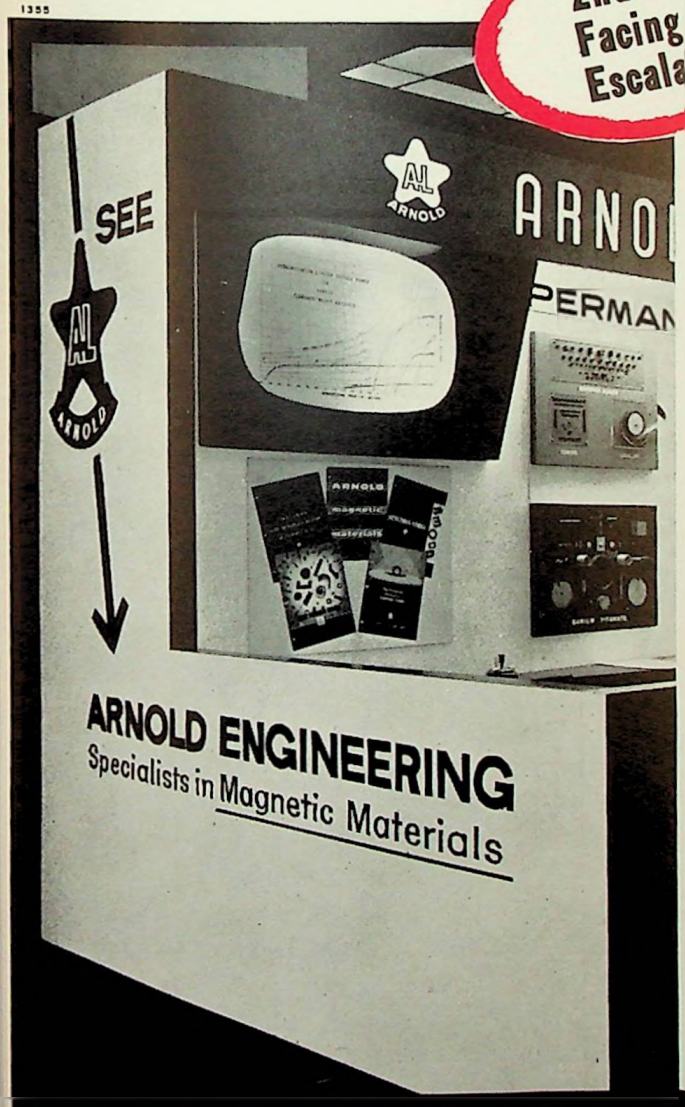


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INSTITUTIONS

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# MEETING CALENDAR

## SAN FRANCISCO SECTION • Tuesday, March 29

Field Trip to New Almaden Museum and Perham Foundation for "Cavalcade of Electronics"
Place: New Almaden Museum, California (For directions see map on page 10)
Dinner: 6:30 P.M., Hawaiian Gardens, 1500 Almaden Road, San Jose, California
Reservations: IRE Office, DAvenport 1-1332 by March 28

## SAN FRANCISCO SECTION 8:00 P.M. • Wednesday, April 6, 13, 20, 27

(Tutorial series on radio astronomy—joint with PGAP, see below)

## PROFESSIONAL GROUPS

### Antennas & Propagation 8:00 P.M. • Wednesday, April 6

(Joint with San Francisco Section, tutorial series on radio astronomy)
Lecture No. 1
"Introduction to Radio Astronomy"
Speaker: Professor R. N. Bracewell, electrical engineering department, Stanford University
Place: Physics Lecture Hall, Stanford University
Dinner: "Meet-the-speaker," 6:30 P.M., Happy Hour 6:00 to 6:30 P.M., Hal's Restaurant, 4085 El Camino Way, Palo Alto
Reservations: Miss Meyring, DAvenport 1-3300, Ext. 365

### Antennas & Propagation 8:00 P.M. • Wednesday, April 13

Lecture No. 2
"The Structure of our Galaxy"
Speaker: Professor Harold Weaver, radio astronomy department, University of California, Berkeley
Place: Physics Lecture Hall, Stanford University
Dinner: "Meet-the-speaker," 6:30 P.M., Happy Hour 6:00 to 6:30 P.M., Hal's Restaurant, 4085 El Camino Way, Palo Alto
Reservations: Miss Meyring, DAvenport 1-3300, Ext. 365

### Antennas & Propagation 8:00 P.M. • Wednesday, April 20

Lecture No. 3
"Identification and Physical Nature of Radio Stars"
Speaker: Professor John Bolton, radio astronomy department, California Institute of Technology
Place: Physics Lecture Hall, Stanford University
Dinner: "Meet-the-speaker," 6:30 P.M., Happy Hour 6:00 to 6:30 P.M., Hal's Restaurant, 4085 El Camino Way, Palo Alto
Reservations: Miss Meyring, DAvenport 1-3300, Ext. 365

### Antennas & Propagation 8:00 P.M. • Wednesday, April 27

Lecture No. 4
(Details to be announced)

### Electron Devices 8:00 P.M. • Monday, March 28

"New Advances of Solid State Micrologic Elements"
Speaker: Dr. Robert Norman, Fairchild Semiconductor Corp.
Place: Physics Lecture Hall, Room 100, Stanford University

### Electronic Computers 8:00 P.M. • Tuesday, March 22

"An Evaporated Random Access Memory"
"A Thin Film Magnetic Shift Register"
Speaker: K. D. Broadbent, Hughes Research Laboratories, Culver City, Calif.
Place: Auditorium, Bldg. 202, Lockheed Missiles & Space Division, 3251 Hanover St., Palo Alto
Dinner: "Meet-the-speaker" 6:00 P.M., Hal's Restaurant, 4085 El Camino Way, Palo Alto

# MEETING CALENDAR

**Engineering Management** — 8:00 P.M. • Tuesday, April 12

"Planning for an Expanding Organization" and plant tour of Fairchild Semiconductor Corporation
Speaker: Dr. Robert N. Noyce and staff
Place: Fairchild Semiconductor Corp., 545 Whisman Road, Mountain View
Dinner: 6:30 P.M., Social Hour 5:45 P.M., Hal's Restaurant, 4085 El Camino Way, Palo Alto
Reservations: Mrs. Iavicoli, LYtell 1-8461, Ext. 227; or Mrs. Susan Schorr, YOrkshire 8-6211, Ext. 2165

**Engineering Writing & Speech** — 8:00 P.M. • Tuesday, March 15

"Career Advancement in Technical Writing"
Speakers: Hyman Olken, chairman PGEWS, Lawrence Radiation Laboratory, Livermore; and Emlen Littell, editor, Stanford University Press
Place: Lenkurt Electric Conference Room, Bldg. 4, 1105 County Road, San Carlos
Refreshments will be served during the intermission
Nominations will be held for 1960-1961 slate of officers at this meeting

**Medical Electronics** — 8:00 P.M. • Tuesday, March 22

"Physiological Effects of Microwave and Ultrasonics"
Speakers: Sydney F. Thomas, M.D., chief of radiology department of Palo Alto Medical Clinic; Thomas Jaski, professional consulting engineer; and David Lord, section leader, engineering test section of the mechanical engineering department, Lawrence Radiation Laboratory. University of California
Place: Room M-112, medical school bldg. of Palo Alto-Stanford University Medical Center (Room M-112 is located in the courtyard of the wing in the center nearest Hoover Tower. Approach from Palm Drive on Stanford Campus, an extension of University Avenue, Palo Alto)
Dinner: 6:00 P.M., Red Cottage Restaurant, 1706 El Camino, Menlo Park
Reservations: George Turner, DAvenport 5-8332

**Reliability & Quality Control** — 7:30 P.M. • Tuesday, April 19

"Transistor Reliability" followed by tour of reliability evaluation division, Fairchild Semiconductor Corporation
Speaker: Julian Hilman, manager of reliability evaluation division, Fairchild Semiconductor Corp.
Place: Hal's Restaurant, 4085 El Camino Way, Palo Alto
Dinner: 6:00 P.M., Hal's Restaurant, 4085 El Camino Way, Palo Alto
Reservations: Julian Hilman, DAvenport 6-6920

**Space Electronics & Telemetry** — 8:00 P.M. • Tuesday, March 29

(Please note change in speaker and date from previous announcement)
"Thoughts on Space Research"
Speaker: Dr. Samuel Silver, director of space sciences laboratory, University of California, Berkeley
Place: Auditorium, Bldg. 202, Lockheed Missiles and Space Division, 3251 Hanover Street, Palo Alto, Calif.
Dinner: "Meet-the-speaker" dinner, 6:30 P.M., Hal's Restaurant, 4085 El Camino Way, Palo Alto, Calif.
Reservations: Lois Reed, REgent 9-4321, Ext. 2-8150 or 2-6602 before noon, March 15

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**CHRONOLOGICAL RECAP**

March 15—Engineering Writing & Speech
March 22—Electronic Computers, Medical Electronics
March 28—Electron Devices
March 29—San Francisco Section, Space Electronics & Telemetry
April 6—Antennas & Propagation/San Francisco Section
April 12—Engineering Management
April 13—Antennas & Propagation/San Francisco Section
April 19—Reliability & Quality Control
April 20—Antennas & Propagation/San Francisco Section
April 27—Antennas & Propagation/San Francisco Section

## SECTION HEADQUARTERS

### Palo Alto Office

Together with WESCON and WEMA (the two other members of the tightly knit electronic triumvirate), IRE this month migrates 11.25 miles south from San Mateo to Palo Alto. The group office, which has been in the Villa Hotel building since 1956, is now in the Whelan Building at 701 Welch Road, Palo Alto, just west of the Stanford Shopping Center. The telephone number is DAvenport 1-1332. Miss Grace Pacak is office manager.

In addition to serving the functions of WESCON in Northern California, the San Francisco Chapter of WEMA, and our Section, the office will also serve C. Wesley Carnahan, Director of the Seventh Region, IRE.

## PROFESSIONAL GROUPS

### More New Chapters?

A review of the San Francisco Section membership shows over ten per cent as floating members of the Professional Group on Circuit Theory. Therefore, a chapter of this group is now being organized. This chapter will serve the technical needs of members who are working in the discipline of circuit theory. An attempt will also be made to satisfy the need for a group on Information Theory.

All members of the IRE and affiliates wishing to take an active part in this chapter of the Professional Group on Circuit Theory should contact: R. C. Kiessling, ITT Laboratories, 937 Commercial Street, Palo Alto. Telephone: DAvenport 1-0211.

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**MORE COVER**

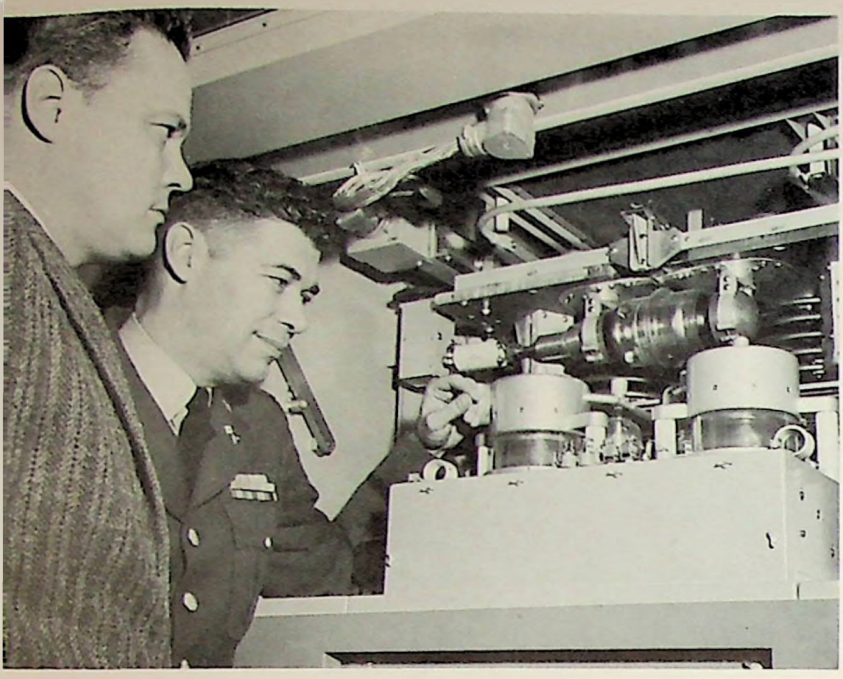
Air Force Cambridge Research Center.

Acknowledgements of credit for special assistance have been made to Professor O. G. Villard Jr., director of the Radioscience Laboratory; Professor Allen M. Peterson; Dr. Philip Newman and the late Dr. Joseph P. Casey Jr. of Cambridge; research assistant T. V. Huang; and graduate students William A. Long, Richard D. Egan, and David S. Pratt.

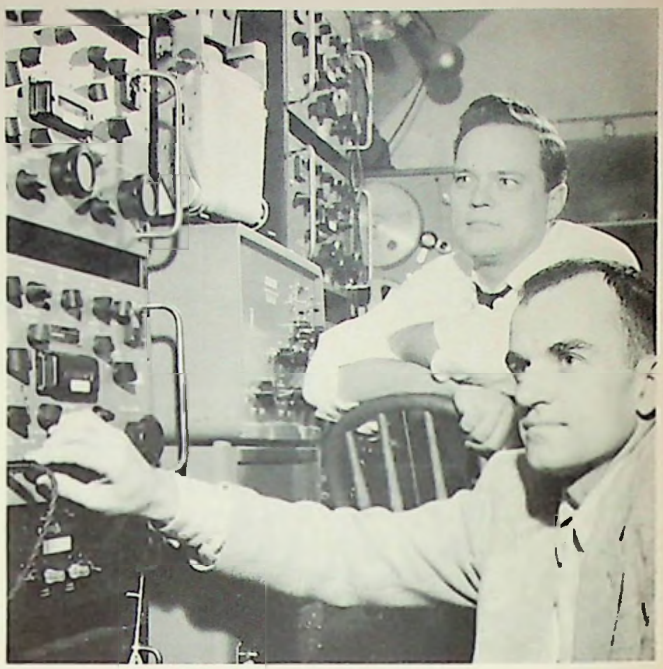
Equipment used was part of the approximately $1 million worth of facilities located in the hills behind the campus. Visible in the illustration, over the horizon at right, is the feed tripod of the new 142-ft radar telescope now under construction and to be in service within a year.

