

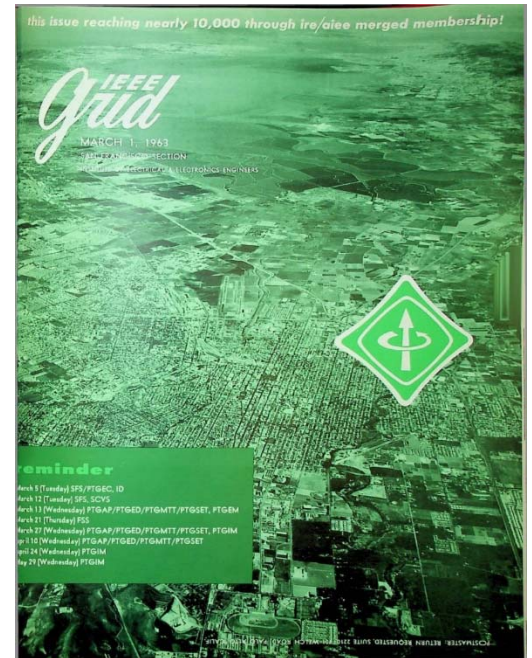
# EDITOR'S PROFILE of this issue

*from a historical perspective ...*

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

March, 1963:

Cover: Here we get an early view of what will become Silicon Valley – looking across San Jose with San Francisco in upper-left, Berkeley and Oakland in upper-right. This is a part of the new IEEE's San Francisco Section, part of the new Region 6. As part of the merger of AIEE and IRE, there are several new subsections formed -- Santa Clara Valley, and Fresno -- to supplement the existing East Bay subsection. There are still five Divisions and 20 Professional Groups that need to be re-aligned into the IEEE's new local chapters. Other merger details on page 5.



Archive of available SF Bay Area GRID Magazines is at this location:

[https://ethw.org/IEEE\\_San\\_Francisco\\_Bay\\_Area\\_Council\\_History](https://ethw.org/IEEE_San_Francisco_Bay_Area_Council_History)

At time of scanning, the bound volumes are held by Paul Wesling.

July, 2021

Contact [p.wesling@ieee.org](mailto:p.wesling@ieee.org)



this issue reaching nearly 10,000 through ire/aiee merged membership!

# IEEE *Grid*

MARCH 1, 1963

SAN FRANCISCO SECTION

INSTITUTE OF ELECTRICAL & ELECTRONICS ENGINEERS



## Reminder

- March 5 (Tuesday) SFS/PTGEC, ID
- March 12 (Tuesday) SFS, SCVS
- March 13 (Wednesday) PTGAP/PTGED/PTGMTT/PTGSET, PTGEM
- March 21 (Thursday) FSS
- March 27 (Wednesday) PTGAP/PTGED/PTGMTT/PTGSET, PTGIM
- April 10 (Wednesday) PTGAP/PTGED/PTGMTT/PTGSET
- April 24 (Wednesday) PTGIM
- May 29 (Wednesday) PTGIM



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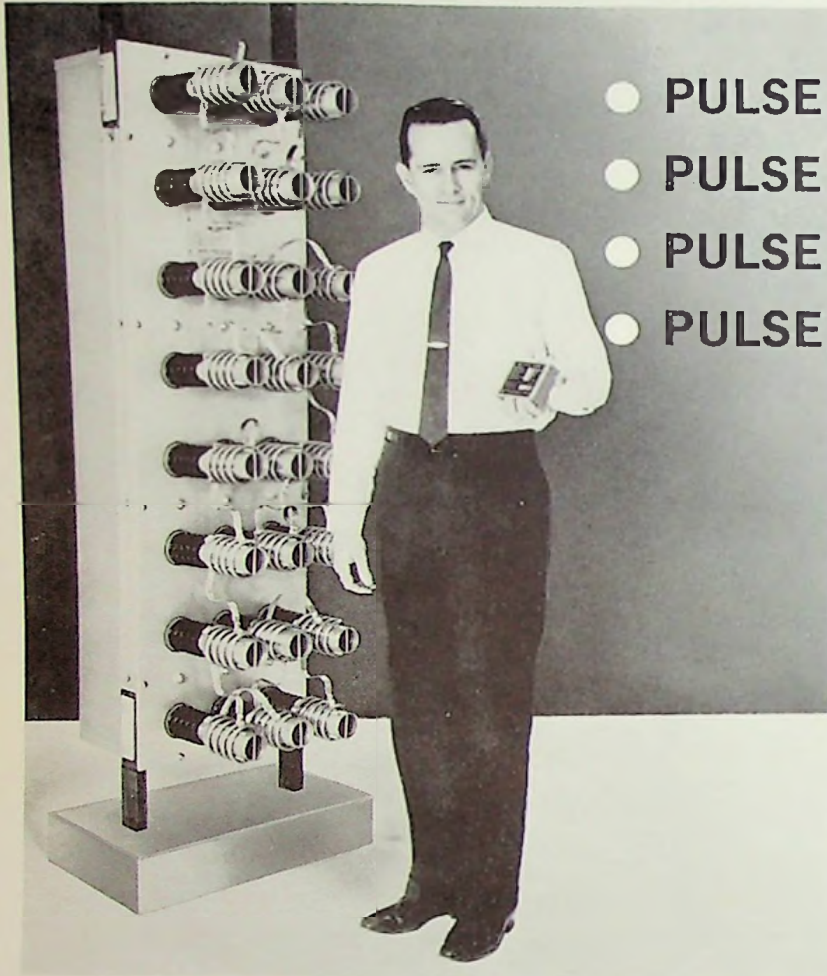
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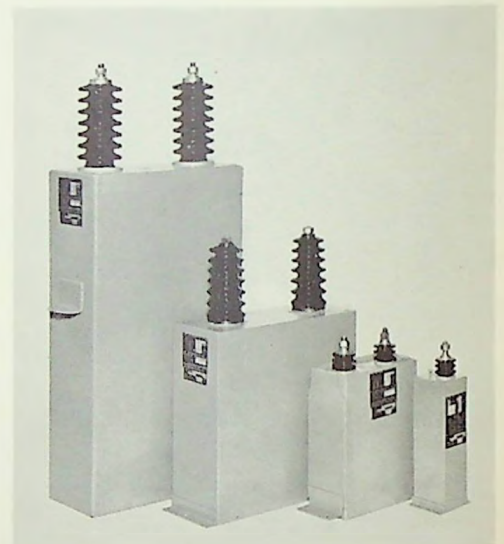
march 1, 1963