For the April tests, described in detail in "Science" for Feb. 5, a Collins transmitter with about 40-kw average out-

*(Continued on page 10)*



*Eshleman and Barthle examine the 40-kw Collins transmitter used in the Stanford Sun-bounce experiment last April. Eshleman was a co-director of the project*



*Eshleman and Gallagher operate the receiving equipment used by the Radioscience Laboratory in recording the return signal. Gallagher was the other co-director*

**MORE COVER**

put was operated at about 25.6 mc. The transmitter was pulsed on and off alternately throughout a time interval of 15 minutes, each on and off period lasting 30 seconds.

The 14-acre four-rhombic array provided about 25 db gain. Since travel time to the sun and back is about 1000 seconds for the 93 million mile trip, the transmitter and pulsing circuits were turned off after 900 sec of transmission, the antenna was connected to the receiving equipment, and the output fed to an Ampex tape recorder for subsequent analysis, using an IBM 797 computer.

Echoes were on the order of 40 to 50 db below noise level after detection, but from post-detection integration, their presence was computed with chances for error on each day of less than 1 in $10^5$. Of the 40 kw transmitted, it is estimated that 100 watts hit the sun and $10^{-16}$ watts returned to earth. Since the sun radiates radio noise at about 40,000 watts per square inch, the relationship between the signals resembles that between the total world's power output for 10 years and that consumed by a flashlight bulb in 1 second.

## SECTION MEETING AHEAD

### The Retrospective View

On March 29 there will be an organized opportunity to visit the unique display of early radio-electronic equipment and documents which constitute the Perham Foundation's "Cavalcade of Electronics." This fascinating facility at New Almaden has been the object of considerable interest and activity by scattered groups in the Section membership, particularly the Historical Committee, for many months.

Now, the official opening will be marked by a Section meeting. Further details are listed in the calendar on page 8.

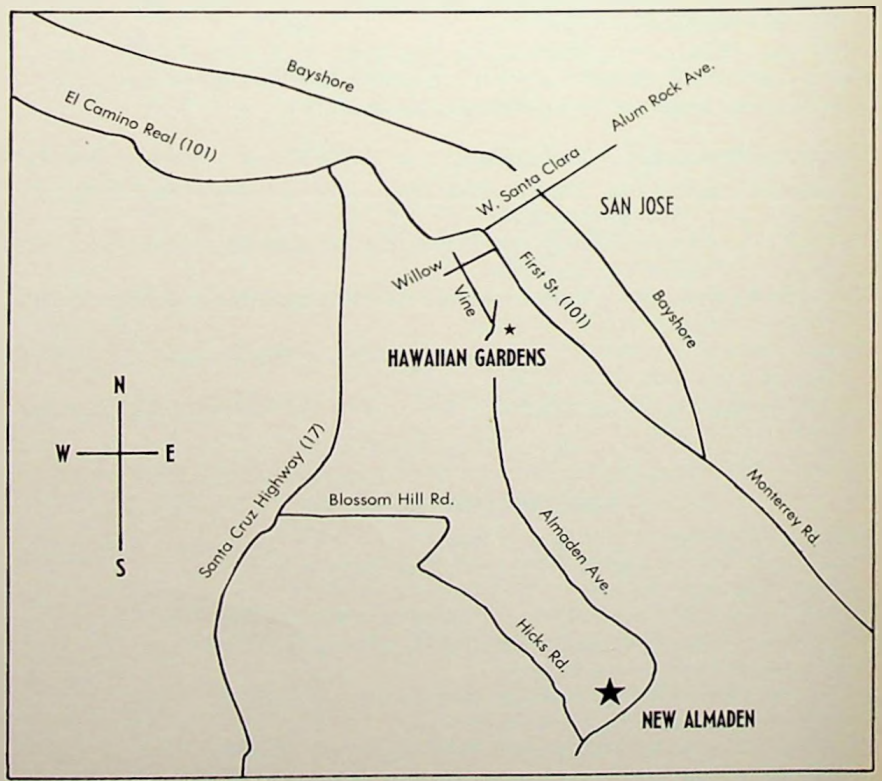
Bring guests and follow the route shown on the accompanying map.

## MEETING AHEAD

### Far Out

Take particular note of the fact that PGSET has changed the date of its March meeting to Tuesday, March 29. For the rest of the details, see the Meet-

*(Continued on page 12)*



ENGINEERS – SCIENTISTS

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Senior members of the Technical Staff will be available for interviews at the MITRE suite in the Waldorf Astoria Hotel.

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*Samuel Silver*

**MORE PGSET**

ing Calendar on page 9.

The speaker, Dr. Samuel Silver, newly appointed director of the Space Sciences Laboratory at the University of California, will put forward, "Thoughts on Space Research."

Sam Silver is well known in this Section for his many activities and presently holds the office of Director 1958-61. He is a Fellow, not only of the Institute but also of the American Physical Society. He holds memberships in Sigma Xi, the New York Academy of Sciences, Eta Kappa Nu, Tau Beta Pi.

Active in the International Scientific Radio Union for a number of years, he has been chairman of Commission VI of the U.S.A. National Committee and is presently chairman of the International Commission VI. In 1958 he was elected secretary of the U.S.A. National Commission.

He is a native of Philadelphia and received both a BA and MA in physics from Temple University. His PhD is from the Massachusetts Institute of Technology.

Silver has been on the faculties of Temple University, Ohio State University, the University of Oklahoma, MIT, and the University of California. As a Guggenheim Fellow, he studied at the Royal Technical University, the Bohr Institute in Copenhagen, and the Cavendish Laboratory at Cambridge.

## MEETING AHEAD

### Dense But Logical

New advances in the technology of solid-state micrologic elements will be described by Dr. Robert Norman of Fairchild at the March meeting of the Professional Group on Electron Devices. See Page 8 for the Calendar to secure further details.

The term "micrologic elements" refers to a family of high-speed low-power digital computer elements.

In discussing these elements the emphasis is placed on the logical function to be performed rather than the element as a circuit built of individual components. For this reason, the term micrologic is preferred to the more common terms, micro-circuitry or micro-electronics, for treating the technology of high-density packaging of digital logic functions.

Basic micrologic elements such as flip-flops, dates, adders, and shift registers will be described. These elements operate at 20 mc with an average power dissipation of about 15 milliwatts per logic function. The elements are currently being packaged in six or eight lead-to-line transistor packages for convenience in handling. The volume occupied by the uncased element will ultimately be much less.

Feasibility of using the uncased elements for packaging the logic system of a typical real-time digital computer in a volume of the order of 1.5 cubic inches is demonstrated. This corresponds to a packaging density of the order of 1.5 million logic functions per cubic foot.

Large numbers of these basic micrologic elements have been on life test for over 1,000 hours. In these life tests the emphasis can now be placed on the reliability of performance of the logical function, rather than on individual component characteristics and reliability. In addition, 2000-hour logical-function reliability life tests have been carried out on micrologic elements simulated using individual transistors. The results of the pair of life tests indicating the feasibility of more extensive micrologic assemblies will be discussed.

Robert H. Norman was born in New York, N. Y., on March 24, 1927. He received a BSEE from Oklahoma State University in 1954.

He was an engineer with Sperry Gyroscope Company, Great Neck, N. Y., until 1959. While there, he worked on transistorized digital circuitry and computer development.

In 1959 he joined the staff of Fairchild Semiconductor Corporation as head of the device evaluation section. He is a member of the IRE and AOA.

## MEETING AHEAD

### Transistor Reliability

On April 19, PGRQC will feature Julian Hilman, manager, reliability-evaluation division of Fairchild Semiconductor Corp., in a paper titled "Transistor Reliability." For details see the calendar on page 9.

Hilman will discuss reliability design features, quality control, and screening and evaluation of transistors at Fairchild. The discussion will be followed by a tour of the reliability-evaluation division.

Hilman holds a BSEE from Pennsylvania State University and an MSEE from San Jose State College. He has been in the past connected with the Taylor Model Basin, the Johnsville Naval Air Development Center, Remington Rand, and American Bosch Arma. His society memberships include AIEE and ASQC.

## MEETING AHEAD

### Solid-State Growth

Fairchild Semiconductor Corp., its growth and status in the Bay Area, will be the focal point of the April meeting

*(Continued on page 14)*

*Robert Norman*

*Julian Hilman*

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The complexity of modern technology...the rapid increase in the number of specializations...and the frequent shifts in technological emphasis all have combined to require a staff of alert, aggressive, creative teams of engineering specialists. Their responsibility is to assist management in the formulation of plans for future efforts.

For our purposes the teams should be staffed by graduate Electronic Engineers and Physicists who have acquired several years of experience with radar, guided missiles, computers, infrared detection, nuclear radiation equipment, micro-electronics, underwater

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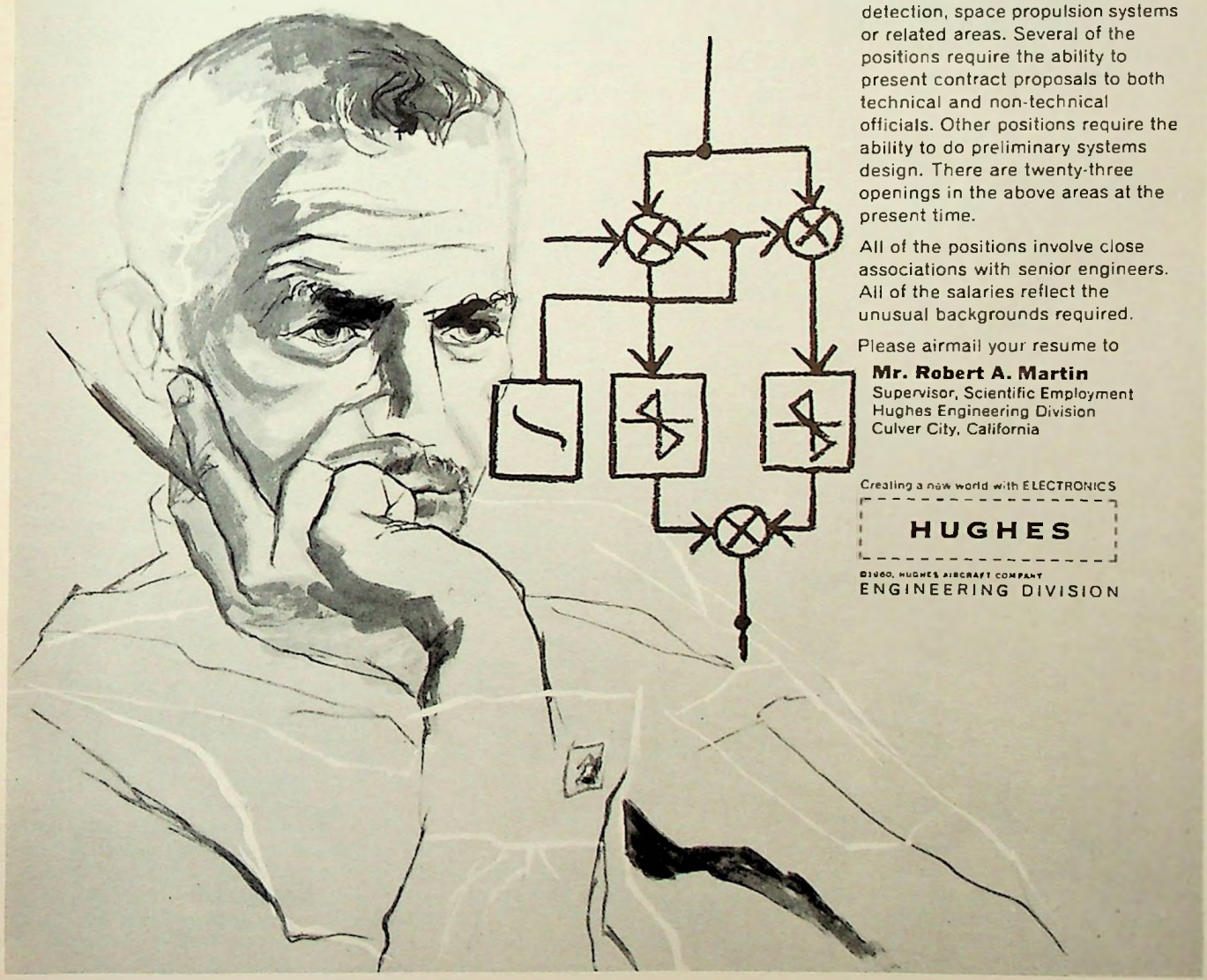

detection, space propulsion systems or related areas. Several of the positions require the ability to present contract proposals to both technical and non-technical officials. Other positions require the ability to do preliminary systems design. There are twenty-three openings in the above areas at the present time.

All of the positions involve close associations with senior engineers. All of the salaries reflect the unusual backgrounds required.

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Hughes Engineering Division
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*Robert N. Noyce*

*Howard M. Zeidler*

**MORE SOLID STATE**

of the Professional Group on Engineering Management. The speaker will be Robert N. Noyce, presently vice president and general manager. His topic will be, "Planning for an Expanding Organization." He will be assisted by his staff.

Noyce was a BS graduate of Grenell College in 1949 and received his PhD in physical electronics from MIT in 1953. Since then he has been in the research division of Philco in Philadelphia and was one of the eight original founders of the Shockley Semiconductor Laboratory in Mountain View, now Shockley Transistor Corp. There he served as R&D head.

Fairchild has at present 1400 employees and a plant area in excess of 100,000 sq ft. A construction program, to be finished some time this year, will double this capacity and the expectation is 2000 employees by the end of the year. Currently, the staff is doubling in size every four months.

## MEETING AHEAD

### Two for the Computers

Principles of operation and characteristics of an evaporated random-access memory and a thin-film magnetic shift register will be discussed by K. D. Broadbent at the March meeting of PGEC. See the Calendar, page 8.

Broadbent, of Hughes Research Laboratories, Culver City, will complete the presentation of the evening by exhibiting a motion picture showing operation of the shift register, which utilizes the magneto-optic effect.

## 1960 WJCC

### May: Computer Time

Forty-nine exhibitors are already on the roster for the upcoming Western Joint Computer Conference, May 3-5, and other plans are proceeding apace. Special coverage of this San Francisco event will be carried in the April issue of the **Grid**.

Twelve sessions of technical programs have been announced under the chairmanship of Howard Zeidler, Stanford Research Institute. These will cover: Computer Organization Trends; Data Retrieval; Learning and Problem-Solving Machines; Analog Equipment; Components and Techniques; Analog Techniques; Trends in Computer Applications; Logical Design, Design, Programming, and Sociological Implications of Microelectronics; Analog Applications; Programming Systems; and Input-Output and Communications.

The distaff support of engineers attending the 1960 Western Joint Computer Conference will have a well-rounded program of social events to fill out the time when their husbands are involved at the Jack Tar Hotel.

Apart from the urbane attractions offered by San Francisco, special events planned by a committee headed by Miss Mary Fraser of IBM, San Jose, will provide plentiful diversions for the several hundred women expected.

Registration and coffee service will take place in the hospitality suite at the Jack Tar on the opening morning between 9 and 11 o'clock.

At 2 o'clock on May 3, at the nearby Century Club, Miss Phyllis Baxendale of IBM will describe some oddities in the Conference's technology in a speech entitled "Conversation with Computers."

In the late afternoon the ladies are invited to the Conference cocktail party to be held in the patio of the Jack Tar.

Wednesday morning at 11:45 o'clock the women will board chartered buses for a trip over the Golden Gate bridge to Sausalito for a luncheon and fashion show at the Alta Mira Hotel overlooking San Francisco Bay. A tour of handicraft shops in the Village Fair will follow.

The ladies will rejoin their husbands for dinner that evening in the International Room of the Jack Tar. Shopping and tours are planned for Thursday.

Serving with Miss Fraser on the committee are Miss Eleanor Schmidt, co-chairman, and Mrs. Marilyn Richardson of IBM, San Jose; Miss Marilyn Black of Stanford Research Institute and Miss Connie Pope of General Electric, Palo Alto.

## SEVENTH REGION

### 1960 Conference

Three major fields will be highlighted in the 1960 Seventh Region Conference to be held May 24-26 in Seattle, according to Dr. Frank S. Holman, chairman for the event. They are control systems, solid state electronics, and electromagnetics.

"We have decided in favor of coverage to considerable depth in these technical areas," stated Program Chairman Dr. Donald K. Reynolds, "instead of a more superficial coverage of a larger number of areas."

*(Continued on page 18)*

## ENGINEERS' WEEK

### Scholarships to Three

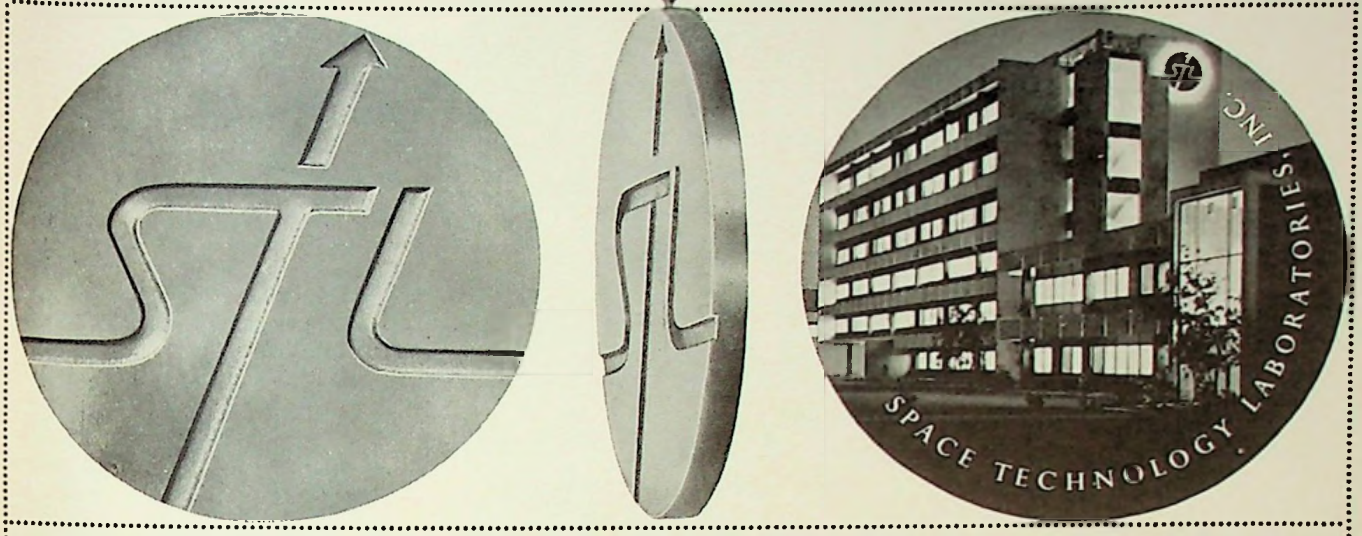
Three high school students were awarded scholarships totaling over $2000 at the annual Engineers' Week banquet at the Sheraton-Palace Hotel this year.

Winner of the top $1000 scholarship was Paul Kayfetz, 17, a senior at Pittsburg, California, High School. Award was made by Dr. R. M. Fulrath, University of California professor and scholarship chairman of the Engineers' Week Committee.

Dr. Fulrath also awarded two runners-up scholarships of $600 each to Margaret C. Martin, 17, El Cerrito High School student, and to Michael Lawton, 17, a student at Redwood City's Sequoia High School.

Awards were made after guest speaker Howard G. Vesper, president of Standard Oil Company of California Western Operations, Inc., spoke to the nearly 500 engineers and their guests on the subject "Human Factors in Science and Engineering."

## SCIENTISTS AND ENGINEERS: There are two sides to the STL coin...

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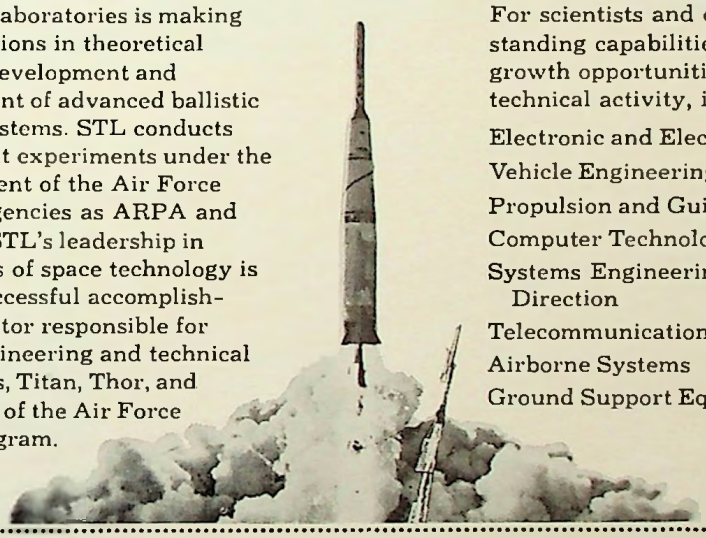

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NEW YORK INTERVIEWS FOR MEMBERS OF IRE

For the convenience of those attending the Institute of Radio Engineers meeting, members of STL's Technical Staff will conduct personal interviews in New York, March 21-24. For an appointment, please telephone Mr. Robert Galbraith at STL's IRE suite, or send a complete resume to *Space Technology Laboratories, Inc., P.O. Box 95004, Los Angeles 45, California*

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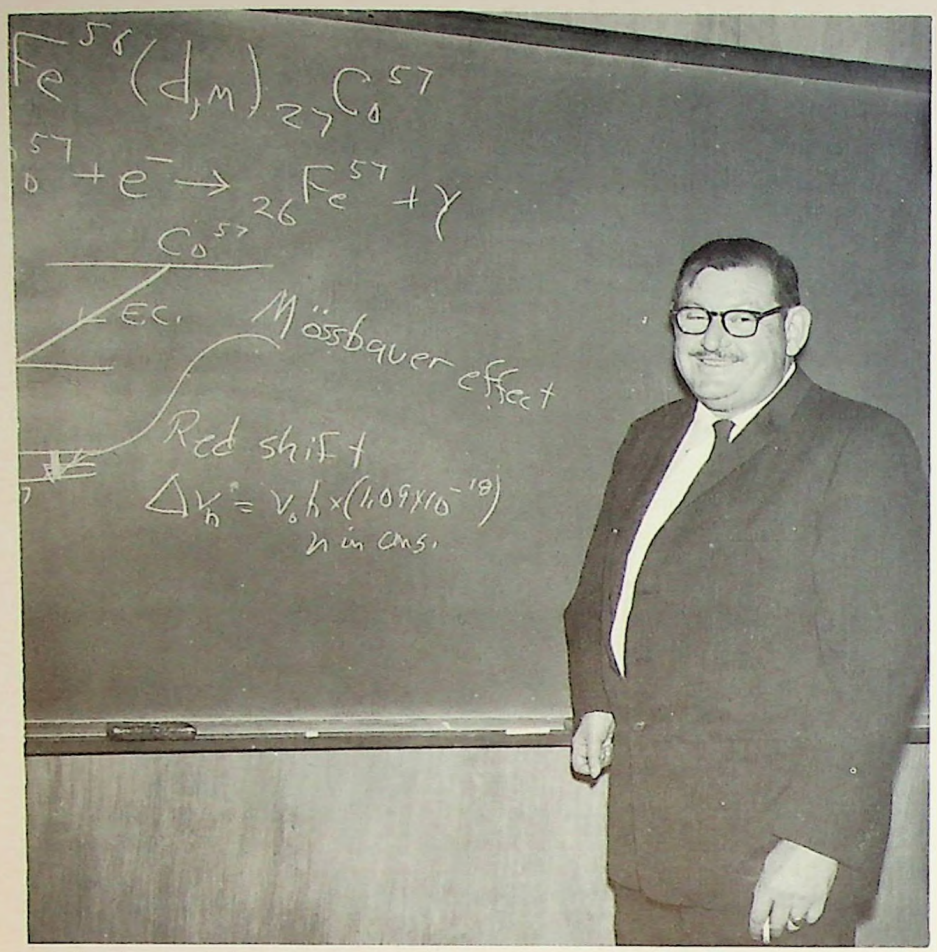


*C. Wesley Carnahan, director of the Seventh Region, pauses during a recent informal talk to members of the Varian central research staff*

SECTION PROFILE

## 7th Region Director

Sections of the IRE are grouped into eight regions, and the San Francisco Section — as practically everybody knows — is included in Region 7. Each region is represented on the board of directors of the Institute by a regional director elected bi-annually from, and by, the membership of the respective region.

In the present case, this means C. Wesley Carnahan, director of central research planning at Varian Associates and a member of that company's staff since 1953.

Wes Carnahan constitutes our official link with 1 East 79 Street and also performs the same services for the Alamagordo-Holloman, Albuquerque-Los Alamos, Anchorage, China Lake, Fort Huachuca, Hawaii, Los Angeles, Phoenix, Portland, Sacramento, Salt Lake City, San Diego, Seattle, and Tucson Sections.

For more than a decade, the San Francisco Section had had a member on the board of directors of the Institute and Carnahan thus joins the august succession of F. E. Terman, J. M. Pettit, W. R. Hewlett, J. R. Whinnery, and B. M. Oliver.

Carnahan, who has worked extensively in the electronics field, received both his BA and MA degrees in physics from Stanford University.

He served as instructor in physical sciences at Fresno State College from 1927 to 1930. After completing work for his MA degree in 1931, he joined Farnsworth Television. The late Russell Varian and Cliff Gardner, now manager of product engineering for the tube division at Varian, were also at Farnsworth at that time.

In 1933 Carnahan joined the Hygrade Sylvania Corporation where he worked for four years in the development of special tubes and lamps at Sylvania's Salem, Mass., laboratory and for three years at their St. Marys, Pa., laboratory on design and testing of cathode ray tubes for television.

He joined Zenith Radio Corp. as a research engineer in 1940. There he worked on the development of frequency modulation and television receivers, and, during World War II, on radar systems. From 1947 to 1948 he was senior engineer at Submarine Signal Co., in charge of the circuit development of submarine fire-control radar.

In 1948 he joined Sandia Corp. as manager of the electronics research department, engaged in the development of classified electronic devices. He was with Sandia until 1953 when he joined Varian Associates.