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**SECTION MEMBERS! To stay on mailing list when you move, send address change promptly to IEEE National Headquarters, Box A, Lenox Hill Station, New York 21, N.Y.**

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*cover*

Only a portion of the area to be served by the San Francisco Section of IEEE is shown in this aerial photograph looking from a point above San Jose to the tip of the San Francisco Peninsula, the Golden Gate, and Marin County. Oakland and Berkeley are at upper right.

Proposed section boundaries will include 22 counties: Del Norte, Humboldt, Mendocino, Lake, Sonoma, Napa, Marin, Solano, Contra Costa, San Francisco, Alameda, San Mateo, Santa Clara, Santa Cruz, Monterey, San Benito, Mariposa, Merced, Madera, Fresno, Kings, and Tulare. (Photo courtesy of Air-Photo Co., Palo Alto Airport.)

*ieee section chairmen through june 30, 1963*

|   |                                       |
|---|---------------------------------------|
| (IRE)   | (AIEE)                                |
| Peter Lacy, Wiltron Co.   | Victor E. Kaste, General Electric Co. |
| Membership Co-chairmen: Fred MacKenzie, Stanford Research Institute, DA 6-6200                                    |                                       |
| William Warren, Shell Development Co., OL 3-2100  |                                       |
| Publications Advisor: Peter Sherrill, West Associates   |                                       |
| Executive Secretary: James D. Warnock, Section Office: Suite 2210, 701 Welch Rd. Palo Alto, California, DA 1-1332 |                                       |

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# MEETING CALENDAR

*grid*

reporters

## EAST BAY SUBSECTION

N. K. (GENE) LITTLE, LAWRENCE RADIATION LABORATORY

## FRESNO SUBSECTION

J. M. SWALL, P.G.&E., FRESNO

## SANTA CLARA VALLEY SUBSECTION

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COMMUNICATIONS SYSTEMS: MAURICE H. KEBBY, LENKURT

CIRCUIT THEORY: R. E. KIESSLING, IIT LABORATORIES

ELECTRON DEVICES: MAHLON FISHER, SYLVANIA, MICROWAVE

ELECTRONIC COMPUTERS: WILLIAM DAVIDOW, GENERAL ELECTRIC

ENGINEERING MANAGEMENT: LEONARD M. JEFFERS, SYLVANIA

ENGINEERING WRITING AND SPEECH: DOUGLAS WM. DUPEN, ASSOCIATED TECHDATA INC.

INFORMATION THEORY: CHARLES H. DAWSON, PHILCO W. D. L.

INSTRUMENTATION & MEASUREMENT: JAMES HUSSEY, GENERAL RADIO CO.

MICROWAVE THEORY AND TECHNIQUES: ROBERT J. PRICKETT, HEWLETT-PACKARD CO.

MILITARY ELECTRONICS: VICTOR A. CONRAD, VARIAN ASSOCIATES

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SPACE ELECTRONICS AND TELEMETRY: TOM LINDERS, LOCKHEED

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## SAN FRANCISCO SECTION

8:00 P.M. • Tuesday, March 5

(Joint meeting with PTGEC)

"Practical Applications for Adaptive Circuits and Systems"

Speaker: Professor Bernard Widrow, Stanford University

Place: Physics Lecture Hall, Room 101, Stanford University

Dinner: 6:00 P.M., The Red Shack, 4085 El Camino Real, Palo Alto

Reservations: May Sharp (Lockheed), DA 3-1831, Ext. 141, by March 4

## SAN FRANCISCO SECTION

6:00 P.M. • Tuesday, March 12

Nontechnical, social event along the lines of a stag party

Place: The Village, Columbus at Lombard, San Francisco

Tickets: \$6.00 each (including dinner, group entertainment, dominoes, door prizes, and other forms of small group entertainment), from Douglas D. Dodds, EX 2-5353

## FRESNO SUBSECTION

8:00 P.M. • Thursday, March 21

"Astron Reactor Design"

Speaker: Dean O. Kippenhan, project engineer, electronics engineering dept., Lawrence Radiation Laboratory, Livermore

Place: P.G. & E. Bldg., 1401 Fulton St., Fresno

## SANTA CLARA VALLEY SUBSECTION

7:30 P.M. • Tuesday, March 12

Field Trip

Place: Main Entrance, Jennings Radio Manufacturing Corp., subsidiary of I.T. & T., 970 McLaughlin Ave., San Jose (McLaughlin Avenue is southern extension of S. 24th Street, between Williams and Story roads, near Bayshore Freeway)

## DIVISIONS

### Industrial

8:00 P.M. • Tuesday, March 5

"A New Approach to 100% Failure-Free Power Systems"

Speaker: Carl E. Gieb, Jr., special project engineer, Ideal Electric & Mfg. Co., Mansfield, Ohio

Place: Room 232, Pacific Gas & Electric Bldg., 245 Market St., San Francisco

## PROFESSIONAL TECHNICAL GROUPS

### Antennas & Propagation

8:00 P.M. • Wednesday, March 13

(Four-part Tutorial Lecture Series: "Laser Theory, Technique, and Application"  
—Joint with PTGED, PTGTT, and PTGSET)

Lecture No. 2: "Gas Discharge and Semiconductor Lasers"

Speaker: Dr. Arnold Bloom, Spectra-Physics Inc., Mountain View

Place: Physics Lecture Hall, Stanford University

Meet-the-Speaker Dinner: 6:00 P.M., Red Cottage, 1706 El Camino Real, Menlo Park

Reservations: Darlene Wheeler, DA 6-6200, Ext. 2695

### Antennas & Propagation

8:00 P.M. • Wednesday, March 27

Lecture No. 3: "Laser Techniques and Applications"

Speaker: Professor Anthony Siegman, Stanford University

Place: Physics Lecture Hall, Stanford University

Dinner reservations: Darlene Wheeler, DA 6-6200, Ext. 2695

# MEETING CALENDAR

**Antennas & Propagation** 8:00 P.M. • Wednesday, April 10  
Lecture No. 4: "Laser Developments Overseas—Report on Third International Quantum-Electronic Conference, Paris, 1963"  
Speaker: Dr. Malcolm Stitch, Hughes Aircraft Co., Culver City  
Place: Physics Lecture Hall, Stanford University  
Dinner reservations: Darlene Wheeler, DA 6-6200, Ext. 2695

**Automatic Control** 8:15 P.M. • Thursday, March 14  
"The Computer Control Problem"  
Speaker: Dr. Jack Bertram, manager, controls systems research, IBM  
Place: Electrical Engineering 126, Stanford University  
Dinner: 6:15 P.M., Old Plantation (formerly Sabella's), El Camino Real & Cherry Chase, Sunnyvale  
Reservations: Mrs. Pauline Eckman, DA 1-3300, Ext. 268, by noon, Wednesday, March 13

**Electron Devices** 8:00 P.M. • Wednesday, Mar. 13, 27  
(Tutorial Lecture Series: Joint with PTGAP, PTGMTT, and PTGSET, see above)

**Electronic Computers** 8:00 P.M. • Tuesday, March 5  
(Joint meeting with SFS, see above)

**Engineering Management** 8:00 P.M. • Wednesday, March 13  
Speaker: Dr. Walter H. Schwidetsky, manager, space navigation and data systems, General Dynamics/Astronautics  
Place: Caravan Inn, 4375 El Camino Real, Mountain View  
Happy Hour: 6:00 P.M.  
Dinner: 7:00 P.M., smorgasbord, \$3.50 inclusive

**Instrumentation & Measurement** 8:15 P.M. • Wednesday, March 27  
Lecture No. 3: "The Instrumentation and Performance of the Mariner II Experiments"  
Speaker: Ivan Walenta, Mariner II science project engineer, JPL, California Institute of Technology, Pasadena  
Place: Lockheed Auditorium, Bldg. 202, 3251 Hanover St., Palo Alto  
Dinner: 6:15 P.M., L'Omelette Restaurant, 4170 El Camino Real, Palo Alto  
Reservations: Mrs. Marje Andrews, DA 1-3300, Ext. 273

**Instrumentation & Measurement** 8:15 P.M. • Wednesday, April 24  
Lecture No. 4: "Detection of Planetary Life"  
Speaker, place to be announced

**Instrumentation & Measurement** 8:15 P.M. • Wednesday, May 29  
Lecture No. 5: "Instrumentation for Man in Space"  
Speaker, place to be announced

**Microwave Theory & Techniques** 8:00 P.M. • Wednesday, Mar. 13, 27  
(Tutorial Lecture Series: Joint with PTGAP, PTGED, and PTGSET, see above)

**Space Electronics & Telemetry** 8:00 P.M. • Wednesday, Mar. 13, 27  
(Tutorial Lecture Series: Joint with PTGAP, PTGED, PTGMTT, see above)



## consolidation notes

### COUNTERPARTS OF IEEE

With this issue the **Grid** now reaches a merged readership of nearly 10,000 throughout the Bay Area and beyond, including nearly 2000 members of the San Francisco Section of AIEE/IEEE, subscribers, and others.