Carnahan became a member of the IRE in 1933, a Senior Member in 1944, and in March, 1952, was awarded the grade of Fellow for "original contributions in the field of frequency modulation, television, and electronics systems engineering."

He was a member of the papers review committee from 1945 to 1948 and served on the board of editors from 1948 to 1954. He was chairman of the New Mexico Section in 1949-1951 and again in 1952-1953.

Carnahan has previously served as vice chairman of the Seventh Regional Committee and was chairman of the 1953 Seventh Regional IRE Conference.

Carnahan is married and the father of one son, Chalon L. Carnahan, who is a nuclear chemist at the Naval Radiological Defense Laboratory.

Carnahan's hobbies are reading and book reviewing. However, since the Seventh Region extends from Arizona on the south to Alaska on the north, and from Utah on the east, to Hawaii on the west, travel will take a major portion of his time in the next two years.

*Carnahan at his desk in the Varian plant, where he is director of central research planning*

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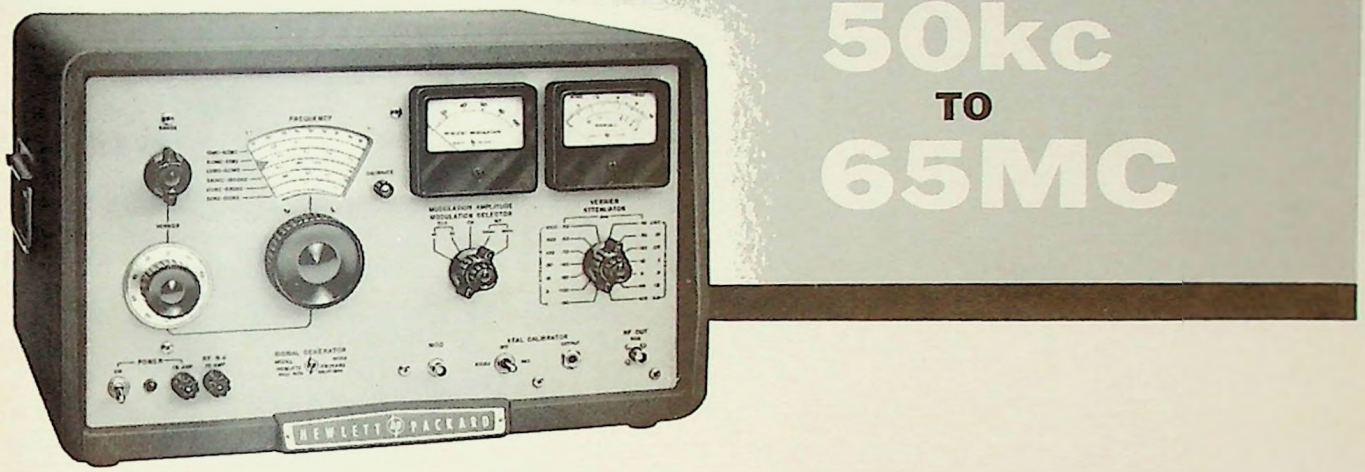


## New -*hp*- 606A HF Signal Generator

Here at last is a compact, convenient, moderately-priced signal generator providing constant output and constant modulation level plus high output from 50 kc to 65 MC. Tedious, error-producing resetting of output level and percent modulation are eliminated.

Covering the high frequency spectrum, (which includes the 30 and 60 MC radar IF bands) the new hp 606A is exceptionally useful in driving bridges, antennas and filters, and measuring gain, selectivity and image rejection of receivers and IF circuits.

Output is constant within ±1 db over the full frequency range, and is adjustable from +20 dbm (3 volts rms) to —110 dbm (0.1 μv rms). No level adjustments are required during operation.

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**Frequency Range:** 50 kc to 65 MC in 6 bands.
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**Frequency Calibrator:** Crystal oscillator provides check points at 100 kc and 1 MC intervals accurate within 0.01% from 0° to 50° C.
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**Output Accuracy:** Within ±1 db into 50 ohm resistive load.
**Frequency Response:** Within ±1 db into 50 ohm resistive load over entire frequency range at any output level setting.
**Output Impedance:** 50 ohms, SWR less than 1.1:1 at 0.3 v and below.
**Spurious Harmonic Output:** Less than 3%.
**Leakage:** Negligible, permits sensitivity measurements to 0.1 μv.
**Amplitude Modulation:** Continuously adjustable from 0 to 100%.
**Internal Modulation:** 0 to 100% sinusoidal modulation at 400 cps ±5% or 1000 cps ±5%.
**Modulation Bandwidth:** Dc to 20 kc maximum.
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**Envelope Distortion:** Less than 3% envelope distortion from 0 to 70% modulation at output levels of 1 volt or less.
**Spurious FM:** 0.0025% or 100 cps, whichever is greater, at an output of 1 v or less and 30% amplitude modulation.
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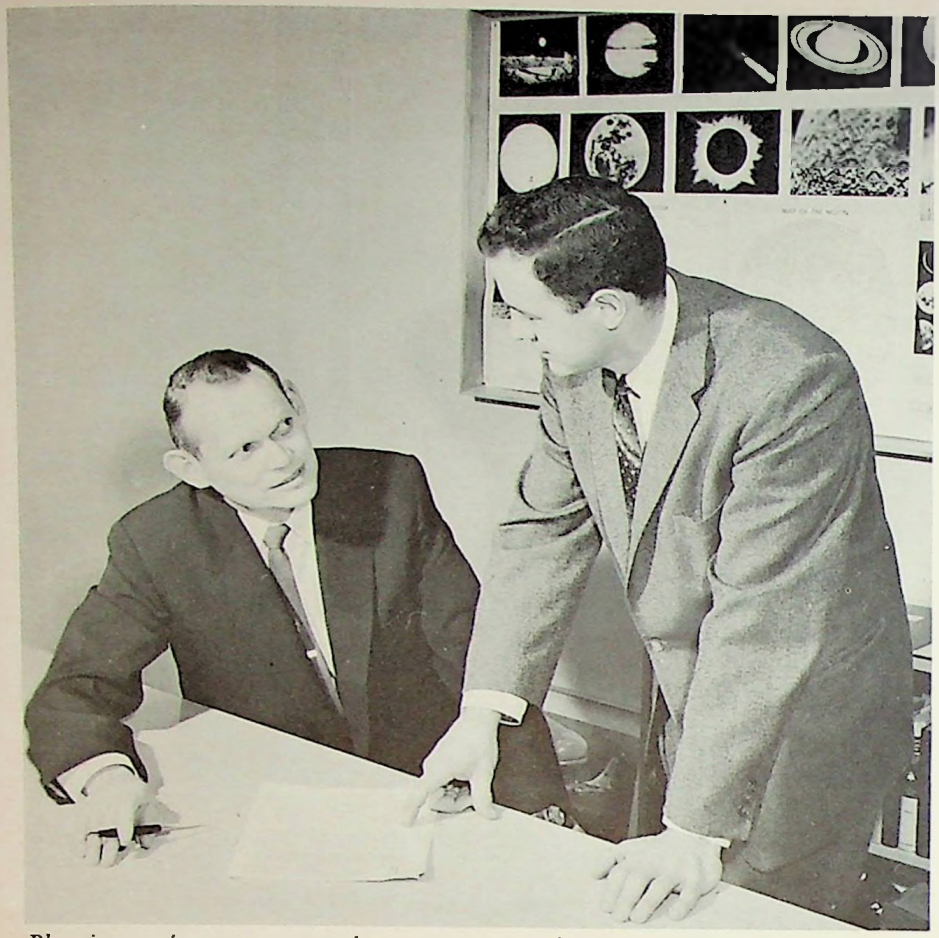


*Planning conference goes on between L. C. Perkins, chairman of the Seattle host Section and Dr. Frank S. Holman, chairman of this year's 7th Region Conference*

**MORE 7th REGION**

Four sessions will be held in control systems, with coverage concentrated in fields of performance criteria, optimal design techniques, non-linear and sampled-data systems, and biological control systems. Three sessions in solid state electronics will feature coverage of semiconductor devices, magnetics, and gaseous phenomena. Four sessions in electromagnetics will cover radio astronomy, very large aperture antennas, and terrestrial electromagnetic phenomena, and arctic ionospheric phenomena.

Assisting Reynolds on the technical program committee for the 1960 Seventh Region Conference are Robert N. Clark, Floyd D. Robbins, H. Myron Swarm, and Lynn A. K. Watt of the University of Washington. William Goss, Theodore P. Higgins, and Robert M. Hubbard from Boeing Airplane Company also serve on the committee.

The technical program is only part of the conference. In addition, a display of products by more than 200 manufacturers will be staged at the Seattle National Guard Armory, under the direction of Rush S. Drake, Seattle manufacturers representative. Cooperating in the exhibit is ISA.

## Election News

At the regular January meeting, Boyd C. Roberts was elected vice chairman of the San Francisco Chapter of PGSET to serve during the unexpired term of Louis H. Smaus, who was transferred to the East Coast.

Boyd C. Roberts was born May 10, 1926, in Las Vegas, Nevada. After serving in the U. S. Navy from 1944 to 1946 as an electronic technician, he attended Brigham Young University for two years in 1950, he received a BSEE degree from the University of Utah.

*Boyd C. Roberts*

From 1950 to 1953, Roberts was associated with Otis Elevator Company in Salt Lake City. In 1953, he joined Lockheed Aircraft Corporation in Burbank, California, as a research engineer. In January 1954, he transferred to the missile systems division where, until 1956, he was engaged in all phases of telemetry, calibration, system checkout, and system design for the X-7A and X-17 programs.

In 1956, he was appointed group supervisor of telemetry design for the PTV or Pre-Polaris missile program, and prepared the design specification for the transistorized telemetry system for this missile.

At present, he is supervisor of the electrical-mechanical design and test instrumentation sections in a satellite program.

## MEETING REVIEW

### The Family Plan

The special interests of wives formed the subject matter for the February meeting of the Professional Group on Engineering Management.

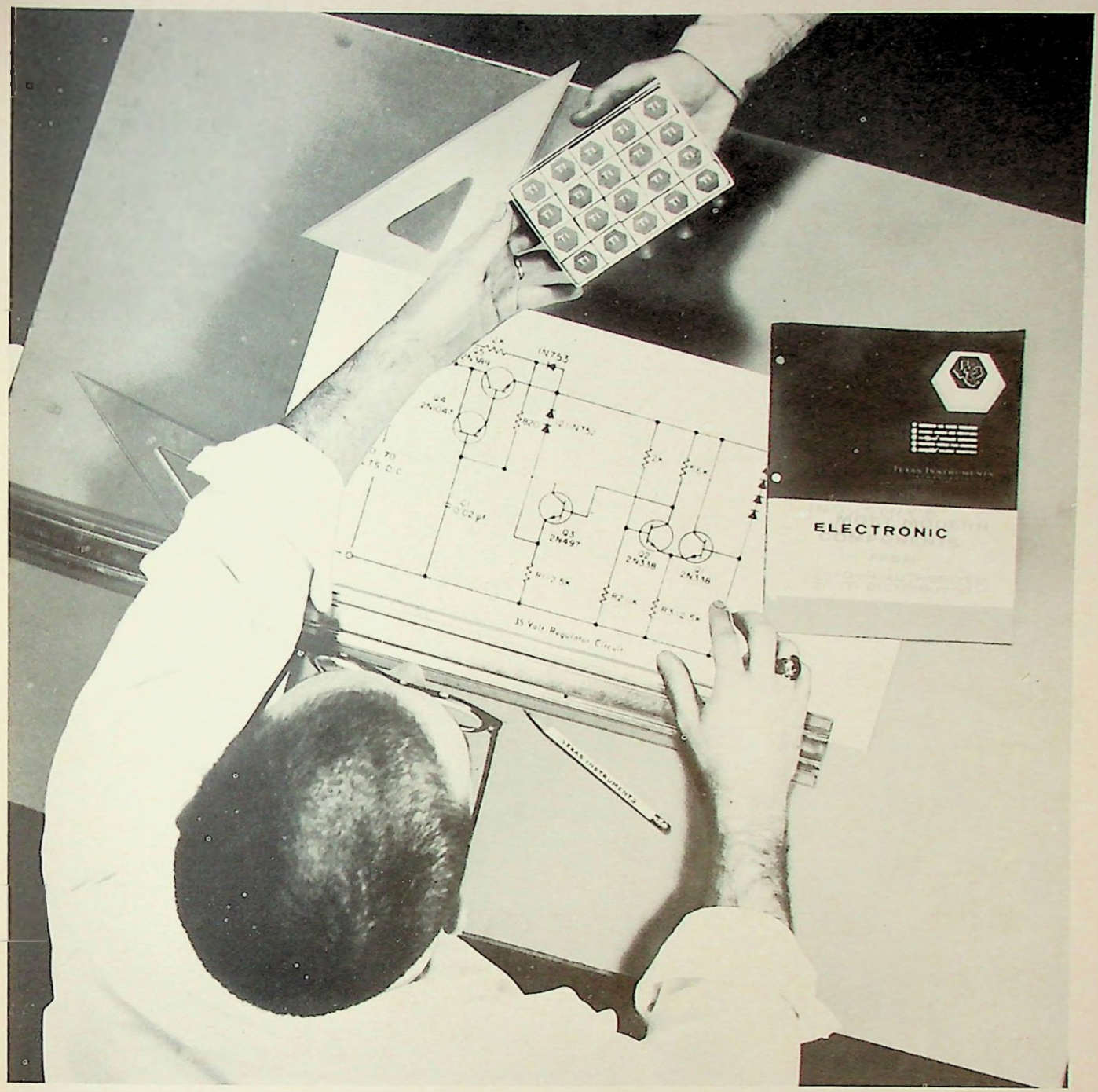
Dr. John V. N. Granger spoke on definitions of engineering, and the ambitions of engineers to become managers. His informal and friendly fashion made it a most enjoyable meeting for everyone. Eighteen couples attended the dinner and meeting.