Merger details, under the co-chairmanship of Stanley F. Kaise and Robert E. Grady, with Dean Robert Parden of Santa Clara University acting as honorary chairman, have made great progress in considerations of finance, publications, program, membership and related activities, publicity and public relations, and historical committees, all of these areas being virtually agreed upon.

Still to be resolved are awards procedure and organization for the new IEEE section; the formation of a nominating committee and its development of a slate of officers to be elected by the membership for the fiscal/program year 1963-64; the writing and adoption of new bylaws; and the question of how many subsections there will be in the section.

Further progress is expected at the March 5 meeting of the joint merger committee.

Five active AIEE/IEEE divisions have been added to the roster of **Grid** reporters, and their meetings will be publicized in the meeting calendar and elsewhere in the publication in the same manner of handling professional group (now known as professional technical group) meetings in the past.

Details on some of the various AIEE/IEEE chairmen and their activities follow.

**Victor E. Kaste** is chairman of the section. His firm is the General Electric Co. and his headquarters are at 235 Montgomery St., San Francisco.

**W. H. Peterson** is vice chairman, responsible for the scheduling of gen-

(Continued on page 10)





John E. Bertram

meeting ahead

### CONTROLLING COMPUTERS

The computer control problem will be the subject of J. E. Bertram, manager, controls systems research, IBM, San Jose, at the March 14 meeting of PTGAC, Electrical Engineering 126, Stanford University.

The speaker will explore the control and data-processing problems involved in applying a digital computer to the control of a typical industrial process.

A graduate of Washington University, St. Louis (BSEE) and Columbia University (MS, Engineering Sc.D.), Dr. Bertram was a member of the applied physics group of the engineering research laboratory of DuPont, and an instructor, associate, and assistant professor at Columbia, having been appointed a research staff member in 1958 at IBM, where he has worked on problems related to the use of digital computers in control applications. Since April 1961 he has been manager of control systems research.

meeting ahead

### INDUSTRIAL DIVISION OF IEEE

A new approach to 100 percent failure-free power systems will be the subject of Carl E. Gieb, Jr., special project engineer, Ideal Electric & Mfg. Co., Mansfield, Ohio, before the Industrial Division of IEEE on Tuesday, March 5.

The 8 p.m. meeting will be held in Room 232 of the P.G. & E. Building, 245 Market St., San Francisco.

The requirement of failure-free power systems has become increasingly stringent for critical applications such as instrumentation, control, and computer power supplies. Mr. Gieb will review the various systems available today and describe in detail a new development which features emergency power supply up to 2000

meeting ahead

### JENNINGS FIELD TRIP

The Santa Clara Valley Subsection of IEEE will sponsor a field trip to Jennings Radio Manufacturing Corp., 970 McLaughlin Avenue, San Jose, at 7:30 p.m. on Tuesday, March 12.

The high-power vacuum electronic components test laboratories at Jennings will hold an open house, with demonstrations of high-voltage and high-power DC, AC, and radio frequencies, along with vibration, shock, and other environmental factors. The Jennings high-voltage vacuum-powered switch laboratory has available up to 200,000 amperes at lower voltage levels, and up to 200,000 volts of 60-cycle power. It also has up to 500,000 volts peak of 60 cycles for high-potential testing, and one million volts for  $1\frac{1}{2} \times 40$  microsecond wave impulse testing.

The high-power radio-frequency laboratory has DC and radio-frequency transmitter capabilities up to 400 kilowatts CW, and a frequency range of 300 kilocycles at over 120,000 volts, up to 600 megacycles. This equipment is used for testing the Jennings radio-frequency vacuum switches, vacuum relays, and vacuum capacitors. It also provides up to 70,000 volts DC for testing vacuum switches used to interrupt higher voltage DC. The environmental test lab provides all the requirements of high-power vibration, shock, and other environmental tests required for reliable military applications. This laboratory also provides precision measurement and calibration for the Jennings vacuum-tube voltmeter which measures up to 200 KV peak of 60 cycles, RF and pulse. Special effect of high-power vibration will also be shown.

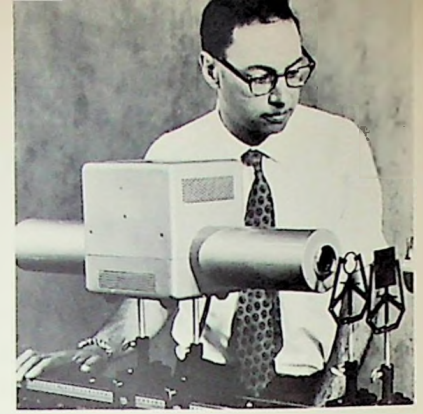
Robert W. Sumner, Westinghouse Electric Corp., Sunnyvale, is chairman of the subsection; Marvin W. Sheets, General Electric Co., San Jose, is secretary-treasurer.