Granger mentioned that engineering is the application of science to practical problems. He compared the engineer's approach to that taken by a playwright in writing a drama: First he states the problem; then he explores the many angles involved, and finally he offers a solution. But engineers are not necessarily the philosophers who are occasionally found among playwrights. Rather, engineers are somewhat conventional people and their actions are marked by their analytical approach to problems.

John pointed out that there is a great deal of serious misunderstanding in the public mind about what an engineer does, and he suggested that wives can help. He cited a Purdue study which showed that many people think that scientists are basically evil; that scientists are willing to sacrifice the common good to their personal ends; and that scientists and engineers can not raise a normal family!

He remarked that wives like to know what engineers do. Naturally, he admitted that they hold meetings. He disclosed the confidential information that

*(Continued on page 20)*

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*Dinner group at the PGEM February meeting. Through the haze, head table occupants can be identified as Oscar T. Simpson, Mrs. Simpson, John V. N. Granger, Mrs. Allen Dunbar, Dunbar, and Mrs. Granger*

—Leonard Jeffers photo

*Dr. and Mrs. Granger were respectively the speaker and, to a large degree, the topic of the PGEM session*

—Leonard Jeffers photo

**MORE FAMILY**

last year our Section held only 85 meetings but that we expect to improve ourselves with an increase for 1960.

Engineers tend to deal with ideas rather than with people. Of course this leads to some minor domestic difficulties because the engineer is trained in the scientific approach which attempts to break down a problem to its simplest parts. For example, Mr. Engineer arrives home in the evening and is faced with his wife's hair-raising tale about the damage done by the eight-year-old. He calmly refuses to recognize a disaster, and sees only a healthy intellectual curiosity in his child.

Finally Granger discussed points of interest for engineers who wish to get into management work. His principal suggestion was that the wife must share her husband-engineer's ambitions. His charming wife, and the success of Granger Associates, are living proof that he is right.

*—L. M. Jeffers*

## MEETING REVIEW

### TWA Trio

Early in February, PGMTT and PGAP held a joint meeting at Stanford University. The speaker was Dr. Arthur Oliner, research professor at the Polytechnic Institute of Brooklyn and national chairman of PGMTT. In his talk he compared and contrasted the several types of traveling-wave antennas and reviewed recent developments in this field.[1]

Traveling-wave antennas may be classified into three basic types: surface-wave antennas, leaky-wave antennas, and periodic antennas or arrays. Dielectric-slab and -rod antennas are examples of surface-wave antennas[2]. This type has the following distinguishing characteristics:

1. Proper guided modes exist on the antenna.
2. The fields of these modes decay exponentially in the direction away from the air-dielectric interface.
3. The modes are slow waves, i.e. the phase velocity is less than the free space propagation velocity.
4. There is no radiation except at discontinuities in the antenna structure.

A uniform surface-wave antenna has an end-fire radiation pattern of the form sin x/x, where x is a function of angle and frequency which has a minimum value in the forward direction. This pattern can be accounted for by assuming a uniform distribution of sources of radiation along the length of the antenna, but this picture is inconsistent with the fact that surface modes are non-radiating except at discontinuities. The paradox can be resolved by showing that the two ends of the antenna act as point sources with patterns of the form $e^{jx}/x$ and $e^{-jx}/x$, the superposition of which gives the observed sin x/x pattern. The fact that half of the radiation comes from the feed shows that the excitation of surface-wave antennas from waveguide feeds is only 50 per cent efficient, a fact which limits the variety of beam shapes attainable with this type of antenna.

Examples of the second type, leaky-wave antennas, are waveguides with longitudinally slitted walls or with a series of closely spaced transverse slots[3]. Antennas of this type have the following distinguishing characteristics, each of which is in contrast with the corresponding characteristic of surface-wave antennas:

1. No proper guided modes can propagate on the antenna structure, but only "pseudo-modes," which have complex propagation constants and describe the fields correctly only in a limited region near the antenna.
2. The fields increase exponentially in the direction away from the guiding structure out to a certain limiting surface, beyond which the pseudo-mode fields are no longer valid.
3. The pseudo-modes are fast waves, i.e. their phase velocity is greater than the free space velocity.
4. Radiation takes place continuously along the antenna.

The fact that end effects can be neglected in leaky-wave antennas makes possible better control over the beam shape than for surface-wave antennas. The direction of the beam is determined by the phase velocity. It can be varied over a limited range, but always makes an acute angle with the end-fire direction.

Periodic traveling-wave antennas, or arrays, have greater flexibility than the first two types, permitting the design of

*(Continued on page 22)*

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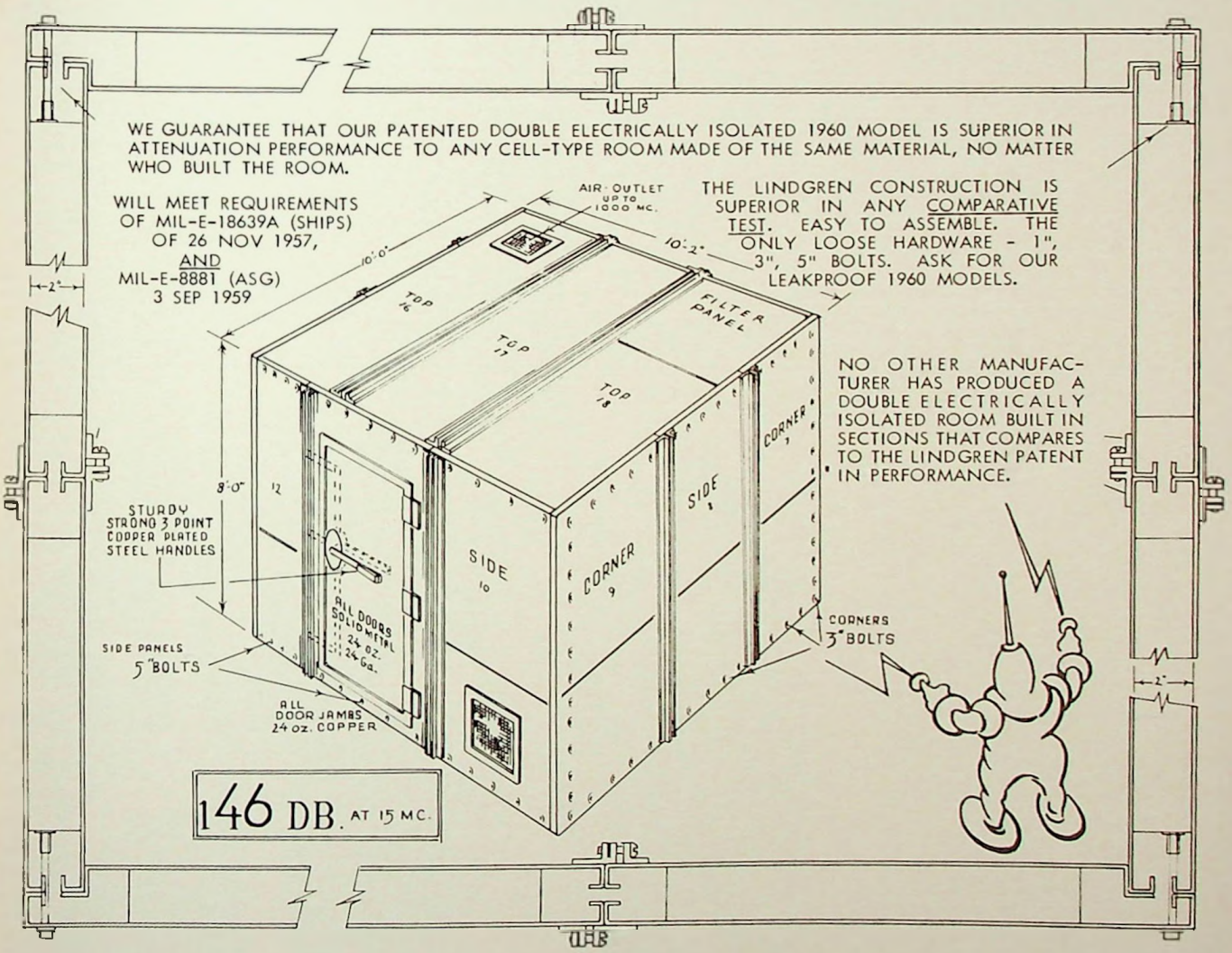


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## MORE TWA

broadside arrays and beams which can be scanned through wide angles. Antennas of this type, which are currently being studied, include the proximity array, in which periodically spaced dipoles are coupled to a parallel-wire transmission line, and modulated arrays, in which the properties of the radiating elements are made to vary periodically along the array.

—*E. F. Barnett*

References:

1. L. O. Goldstone and A. A. Oliner, "Leaky-Wave Antennas I: Rectangular Waveguides," *IRE Trans. AP-7*, pp 307-319, October, 1959.
2. F. J. Zucker, "The Guiding and Radiation of Surface Waves," *Proc. Symp. on Modern Advances in Microwave Techniques*, Polytechnic Institute of Brooklyn, pp. 403-435, November, 1954.
3. R. C. Honey, "A Flush-Mounted Leaky-Wave Antenna with Predictable Patterns," *IRE Trans. AP-7, pp.* 320-328, October, 1959.

## MEETING REVIEW

### How Small Is Small?

Members of the Professional Groups on Military Electronics, Production Techniques, and Reliability & Quality Control heard three speakers discuss problems and techniques associated with microminiaturization at a joint February meeting. There is no strict definition of the word microminiaturization, but Charles Reis of Hewlett-Packard Company, Jack Jennings, president of Spectracoat Inc., and Dr. Ross Quinn of Lockheed led those present to believe that it means you need a microscope to see the workmanship in the fabrication of component parts.

Reis has been concerned with the development and manufacture of very, very small photo-conductive cells for use in Hewlett-Packard instruments. A photo-conductive cell is a device which changes its resistance abruptly upon being illuminated with light and returns to its original high resistance when the light is removed. The result is much the same as a switch except that its response time has been reduced to a few microseconds.

Very thin films, both conductive and non-conductive, are deposited by a process of evaporation under high vacuum and in the presence of a strong electric field, according to Jennings. Color slides were shown of some of the equipment used in the production of thin films. How thin are these films? So thin that their thickness is measured by optical means.

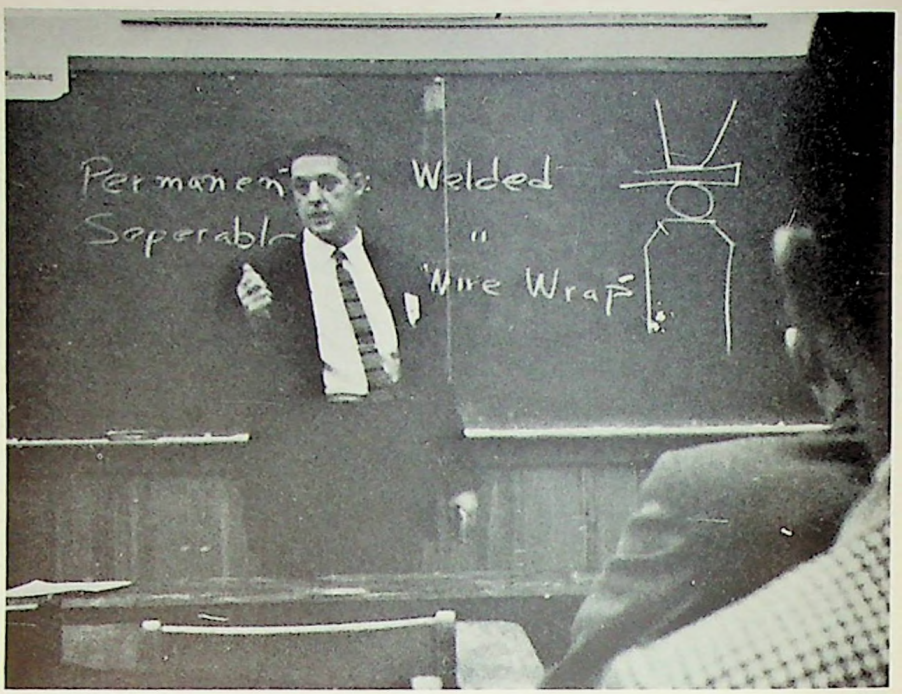
Quinn discussed the means by which thin films are deposited chemically. He also pointed out the role of the chemist in the world of electronics by an analogy which he calls the "chemistree." The chemistree is one with electronic branches and chemical roots.

The meeting of February 2 was the primer in a series of four meetings to be held on microminiaturization under the same auspices.

—*John W. Hall*

*Charles Reis, John Jennings, and Ross Quinn discuss a photocell at the joint meeting described above. Microminiaturization is the subject of a continuing series of four meetings*

—John Hall photo




*William Ayers, speaker at the February 9 joint microminiaturization meeting, makes a point from the blackboard*

—George Reyling photo

## MEETING REVIEW

### Draftsman Beats Computer!

Fifty souls ventured forth on a rainy evening to hear William H. Ayers, engineer in charge of high density packaging, Sippican Corp., Marion, Mass., give a talk which could have been titled "Microminiaturization Here and Now." Actually, the title was, "Welded Assemblies and the Use of Computers to Develop Optimum Wiring Sequence."