KW with no drop in frequency, no drop in voltage, and no shock to the stand-by prime mover.

communication notes

### TELEPHONE REVIEW

To reach the Section Office, dial 321-1332 or 321-1333. To reach the WESCON Business Office, dial 321-1334 or 321-1335.



Arnold Bloom

meeting ahead

### SECOND IN LASER SERIES

The second lecture in the Laser Tutorial Series is to be given Wednesday, March 13, by Dr. Arnold Bloom, on the subject, "Gas Discharge and Semiconductor Lasers," at the Stanford physics lecture hall.

Dr. Bloom performed his doctoral studies in high-energy nuclear physics under Chamberlain and Segré at the University of California. He has since concentrated on theoretical investigations of resonance physics and optical pumping, accompanied by concurrent experimental work. Beginning at Varian in the theoretical study of nuclear magnetic resonance, he made significant contributions in this field, in 1955 publishing a basic paper on double resonance phenomena. Since then he has published over a dozen papers in the field of optical pumping. During 1958, he studied this subject at the University of Paris with Professor A. Kastler, one of the original discoverers of the optical pumping phenomena. Dr. Bloom has given invited papers at several significant conferences and has authored more than 20 technical papers. He is therefore eminently qualified to discuss those lasers that employ gas discharge excitation.

meeting ahead

### FRESNO SUBSECTION

Astron reactor design will be the subject of Dean O. Kippenham, project engineer, electronics engineering department, Lawrence Radiation Laboratory, Livermore, at the March meeting of the Fresno Subsection of IEEE. The 8:00 p.m. meeting will be held on March 21 in the P.G. & E. Building, 1401 Fulton Street, Fresno.

Roy V. Hall is chairman of the subsection; J. M. Swall, P.G. & E., Fresno, is secretary-treasurer.



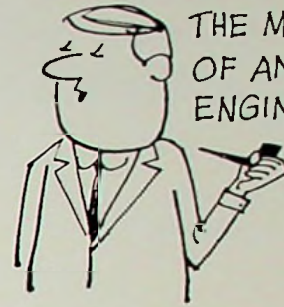
SO HERSHEYER  
COMES IN AND  
I TELL HIM  
I'M QUITTING!



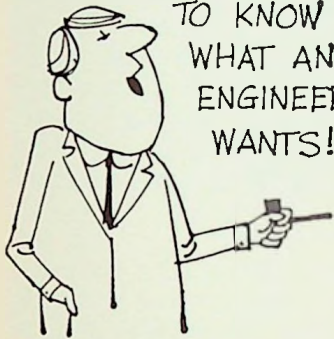
AND HE SAYS  
**WHY?** YOU'RE  
GETTING AS MUCH  
AS SIEFRIED  
AND LUCAS!



SO I SAID: MONEY!  
WHAT'S MONEY? YOU  
BUSINESSMEN JUST  
DON'T UNDERSTAND  
THE MIND  
OF AN  
ENGINEER!



I'M AN ENGINEER  
AND I OUGHT  
TO KNOW  
WHAT AN  
ENGINEER  
WANTS!



I WANT **FULLFILLMENT**  
I WANT TO WORK ON  
THE **SURVEYOR**  
AT HUGHES!



JUST THINK!  
SOMEDAY THERE'LL  
BE A LITTLE  
PIECE OF **ME**  
ON THE  
MOON!



NO MORE ELECTRONIC  
EGG-TIMERS! I'LL  
BE **CONTRIBUTING!**  
I'LL BE DOING  
SOMETHING **SIGNIFICANT!**  
SOMETHING **INTER-PLANETARY!**



BESIDES—  
HUGHES  
IS CLOSER  
TO THE  
BEACH.



**Hughes is hiring!** Numerous opportunities now exist in a variety of advanced projects and studies. Examples include: The MMRBM—Mobile Mid-Range Ballistic Missile (Integration, Assembly & Checkout), TFX(N) Electronics, SURVEYOR—soft-landing lunar spacecraft, SYNCOM—synchronous-orbit communications satellite, VATE—automatic test equipment, BAMBI—anti-missile defense, and others. Positions are open at all levels for specialists with degrees from accredited universities.

**CONTROLS ENGINEERS.** Concerns airborne computers and other controls related areas for: missiles and space vehicles, satellites, radar tracking, control circuitry, control systems, control techniques, transistorized equalization networks and control servomechanisms.

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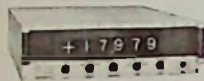
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*David S. Pratt*

*meeting review*

**IONOSPHERIC SOUNDINGS**

David S. Pratt, project engineer at Granger Associates, presented a very interesting program of slides and motion picture material concerned with synchronized oblique ionospheric soundings, January 15, to a combined meeting of IRE/PGCS/AIEE (Communications Division).

Mr. Pratt described older methods, such as vertical sounding and backscatter, and discussed their advantages and limitations when applied to the 4-to-32-megacycle communications band. The propagation characteristics of this portion of the spectrum were considered in some detail with the aid of slides depicting single and multi-hop paths between two fixed points and the effects of the ionosphere on these paths. These changing characteristics illustrated very well the desirability of changing frequency on a given circuit every few hours if the optimum performance is to be realized.

A description of the synchronized oblique sounding technique and its associated equipment pointed out the advantages of this type of sounding. By transmitting a very-short-duration pulse over an actual or typical communications path, the characteristic of the received pulse (or lack of a received pulse) may be analyzed to determine the usability of the path at a given frequency at a given time. In the synchronized oblique sounding system, a transmitter and receiver are stepped in discrete frequency increments throughout the spectrum of 4 to 32 megacycles.

A pulse of transmitted energy only a few microseconds in duration is transmitted, and its reception or ab-

sence at the receiving location is recorded on a suitable storage display tube. As the transmitter and receiver step through the frequency spectrum, a pattern is obtained which will show the lowest usable frequency, the multi-hop characteristics, and the maximum usable frequency at the particular time of sounding.

If soundings are taken at regular intervals throughout the day, actual predictions of changes of the maximum usable frequency may be made prior to the change. The ability to predict these changes has resulted in an increase of the circuit usability from 92 percent to 99 percent over a test path between Hawaii and San Francisco.

The synchronized oblique sounding technique will permit the communications circuit operator to observe when the lowest usable frequency is higher than the maximum usable frequency and, as a result, a circuit rendered inoperative. This condition may easily be observed on present-day sounding equipment.

Mr. Pratt pointed out the importance of known antenna characteristics for both the sounding and the communications circuits. Since the angle of radiation has bearing on the maximum usable frequency, the communication antenna and the sounding antenna, if not one and the same, must have identical characteristics or be capable of being equated.

In the question-and-answer session that followed Mr. Pratt's presentation, it was brought out that interference to other services by synchronized oblique sounding was nil owing to the extremely short pulse duration and slow repetition rate used.

Mr. Pratt joined Granger Associates in 1962. He is participating in design and development of ionosphere sounders and communications systems. From 1957 to 1962 he was a research associate with the electronics laboratory of Stanford University. His duties there included design and development of instrumentation for research in ionospheric physics and radio propagation. He is a member of the IRE and the American Geophysical Union. He is the author or co-author of numerous technical papers and reports.

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Storage time can be more than one hour; erase time approximately 250 milliseconds.

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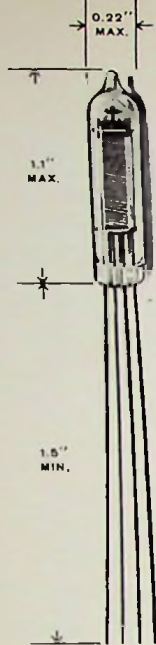
## Wide operating versatility available through 2-series and 3-series plug-ins

| AMPLIFIER UNITS TYPE                               | PASSBAND (3-db down)                                   | SENSITIVITY   | PRICE  | TIME-BASE UNITS TYPE                                | SWEEP FEATURES  | TRIGGERING  | PRICE |
|--|--|---|--------|---|---|---|-------|
| 2A60   | dc—1 Mc.   | 50 mv/cm—50 v/cm<br>4 decade steps<br>with variable control.    | \$105  | 2B67  | 1 $\mu$ sec/cm to 5 sec/cm,<br>1-2-5 sequence,<br>variable between rates.<br>5X Magnifier.<br>Single Sweep.   | Internal, External, Line;<br>Amplitude-Level<br>Selection; AC or DC-<br>Coupling; Automatic<br>or Free-Run; $\pm$ Slope.  | \$175 |
| 2A63—Differential<br>(50:1 rejection ratio)        | dc—300 kc.   | 1 mv/cm—20 v/cm<br>1-2-5 sequence,<br>with variable control.    | \$130  | 3B1   | Normal and Delayed<br>Sweeps—0.5 $\mu$ sec/cm to<br>1 sec/cm, 1-2-5 sequence<br>18 calibrated delay<br>settings, 0.5 $\mu$ sec to<br>10 sec, variable<br>between rates<br>uncalibrated.           | Internal or External;<br>AC or DC Coupling;<br>Automatic; $\pm$ Slope<br>Same features for<br>Normal and Delayed<br>Sweep Modes,<br>except automatic.                                   | \$475 |
| 3A72—Dual Trace<br>(Identical Channels)            | dc—650 kc.<br>(each channel).                          | 10 mv/cm—20 v/cm,<br>1-2-5 sequence,<br>with variable control.  | \$250  | 3B3   | Normal and Delayed<br>Sweeps—0.5 $\mu$ sec/cm<br>to 1 sec/cm,<br>1-2-5 sequence.<br>Continuously variable<br>calibrated delay from<br>0.5 $\mu$ sec to 10 sec.<br>Single Sweep<br>for main sweep. | Internal or External;<br>Line; AC or DC-<br>Coupling; Automatic;<br>$\pm$ Slope; for Normal<br>Sweep Mode; Same<br>features (except no Line<br>or Automatic) for<br>Delayed-Sweep Mode. | \$525 |
| 3A74—Four Trace<br>(Identical Channels)            | dc—2 Mc<br>(each channel).                             | 20 mv/cm—10 v/cm,<br>1-2-5 sequence,<br>with variable control.  | \$550  | 3T77<br>Sampling<br>Sweep<br>(for use with<br>3S76) | Equivalent to<br>0.2 nsec/cm to 10<br>$\mu$ sec/cm, 1-2-5<br>sequence, variable<br>between rates.<br>10X Magnifier.   | Internal or External,<br>$\pm$ Slope.   | \$650 |
| 3A75   | dc—4 Mc.   | 50 mv/cm—20 v/cm,<br>1-2-5 sequence,<br>with variable control.  | \$175  |   |   |   |       |
| 3A1—Dual-Trace<br>(Identical Channels)             | dc—10 Mc.<br>(each channel).                           | 10 mv/cm—10 v/cm<br>1-2-5 sequence<br>with variable control.    | \$410  |   |   |   |       |
| 3S76—Dual Trace<br>Sampling<br>(for use with 3T77) | equivalent<br>dc-to-875 Mc.<br>(0.4-nsec<br>rissetime) | 2 mv/cm—200 mv/cm,<br>1-2-5 sequence,<br>with variable control. | \$1100 |   |   |   |       |