The meeting was the second in the current series on miniaturization by the Professional Groups on Military Electronics, Production Techniques, and Reliability & Quality Control

The microminiaturization techniques of today consist of using the smallest available components approved by service and reliability groups and connecting them, using standard techniques; although these techniques need not necessarily be those of the electronic industries but rather things which are available in related industries if applicable.

The objectives in undertaking this work are (1) maximum reliability and, (2) minimum size and minimum weight. Selection of techniques which satisfy this demand have resulted in an approach which includes encapsulated throw-away sub-assemblies which are arranged so that they can be mutually supporting by fastening with a through bolt.

It is possible to provide adjustable components and even coax in these encapsulated packages. Adjustments are made by grinding out the encapsulation over screw-driver settable components and making the adjustments with the aid of a microscope.

*After the meeting, Ayers, left, talks it over*

The components inside the encapsulated sub-assemblies are connected by resistance welding and the connections are made as close to the components as physically possible.

Damage due to heating component leads is prevented by the use of high-speed weld discharges. Manufacturability is increased by accurate location of components, tolerances often being held to $\pm 0.005$. Special connecting techniques are used where it is necessary to have separable connections. This is done by welding or using cold-flow crimping techniques in such a way as to make it possible to cut off the welded section and re-weld or re-crimp on the remaining stub. On a properly designed part this can be done several times.

*(Continued on page 25)*

## MORE DRAFTSMAN

Wire wrap can also be used on separable connections and when properly designed has proved to be a reliable method of connection.

The requirements for each individual weld, such as: pressure, weld time, etc., must be carefully worked out and recorded so that maximum weld reliability can be achieved. Material combinations, various wire sizes, and plating and coating on wires must be carefully checked.

Connections in the encapsulated subassemblies are achieved by use of layerized matrices which are printed on plastic film. These connections are made by welding leads or short wires on the metal film matrix and cutting leads or welding through the matrix to make connection from one part of the circuit to another. The number of welds necessary, to achieve this, vary from three to a dozen; and making connections with a minimum number of total welds in a package depends on "how clever you are."

During the discussion of the techniques used to connect through the matrix, the question was raised as to the possibility of the use of a computer to do this work. Ayers pointed out that it was possible to achieve 70 to 75 per cent utilization of the available connec-

*(Continued on page 26)*

## MORE DRAFTSMAN

tions by using a computer; but that a draftsman who was taught the rules and worked as an organic computer was able to achieve 97 per cent utilization.

The use of encapsulated sub-assemblies has been shown to improve reliability and reduce maintenance costs. The choice of size of these encapsulated units is brought about by a balance between reliability and the cost of the units when they are thrown away.

Considerations involved in determining the cost savings achieved by such packaging include the cost of training and equipping maintenance personnel, the cost of stocking numerous components, and so forth.

Separable connections from one encapsulated package to the other are made by the techniques outlined above, but the final connection is made with a standard type of block and socket unit. "You have to take a chance on a conventional unit eventually."

Use of these techniques has led to assemblies which are inherently more reliable than those produced by conventional techniques as well as being smaller and lighter in weight.

*—G. Reyling*

## NEWS OF HAWAII

### Just for the Halibut

For its February meeting, the Hawaiian Section lists a paper titled "Control and Safety Features of a Submarine Nuclear Reactor" by Wallace Y. F. Chang. Chang is an electronic engineer in the employ of the Navy at Pearl Harbor Naval Shipyard. He has just returned from duty at Mare Island Naval Shipyard where he spent 8½ months working on the reactor-control system on our newest submarine, the USS Halibut. Chang's future assignment is to establish a course and train other electronic engineers in reactor-control systems as applied to naval atomic-powered vessels.

## MEETING REVIEW

### Scatter & Diversity

The Professional Group on Communications Systems held their January meeting at Stanford. Chairman Alan Waterman presided. Dr. Wolfgang Kummer of Hughes Aircraft Company talked about his studies, conducted at the Bell Telephone Laboratories (Holmdel), using twin-feed diversity reception on a 171-mile scatter circuit. His entertaining talk also included an examination of the limitations to the useful bandwidth due to multipath delays on this tropospheric circuit.

Kummer discussed the comparisons

*Dr. Wolfgang Kummer*

of results using closely spaced feed-horns, horizontally disposed as well as vertically, at frequencies of 460 mc and 4110 mc. Since the horns were each near the focal point of the parabola, the cross-over point was only down about 5 decibels. The proof of diversity action was reception of uncorrelated signals; accordingly, the experimental equipment included a coincidence counter as well as a two-channel recorder for comparing the combined diversity against one of the received channels.

While uncorrelated signals should have been obtained for the two feeds because they were oriented to illuminate different parts of the atmosphere, results showed correlation occurred at times when receiving the 460-mc signal on horizontally disposed horns. Desired uncorrelated signals were received on horizontally and vertically placed horns for the 4110-mc signal and on the vertically-fed 460-mc horns. Idealized models of layered atmosphere were illustrated to explain these findings. To show the basis for correlation, a single, wavy layer represented the scattering surface of the 460-mc signal and the vertical variation of this layer was not considered sufficient for diverse horizontal dispersions.

For comparison with a 10-kw single-channel path, equal results with a 300-watt radiated signal can be achieved with the usual two antennas spaced about 100 wavelengths apart, and similar results can be achieved with a 600-watt signal using closely spaced horns on a single antenna when the horns are vertically disposed.

For bandwidth studies at 4110 mc, Kummer used a transmitter which was sawtooth modulated over a 20-mc band at a 1000-cps rate and a receiver which was non-synchronously swept at a 30-cps rate. Slides of the oscilloscope display of the resultant pulses were shown at the meeting. The experiment used a 28-ft transmitting antenna and 60-, 28-, and 8-ft receiving antennas. The fading rate was slow and the bandwidth varied from 15 mc. using the larger antennas, down to 3 mc at times, using the 8-ft antenna. Using a 28-ft antenna, a bandwidth of 5 to 7 mc could be considered rather reliable. As one might expect, multiple layers

*(Continued on page 28)*

**MORE DIVERSITY**

and the subsequent phase delays caused the narrowing of the bandwidths.

*—Kenneth Patterson*

## MEETING REVIEW

### Sampled-Signal Data

The regular monthly meeting of PGSET was held in the LMSD auditorium in Palo Alto on February 16 with 43 persons in attendance, attesting the interest held in the Bay Area regarding the pam/f-m method of data transmission. The speaker of the evening was Thomas D. Lusk, associate research scientist with Lockheed missiles and space division, whose topic was "Design Considerations for a PAM/F-M Telemetry System."

Lusk described a basic pam/f-m system which utilizes a multiplexing operation through which the individual input data signals undergo a sampling operation and are combined into a composite pulse-data signal which modulates the f-m transmitter. In the ground station, the recovered composite pulse signal is passed through a post-detection filter and is then converted to a digital number which is recorded on magnetic tape.

To provide a direct display capability, the composite pulse train is subjected to a demultiplexing operation, an inverse of the multiplexing performed in the airborne unit to yield the individual channel sampled signals. These signals after smoothing are used to drive appropriate chart recorders.

Several interesting aspects of the overall system design formed the basis of the discussion.

To recover the continuous signal from its samples required that first the sampling rate be high enough to provide at least two samples per cycle of the highest frequency component in the data signal, and, second, that the input data signal be band-limited. In a practical system the data cannot be assumed to be ideally band-limited and the error in the recovery process was discussed as a function of the characteristics of the filter used to restrict data-signal frequency components.

The transmission of the composite pulse train over a radio link requires that attention be given to the suppression of those portions of the r-f spectrum which might cause interference to adjacent-channel receivers. In the system under discussion this was accomplished by a moderate amount of filtering applied to the composite pam sequence before modulation of the f-m transmitter.

The interesting part of the ground station is the design considerations

*(Continued on page 29)*

**MORE DATA**

given to the post-detection filter and the method used to recover the synchronizing signal.

In the digitizing operation, the composite pulse signal is sampled at the peak value of each pulse and this value is held for a time necessary to form the binary number. The requirements placed on the design of the post-detection filter were that it provide, at this sampling time, a maximum output signal-to-noise ratio and that it introduce no interchannel crosstalk. The type of filter used was a finite-memory filter which has been shown to be the optimum linear filter with this characteristic in the presence of f-m noise.

The composite signal is arranged so that the data amplitude modulates the pulses bi-directionally about a fixed d-c level, called the pedestal level. The frame-synchronizing method makes use of a primary channel of the system. The pedestal level is transmitted in alternate frames during this interval. On the intervening frames the base-line level of the pulse train is transmitted. This type of alternating synchronization is utilized in the ground station for deriving a zero-data level against which the modulated pulses can be compared. The blank space introduced by leaving out a pulse every other frame causes a large frequency component to occur in the pulse spectrum at the composite sampling frequency. A narrow filter in the ground station is used to recover this component which contains all the information for deriving the necessary synchronizing signals for the digitizer and for the demultiplexing operation.

Measurements made on a prototype system indicate that the synchronizing component can be recovered from the received signal at input-signal levels where the data accuracy has deteriorated appreciably. This advantage amounts to some 20 db when the f-m receiver is operated above threshold.

*—Robert B. Morgan*

## MEETING REVIEW

### The New School

On February 23, the Professional Group on Electronic Computers held a joint meeting with the local chapters of the Association of Computing Machinery and the Society of Industrial and Applied Mathematics. Dr. Lou Fein, private consultant, spoke on the topic "The Role of the University in Computers and Closely Allied Fields."

In the fall of 1956, Fein was hired by Stanford University to investigate computer programs in universities. He gained his information not from formal

*(Continued on page 30)*

## MORE SCHOOL

questionnaires but rather from informal interviews with university administrators, directors of computing centers, faculty members, students, industrial representatives, and others who would bring out important facts and opinions

The result of his study along with his own experience in the computer and data-processing field was that there should be a definite, integrated program in the university for the computer science. In his opinion, this could be implemented by establishing a graduate school of computer science or, at least, a separate department, not part of an existing department as it is in many cases.

The program might be organized in a manner similar to that of the field of mathematics. In mathematics, where there are courses for the pure mathematician: algebra, calculus, number theory, differential equations, etc. There would be courses for the pure computer scientist: theory of modules, computer theory, algebra of formal languages, theory of classes, information retrieval, etc. Where there are courses for the applied mathematician: aerodynamics, thermodynamics, etc., there would be courses for the applied computer scientist: computer design, programming, simulation, self-organizing machines, etc. Where there are courses for the professional man: mathematics for the engineer, physicist, or psychologist, there would be computer science for the engineer, physicist, or psychologist.

The responsibility of the university in our changing society, Fein stated, is to incorporate these new fields effectively into their academic structure.

*—I. A. Bossen*

## RADAR CONFERENCE

### About Weather

Sir Robert Watson-Watt, inventor of the radar, will be featured speaker at the Eighth Weather Radar Conference to be held from April 11 to 14 at the Sheraton-Palace Hotel, San Francisco.

The British scientist will speak to some 200 meteorologists who are expected to attend the meeting sponsored by the Northern California Branch of the American Meteorological Society in cooperation with Stanford Research Institute.

Thirteen sessions will hear 70-odd papers by specialists on weather data processing, radar satellites, weather echoes, hurricanes and tornado detection and cloud and precipitation physics.

Conference chairman is Dr. M. G. H. Ligda, head of the aerophysics group at SRI.

## Sports Automated

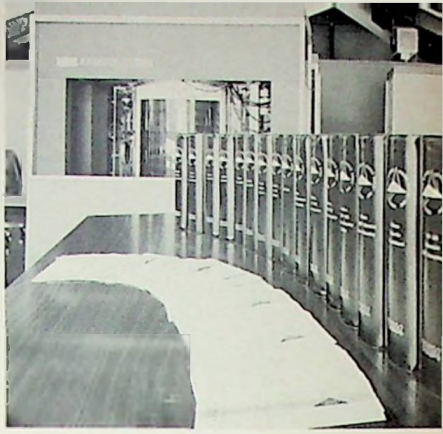
Doubtless the VIIIth Olympic Winter Games just ended at Squaw Valley represented the most intensive application of electronics to sports yet recorded in the world's history.

The stunning job of television coverage turned in by CBS was supported in its technical aspects largely by our Los Angeles Section colleagues, although our homegrown Ampex Video-

*Finish line for the men's giant slalom course at the VIIIth Winter Olympic Games. Judge, in foreground, phones time to IBM processing center*

tape Recorders were not without a starring role. In fact, including audio and video activities, somebody at Ampex has figured out that 197 miles of tape were consumed, enough to reach back to San Francisco from Blythe Ice Arena. Radio and television coverage was organized and supervised by Don Reeves, former Modesto broadcaster.

*T. C. Bailey of IBM, San Jose, developed the punch-tape recorder shown. It was part of the system which produced scoring results within 1 minute of event*



*In processing center at Squaw Valley, Ramac 305 has all these volumes of detailed programming and scoring procedures committed to memory*

General communications fell under the direction of Marion V. Long of Shell Development Co., Emeryville. This included a telephone net with 36 carrier channels on some runs, a radio relay system with 12 voice channels, timing circuitry, and weather facilities. The cross-country coverage alone required 300 miles of wire. The central communications patch-panel terminated 270 pairs of lines from 21 different areas.

Another outstanding local contribution was made by IBM and the Ramac 305's. Swallowing up huge gobs of complex information about rules and the like, they were able to spew forth results of events almost as fast as the events took place. Twenty-five seconds was par for getting data onto the scoreboard; five minutes was enough to Multilith tabulated results for distribution to the press. For reference, eight hours was the previous World's record for completing the figure-skating scores, set last March in Colorado Springs. Ramac 305 also ground out

*Don Reeves takes a bearing on his press-building office during the winter Olympic games*
—David Haylock photo

bi-lingual (French & English) biographical sketches of all contestants, complete with phonetic pronunciations, in case you wondered how the announcers became so facile.

*Gil Wyland, right, CBS technical head, supervises monitor rack in the equipment van at Squaw*

—David Haylock photo

## GRID RETURNS

### Letter to the Editor

Stanford Research Institute
Menlo Park, California

Dear Sir:

I should like to call your attention to the **Grid** news item on the recent testimonial dinner for John Reinartz. This is on page 18 of the February 1960 issue.

What prompted me to write is the subtitle "Don't Call Them Hams." I wonder why such words were chosen. Please be assured that it is no sin for a radio amateur to be a "Ham," whether he happens to be a radio engineer, a Fellow of the IRE, or just a plain layman (not working in radio as a vocation). In other words, to be a good Ham, as John Reinartz always has been, is the highest honor there is in any field of endeavor—professional or not.

You will note that a goodly portion of the electronic achievements were originated by the radio amateurs working in or out of their vocational lives. Citing a few examples, there are the Eimac and Collins Radio industrial complexes; they were started by radio amateurs to fill certain needs of their own group for satisfactory transmitting equipment. Single-sideband techniques and applications to radio communications have been for the most part made by the "Hams." James Lamb, of the American Radio Relay League staff, pioneered the use of crystal-filter "Single-Signal" reception techniques. And you will note the illustrious Senatore Guglielmo Marconi—generally regarded as the father of radio—always regarded himself as an amateur at heart. Everywhere the electronic art is being advanced you will find radio amateur people in the vanguard.

As for the origin of the word "Ham" —it probably came from the slang term for "amateur" as "am" — pronounced "ham' by the English cockneys. This term very likely came to amateur radio from the landline operators where the word originally meant beginning telegrapher. Now, however, its meaning is that of "unprofessionalism." Amateurs view their appellation with considerable pride. To be considered a "good Ham" is just about the highest mark of honor there is . . .

Yours sincerely,

Robert H. Weitbrecht, W6NRM
Research Physicist.

*In the unfortunate event that others besides Member Weitbrecht may have read a derogation of radio amateurs into the heading mentioned, may we record a deep admiration for the entire breed and for their activities and accomplishments—an admiration having the additional distinction that we ourself are not one.*

*Actually, the heading was intended to set forth an impression we have received (perhaps erroneous) that hams prefer to be called amateurs—particularly in print.*—Ed.

## EVENTS OF INTEREST

### Meetings Summary

March 24-25—**Annual Symposium on Human Factors in Electronics.** Bell Tel Labs Auditorium, 463 West Street, New York, N.Y. K. G. Van Wynen, Bell Telephone Laboratories, Room 628A, 463 West Street, New York, N. Y.

April 3-8—**Sixth Nuclear Congress.** New York Coliseum, New York City. M. E. Cassidy, USAEC New York Operations Office, 376 Hudson Street, New York 14, N. Y.

April 12-13 — **Fourteenth Annual Spring Technical Conference on Electronic Data Processing.** Hotel Alms, Cincinnati, Ohio. C. W. Stuhlbarg, AVCO Corp. Crosley Division, 1329 Arlington Street, Cincinnati, Ohio.

April 18-19 — **Conference on Automatic Techniques.** Sheraton Cleveland Hotel, Cleveland, Ohio. L. W. Herschenroeder, Westinghouse Electronic Corp., East Pittsburgh, Penna.

April 19-20 — **International Symposium on Active Networks and Feedback Systems.** Engineering Society Building, Auditorium, New York City. Herbert J. Carlin, Polytechnic Institute of Brooklyn, 55 Johnson Street, Brooklyn, New York.

April 20-22 — **Joint Conference of Southwestern IRE (SWIRECO) and National Professional Group on Medical Electronics.** Shamrock-Hilton Hotel, Houston, Texas. Ralph T. Dosher, Jr., Texas Instruments, P.O. Box 6027, Houston 6, Texas.

### Papers Calls

**May 1**—Abstracts of 100-150 words for publication in program and either a 400-500 word summary or the completed paper for review for the National Electronics Conference (October 10-12). Send to: Prof. Thomas F. Jones, Jr., NEC Program Chairman, School of Electrical Engineering, Purdue University, Lafayette, Indiana.

**May 1**—100-200 word abstracts for the 1960 Western Electronic Show and Convention (August 23-26). Send to: Chairman of the Technical Program, Richard G. Leitner, WESCON Business Office, 1435 South La Cienega Blvd., Los Angeles 35, Calif.

**May 16**—Abstracts of not more than 800 words for the Seventh National Symposium on Reliability and Quality Control (Jan. 9-11, 1961) sponsored by IRE, the AIEE and the ASQC. Send to: R. E. Kuehn, IBM Owego, Owego, New York.

## GRID SWINGS

### It Is Reported:

Establishment on the Berkeley campus of the University of California of a new Space Sciences Laboratory to delve into the scientific problems generated by the advent of space travel has been announced.

**Samuel Silver,** professor of engineering science, has been named director of the new laboratory.

Now in the process of becoming established, the laboratory will serve as an interdisciplinary facility making it possible for faculty members from various University departments to coordinate their efforts in the pursuit of solutions to a wide range of space-oriented research problems.

Silver has been a member of the electrical-engineering faculty of the University since 1947. For the past three years he has been director of the electronics research laboratory on the Berkeley campus. An authority on molecular structure and electromagnetic theory, he is currently chairman of the commission on radio waves and circuits of the International Scientific Radio Union.

**Carad Corporation,** Redwood City, has purchased Hird Chemical Refining Corp. A wholly owned subsidiary, it will be called **Carad Chemical Corporation.**

**General Telephone & Electronics Laboratories Incorporated,** a subsidiary of **General Telephone & Electronics Corporation,** has completed arrangements for the acquisition of land in the Palo Alto, Calif., area as a site for future research facilities for the entire GT&E organization.

The subsidiary is headed by **Dr. Herbert Trotter, Jr.,** formerly senior vice president — research and engineering for Sylvania Electric Products Inc., also a GT&E subsidiary. Nucleus of the new laboratories is the former Sylvania research center in Bayside, L.I. **Lt. Gen. James D. O'Connell,** retired chief signal officer of the U.S. Army and a vice president of GT&E Laboratories, will be in charge of the West Coast laboratory.

**Philip E. Halinger** has been appointed a sales engineer in the San Carlos office of **Richard A. Strassner Co.** He has been with Philco Corp. as a field engineer, an instructor, and a technical representative.

A special honorable mention certificate has been awarded to **Dr. S. B. Cohn** of Stanford Research Institute for a paper in the April 1958 issue of PGMTT Transactions, according to the

*(Continued on page 36)*

## MORE SWINGS

January 1960 Newsletter of that Professional Group.

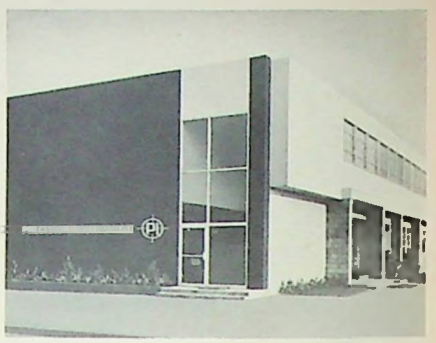
**Dr. Donald A. Dunn** has been named director of the newly formed research division of Eitel-McCullough Inc. Dunn, a senior research associate and lecturer in the electricol engineering department of Stanford University, joined Eimac in 1959 as manager of the supporting research group. He holds a BS degree from California Institute of Technology, and MS and PhD degrees in electrical engineering, and an LLB from Stanford. He is currently vice-chairman of the San Francisco Section.

**Earl J. Shelton** has been appointed director of development. He has been with Raytheon Manufacturing Co. since 1946. His latest assignment was manager of the high power tube laboratory of Raytheon's Spencer Laboratory in Waltham, Massachusetts. He was graduated from the University of Colorado with a BSEE in 1943 and has done graduate work at Boston University, Massachusetts Institute of Technology, Harvard, and Northeastern University.

A new Eimac subsidiary has been formed in Geneva, Switzerland. The corporation, known as Eitel-McCullough, S.A., will serve a marketing function in Europe and will not initially include a manufacturing operation. **Warren Hoffman,** export manager of Eimac, will become managing administrator and chairman of the board of the new company.

*Dunn* *Justice*

An antenna and microwave component development group has been formed at **Granger Associates,** Palo Alto. Centralized in the new section will be the firm's activities in the development and manufacture of large parabolic-reflector antennas, wide-band log-periodic antennas, antennas for missiles and aircraft, and associated devices such as multiplexers and band separation filters. Heading the new group is **Dr. Ray Justice,** formerly supervisor of research and development of the radiation research and development section at Convair division of General Dynamics.



Completion of remodeling and new additions to existing administration and manufacturing facilities has been announced by **Precision Instrument Company,** makers of magnetic-tape instrumentation recording equipment. The expanded plant, located at 1011 Commercial Street in San Carlos, now includes a total of 12,500 sq ft of manufacturing, engineering and administrative space for the 3-year-old firm.

The promotion of **Robert C. Treseder** to senior engineer has been announced at the San Jose laboratory of **IBM's** advanced systems development division. Treseder joined IBM as a staff engineer in December 1956 and advanced to development engineer a year

later. He is presently manager of analog components.

**Harold F. Martin** is assigned to Paris, where he will be technical assistant to the director of development engineering, IBM World Trade Corporation. He is now manager of development engineering at the development laboratory.

**Electronics Capital Corporation** has purchased $300,000 of five-year convertible debentures issued by **Ultronix, Inc.,** San Mateo. Ultronix is presently supplying subminiature component assemblies for guidance systems, servo-control packages, and communication systems for missile and space programs.

Appointment of **Sidney Wiesner** to the position of quality control manager for **Rheem Semiconductor Corporation,** Mountain View, has been announced. For the past two years, he has been director of quality control for General Transistor Corporation, Jamaica, New York.

Appointment of **William W. Calhoun** as manager of applications research for

*(Continued on page 38)*

## MORE SWINGS

the Spinco Division of **Beckman Instruments, Inc.**, Palo Alto, has been announced. Calhoun will be responsible for investigating the uses of Spinco instruments in medical research and clinical laboratories. He formerly was a technical representative for the division in Houston, Tex.

**Watkins-Johnson Co.** has announced three additions to its technical staff engaged in research and development on microwave tubes and devices.

**Dr. Boyd P. Israelsen,** whose attention will be directed toward the development of low-noise traveling-wave tubes, was a National Science Foundation Fellow and research assistant at Stanford Electronics Laboratories. Before coming to Stanford, where he was awarded his PhD, Israelsen was a senior research engineer at Jet Propulsion Laboratory, Pasadena, working on components for missile guidance systems. He has BS and MS degrees from CalTech.

**Dr. Kenneth L. Kotzebue,** who will work on solid-state and electron-beam parametric amplifiers, was formerly a senior engineer with the apparatus division of Texas Instruments, Inc., Dallas. He has made significant contributions in the field of parametric amplifiers. He was a Bell Telephone Laboratories Fellow at Stanford University, where he received his PhD last year; and a research assistant at Stanford Electronics Laboratories. His BS is from the University of Texas and his MS is from the University of California at Los Angeles.

**Edward Stefanowicz,** a chemical engineer, has been assigned to Watkins-Johnson's research and development program in the areas of oxide cathodes and metal-ceramic tube-construction techniques. A graduate of Columbia University, he was employed in tube work for seven years at Radio Corporation of America's Harrison, N.J. plant. Earlier he was with Federal Telephone & Telegraph Co. and Cornell-Dubilier Corp.

*Israelson* *Kotzebue*

In the **Sylvania Electric Products Inc.** Mountain View operation, two appointments have been announced: **Carl P.**

*(Continued on page 39)*

*Dudley* *Hunter*

**Dudley** becomes field engineer in the special tube operations where he will be responsible for technical liaison between sales engineers and the production facility. He was previously with the instrumentation department of the special tube operations. **Dr. Larry C. Hunter** becomes head of the operational-analysis section at the electronic defense laboratories. Hunter will be responsible for directing the study of mathematical and probabilistic methods for theoretical and applied evaluation of electronic-warfare equipment. He has been an advanced research engineer in the laboratory.

**Dalmo Victor Company** announces the appointment of **The Thorson Company** as manufacturer's representative. Thorson Company offices are in Palo Alto.

**United Research Corp.** of Menlo Park has changed its name to **United Technology Corp.** It is a wholly owned subsidiary of the United Aircraft Corporation. At the present time the Company has two multi-million dollar space-age facilities under construction. One, a research and engineering center is being built on a 25-acre site in Sunnyvale. The other is a development and test center under construction on a 3200-acre piece of land some 10 miles southeast of San Jose.

**Robert V. Johnson** has been appointed manager of applications engineering in the equipment division of **Levinthal Electronic Products** (subsidiary of Radiation Incorporated). Johnson moves to Levinthal from Lenkurt Electric Company, where he was concerned with sales of research and development programs and systems engineering in connection with carrier telephone and telegraph and other communications-engineering activities for the government.

In the past he has been affiliated with Murdoch Engineering in design, production, and sales; and Western Union Telegraph Company as a field engineer.

A graduate of the University of California with a BS in electrical engineer-

*(Continued on page 40)*

## MORE SWINGS

ing, he has also taken the U.S. Army electronics training course at Harvard and M.I.T. and attended the Signal Corps Radar School at Ft. Monmouth.