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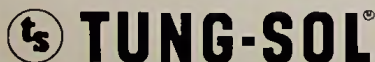
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eral and technical programs. He is division electric superintendent of the East Bay division, P.G. & E.

Gerard K. Lewis is secretary-treasurer of the section. His firm is the Allis-Chalmers Mfg. Co. with headquarters at 142 Sansome St., San Francisco.

Robert E. Grady is junior past chairman of the section and chairman of the joint merger committee. He is a consulting engineer.

Charles G. Dols is chairman of the technical papers committee which conducts the section prize paper contest. He is an electronics engineer at the University of California's Lawrence Radiation Laboratory.

Robert Howland is vice chairman of the program committee of the Communications Division. He is also treasurer of PTGEWS. As senior engineer with P.T. & T. he is responsible for many of the private line service designs for the military services.



Tilles



Garland



McCann



Wells

Dr. A. Tilles is a past chairman of the section and is currently chairman of the transfers committee, responsible for encouraging the upgrading of members and selecting members for the grade of Fellow. He has taught at the University of California and the Israeli Institute of Technology in Haifa. He is presently in the electronics engineering department at the University of California Lawrence Radiation Laboratory at Livermore.

W. D. Garland is a member at large of the executive committee and chairman of the subsection committee. He is a staff transmission engineer with P.T. & T.

Roy V. Hall is chairman of the Fresno subsection and has placed emphasis in programming on reaching high school science classes and college students. He served with P.G. & E. from 1926 until March 1, 1956, retiring at that time.

James J. McCann is chairman of the technical program committee of the Power Division. He is supervising electrical engineer, department of engineering services, P.G. & E.

J. A. Wells is chairman of the Industrial Division technical programs. He founded Artwel Electric, manufacturing representative firm, in 1957.

Frank Thatcher is chairman of the publicity committee and responsible for coordinating material for the Grid. He is a transmission engineer with P.T. & T.

Ronald K. Church is program chairman of the Instrumentation and Controls Division. He is a member of the product development and production engineering operations at Hewlett-Packard, Palo Alto.

Einar Nilsson is chairman of the fellowship committee, responsible for welcoming new members at the section.

*(Continued on page 12)*

Hall

Thatcher

Church

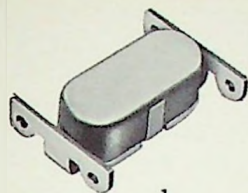
Nilsson



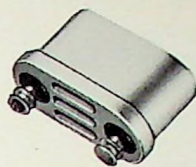


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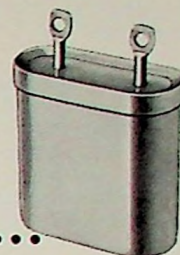
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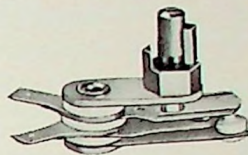
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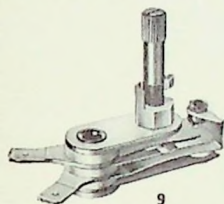
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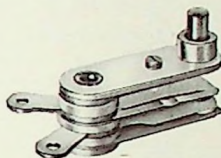
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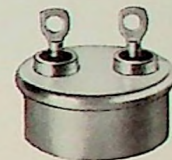
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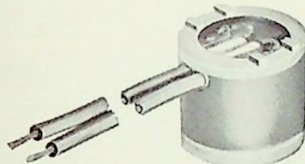
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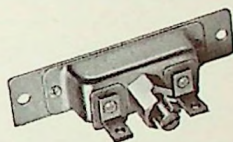
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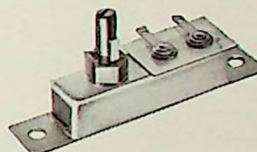
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14



15



16

1, 2, **TYPE C1** semi-enclosed (1), hermetically sealed (2). Small, positive acting with electrically independent bimetal strip for operation from  $-10^{\circ}$  to  $300^{\circ}\text{F}$ . Rated at approximately 3 amps, depending on application. Hermetically sealed type can be furnished as double thermostat "alarm" type. Various terminals and mountings. Bulletin 5000.