In his new post he will be in charge of applications-engineering activities affecting the company's line of transmitters, modulators, power supplies, pulse transformers, and accessories as used in the fields of radar, communications, and tube development.

*Johnson*

*Eirman*

**H. Norman Eierman** is regional manager for **Premmco, Inc.** with new central offices for the Northern California division at 2406 Lincoln Avenue, Alameda. Premmco has been recently appointed representative for **Airflow Co.**

Several appointments have been announced at **Varian Associates: Emmet G. Cameron,** formerly executive vice president and general manager of the Palo Alto facility, becomes group executive of all tube operations. **Howard Patterson,** formerly vice president of the Palo Alto tube division, becomes group executive for instruments and equipment. **Ralph W. Kane,** formerly vice president of the instrument division, becomes vice president and manager of foreign operations.

**Dr. Robert F. Mager,** an experimental psychologist specializing in the use of electronic techniques, joins the staff of the company's central research laboratory at Palo Alto. Since 1954 he has been serving as research scientist for the U. S. Army air-defense human-research unit at Fort Bliss, Texas. He has also served on the faculties of Ohio University, Sacramento State College, Tyler Commercial College, and Tyler

*Cameron*

*Patterson*

*Kane*

*Yocum*

Junior College. He is a past chairman of the El Paso Section of the Institute.

**Willis H. Yocom** becomes manager of wave tube development. He has been in the tube division since 1956, coming there from Bell Telephone Laboratories where he was in research and development work.

Exhibit space applications for the 1960 **Western Electronic Show & Convention** have been distributed to more than 4000 electronics companies. WESCON, which will be staged for the first time in the new Los Angeles Memorial Sports Arena, August 23-26, will present about 1000 exhibit booths in all, on the concourse, lower levels, and annex building.

The Sports Arena, which will also house all technical sessions in specially

*(Continued on page 42)*

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*WESCON Through the Ages—These members of the San Francisco Section represent a sampling of the helmsmen for WESCON from 1952 until now. At a recent WEMA meeting they were presented with plaques commemorating their chairmanships as follows: Joseph H. Landells, Westinghouse, 1952-4; Walter E. Noller, Noller Associates, 1952-6; Albert J. Morris, Levinthal Electronic Products, Inc., (member of the WESCON Board for the IRE, who made the presentations); Dr. Joseph Pettit, Stanford University, 1949; Dr. Karl Spangenberg, consultant, 1947; and Donald B. Harris, Stanford Research Institute, 1955-7. Absent: Dr. Leonard J. Black, University of California, 1951, and Dr. Bernard M. Oliver, Hewlett-Packard Company, 1957-9*

constructed meeting rooms in the air-conditioned pavilion, will be supplemented by a huge, hard-wall tent annex, specially designed for optimum exhibit exposure and containing its own cooling system.

Executive committee members have been announced as follows: **Hugh P. Moore,** chairman, (Lerco Electronics); **Walter E. Peterson,** chairman of the WESCON board, (Micro Gee Products); **Bruce S. Angwin,** concention director, (General Electric); **Donald C. Duncan,** show director; and **Don Larson,** WESCON manager.

Committee chairmen and vice chairmen, and their areas of responsibility are: All-Industry Luncheon, **Edward C. Bertolet** (Behlman Engineering) and **E. H. Lockhart** (Radiatronics); Cocktail Party, **William J. Miller** (Burton Manufacturing) and **Robert L. Boniface** (Neely Enterprises); Distributor Conference, **W. Bert Knight** (W. Bert Knight Co.) and **R. V. Weatherford** (R. V. Weatherford Co); Exhibits, **Ernest Clover** (Triad Transformer) and **Herb Becker** (Herb Becker Co.); Faciilties, **Donald N. Montgomery** (Aeronutronics) and **Duane Wood** (Lockheed Aircraft Service); Field Trips, **A. N. Curtiss** (RCA) and **Eugene M. Knight** (Space Technology Labs.); Future Engineers, **Joel H. Axe** (Ramo-Wooldridge) and **Col. Frank J. Shannon, Sr.,** USAF (Ret.) (Packard Bell).

Also, Hospitality, **Burgess Dempster** (Electronic Engineering) and **John J. Guarrera** (Burton Manufacturing); Industrial Design, **Kenneth J. Slee** (Librascope) and **Robert C. Saunders, Jr.** (Benson-Lehner); Public Relations, **Willard B. Gregory** (Beckman Instruments) and **Richard L. Paullus** (Electronic Investment Management Corp.); Registration, **G. Goldenstern** (Hoffman Electronics) and **Harry J. Delaney** (Hughes Aircraft); Technical Program, **Richard G. Lietner** (System Development Corp.) and **Harper Q. North** (Pacific Semiconductors); Visitors Services, **Al J. Rissi** and **C. T. "Cap" Kierulff** (Kierulff Electronics); and Women's Activities, **Mrs. Jeff Montgomery** and **Mrs. Don Larson.**

WESCON's Industrial Design competition, premiered last year in San Francisco and received enthusiastically, will be greatly expanded in 1960. Another traditional WESCON feature, the Future Engineers competition, will also have wider representation from student engineers throughout the West.

**Litton Industries** has opened a new 43,000-sq-ft addition to its electron tube division building in San Carlos. The expansion represents a $2 million investment. The new addition will house the klystron and display devices product lines, the latter group being moved from Emeryville.

## Membership Status

Following are the names of IRE members who have recently entered our area, thereby becoming members of the San Francisco Section:

Richard T. Barck
James H. Bentley
Richard E. Bradley
Arnold F. Brown, Jr.
Kenneth H. Brown
Robert R. Chevron
John K. Clemens
Frederick Dunham
Ardith W. Eaton
Samuel E. Estes
George L. Foster
William F. Gabriel
Mark A. Gallant
William C. Hazel
Donald E. Henkel
James J. Herman
Clarence E. Hinsen
Gilbert L. Johnson
Edwin D. Jones
James A. Kimball
Kenneth L. Kotzebue
Edward A. Kritzer
Herbert Kunnes
Arthur J. McFarlane
Richard D. Meehan
James J. Murphy
Howard A. Mussell
Benjamin M. Nauss
Gordon G. Nelson
Richard D. Nelson
William C. O'Neal
M. John Prucha
Wilson G. Reid
Bruce E. Reinecke
Dillard L. Saylors, Jr.
Carl E. Scholz
Gerald H. Scull
Joseph J. Slomski
Kay D. Smith
Richard W. Soshea
Harold E. Sweeney
James L. Weaver
Warren G. Weis
James R. Wilson
William R. Zinky

Following are the names of individuals who have been elected to current membership:

Charles E. Anderson
Mogens G. Andreasen
Ned E. Baxter
Ralph W. Beall
Joe F. Chandler
Philip F. Chew
Leo J. Cronin
Henry J. Davis, Jr.
Robert J. Deitz
Anthony Estrada
Donald J. Farquhar, Jr.
Benson T. Fogle
Harvey J. Garrow
Bruce G. Hall
Bruce J. Hansen
James R. Harvey
Ronald S. Hawke
Lee M. Hester
Douglas E. Hewitt
Arthur W. Hirsch
Sheldon M. Hubbell
William L. Jump
Fred A. Lindholm
Richard E. Lohse
Edmund H. Louie
Archie D. Marez
David A. Matthews
Saad L. Mikhail
Gordon E. Moore
Stanley E. Moore
Robert L. Nielson
George E. Orrick
Robert R. Payne
Henry R. Puente, Jr.
Ralph M. Tidball
Frank T. Veldhuizen
Carl E. Westenskow
Robert A. Wood
Joseph H. Wujek, Jr.
Philip K. Yonge

Following are the names of members who have recently been transferred to a higher grade of membership as noted:

SENIOR MEMBER

Calvin D. Conrod

MEMBER

Matthew A. Allen
Ray Aylsworth
Murray J. Baron
Stephen E. Bederka
Donald L. Cameron
William C. Cottrell
James F. Dean
Ira D. Eagle
Albert F. Fliegner
Richard T. Franke
Curtis A. Gleason
Robert E. Goldman
Morey Goldstein
Dave C. Grometer
Donald W. Hanson
Phillip E. Hargrove
Phillip Harris
Masao Hashiguchi
Yukio Hiramatsu
James W. Jones
John F. McCole
John C. McDonald
John A. Martin
Bill B. May
William R. Purcell
Richard J. Reynolds
Roy L. Rogers
Donald E. Schmitt
P. Thomas Schoenemann
Theodore W. Statler
Willis D. Stinson
Robert A. Stortz
Calion H. Strobele
Julius L. Trager
Marvin L. Vickers
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**HEWLETT-PACKARD COMPANY**
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**VARIAN ASSOCIATES**
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| Manufacturer | Representative |
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| Accurate Instrument Co. | Jay Stone & Assoc. |
| Acton Laboratories | White and Co. |
| Alfred Electronics | White and Company |
| Airflow Company | Premmco, Inc. |
| Ameray-Nuclear Shielding Prod. Div. | White & Co. |
| American Mach. & Fdry. | McCarthy Assoc. |
| Analab Instrument Corp. | V. T. Rupp Co. |
| Antlab, Inc. | Jay Stone & Assoc. |
| Baldwin-Lima-Hamilton Corp. | Neely Ent. |
| Beckman/Berkeley Division | V. T. Rupp Co. |
| Behlman Engineering Co. | T. Louis Snitzer Co. |
| Bogart Microwave | Jay Stone & Assoc. |
| Bomac Laboratories, Inc. | Neely Ent. |
| Boonton Electronic Products, Inc. | O'Halloran Assoc. |
| Callite-Tungsten Corp. | Jack Kaufman |
| Data Instr., Tele | T. Louis Snitzer Co. |
| Daytronic Corp. | McCarthy Associates |
| Di/An Controls, Inc. | Jay Stone & Assoc. |
| Dymec, Div. Hewlett-Packard Co. | Neely Ent. |
| Electro-Pulse, Inc. | T. Louis Snitzer Co. |
| Electro Switch Corp. | Jack Kaufman |
| Electronic Measurements Co. | O'Halloran Assoc. |
| Electronic Mechanics Inc. | Jack Kaufman |
| Emerson & Cuming | McCarthy Assoc. |
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| Heli-Coil Corp. | Premmco, Inc. |
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| Levinthal Electronic Equip. Div. | O'Halloran Assoc. |
| Lindsay Structures | Premmco, Inc. |
| Manson Laboratories, Inc. | White and Co. |
| Massa Div., Cohu Electronics | McCarthy Assoc. |
| Menlo Park Engineering | O'Halloran Assoc. |
| Microwave Electronics Corp. | Jay Stone & Assoc. |
| Millivac Instrument Div., Cohu | McCarthy Assoc. |
| Narda Microwave Corp. | O'Halloran Assoc. |
| Oregon Electronic Mfg. | White and Company |
| Polarad Electronics | T. Louis Snitzer Co. |
| Radiation Counter Labs | White and Company |
| Rantec Corp. | O'Halloran Assoc. |
| Sanborn Company | Neely Enterprises |
| Sensitive Research Instrument | McCarthy Assoc. |
| Sierra Electronic Corp. | T. Louis Snitzer Co. |
| Sorensen & Co. | McCarthy Assoc. |
| Telonic Industries | T. Louis Snitzer Co. |
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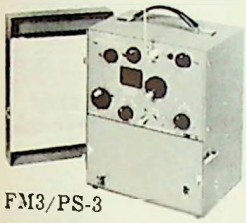

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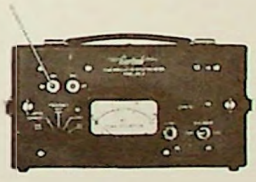

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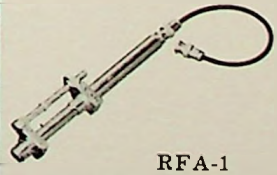

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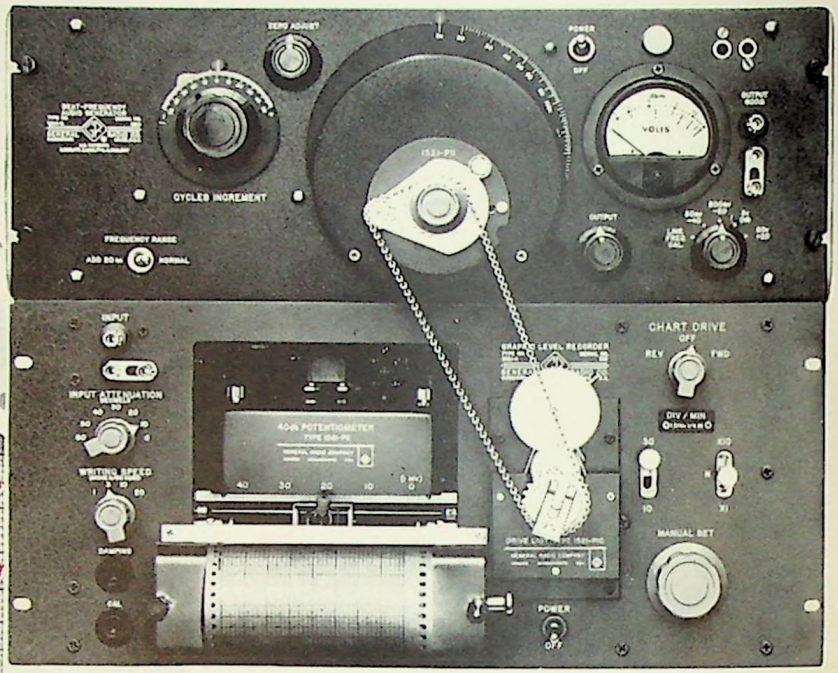


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