3, 4, **TYPE M**† semi-enclosed (3), hermetically sealed (4). Snap acting bimetal disc types for electronic applications from  $-50^{\circ}$  to  $300^{\circ}\text{F}$ . Rating: 3 to 10 amps at 115 VAC and 28 VAC/DC. Semi-enclosed with virtually any type terminal; hermetically sealed with pin or solder terminals, wire leads, various mounting brackets. Bulletin 6000.

5, 6, **TYPE MX**† semi-enclosed (5), hermetically sealed (6). Snap acting miniature units to open on temperature rise for missile, avionic, electronic and similar uses.  $2^{\circ}$  to  $6^{\circ}\text{F}$  differentials available. Rated at 3 amps to 1 amp, depending on duty cycle, at 115 VAC and 28 VAC/DC. Semi-enclosed types with metal or ceramic bases; hermetically sealed in circular or CR7 cans. Various terminals, mountings, brackets, etc. Bulletin 6100.

7, 8, **TYPE S**† adjustable (7), non-adjustable (8). Positive acting with single stud or nozzle mounting. Operation to  $600^{\circ}\text{F}$ . Rated at 15 amps at 115 VAC, 7 amps at 230 VAC. Spade, screw or formed terminals,

various adjusting stems, etc. Bulletin 1000.

9, **TYPE SA**† adjustable, or non-adjustable. Snap acting with electrically independent bimetal. Also single-pole, double-throw. Single stud or nozzle mounting. Rated at 1650 watts at 115-230 VAC only. Spade or screw terminals. Bulletin 2000.

10, **TYPE SM**† manual reset. Electrically same as Type SA except for manual reset feature. Bulletin 2000.

11, 12, **TYPE A**† semi-enclosed (11), hermetically sealed (12). Insulated, electrically independent bimetal disc gives fast response and quick, snap action control for electronic and apparatus applications from  $-50^{\circ}$  to  $300^{\circ}\text{F}$ . Lower or higher on special order. Rating: 4 to 15 amps, depending on duty cycle, at 115 VAC and 28 VAC, DC. Various enclosures and mountings, including brackets. Bulletin 3000.

13, **POTTED TYPES A & G**†. For refrigeration, air conditioning, or applications requiring a sealed thermostat, the Types A and G are available with lead wires and epoxy sealed. Type G is shown. Various mounting brackets. Bulletin 3000 for Type A, Bulletin 3500 for Type G.

14, **TYPE R**† sealed adjustable, sealed non-adjustable. Positive acting for operation to  $600^{\circ}\text{F}$ . Rated at 15 amps at 115 VAC, 4 amps at 230 VAC. Screw terminals. Bulletin 7000.

15, **TYPE W**† adjustable, or non-adjustable. Snap action bimetal strip type for operation to  $300^{\circ}\text{F}$ . Depending on duty, rated: 5 to 10 amps, 115 or 230 VAC. Screw or nozzle mountings; spade or screw terminals. Bulletin 4000.

16, **TYPE G**† exposed, or enclosed bimetal disc types, or epoxy sealed for moisture and dust resistance. Snap action for positive and instantaneous opening or closing of electronic and avionic circuits to  $300^{\circ}\text{F}$ . Various mountings and terminals. Bulletin 3500.

Illustrations, for general information only, do not necessarily show size comparisons. Fully dimensioned and certified prints on request. Manufacturer reserves right to alter specifications without notice.

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UNRETOUCHED PHOTO OF OUTPUT PULSE, MODEL L2005  
(Horizontal scale: 5  $\mu$ sec/cm)



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| L1003  | 10 mc        | 3 mc      | 80 db         | 0.3 $\mu$ sec       |
| L1505  | 15 mc        | 5 mc      | 80 db         | 0.2 $\mu$ sec       |
| L2005  | 20 mc        | 5 mc      | 80 db         | 0.2 $\mu$ sec       |
| L3002  | 30 mc        | 2 mc      | 90 db         | 0.5 $\mu$ sec       |
| L3010  | 30 mc        | 10 mc     | 80 db         | 0.1 $\mu$ sec       |
| L6002  | 60 mc        | 2 mc      | 90 db         | 0.5 $\mu$ sec       |
| L6010  | 60 mc        | 10 mc     | 80 db         | 0.1 $\mu$ sec       |
| L6020  | 60 mc        | 20 mc     | 80 db         | 0.05 $\mu$ sec      |
| L7002  | 70 mc        | 2 mc      | 90 db         | 0.5 $\mu$ sec       |
| L12020 | 120 mc       | 20 mc     | 80 db         | 0.05 $\mu$ sec      |

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## meeting review

### SOLVING CONTROL PROBLEMS

An interesting approach to the solution of optimal control problems was presented at the January 31 meeting of the PGAC. Dr. J. B. Rosen, visiting professor of computer science at Stanford University, developed a convex programming solution employing a somewhat more general cost function than is usually considered.

Given the vector differential equation

$$\dot{x} = f(x, u(t), t); 0 \leq t \leq T$$

where  $x$  is the  $n$ -dimensional state vector and  $u$  is the  $r$ -dimensional input vector, we are asked to find that input  $u(t)$  that minimizes

$$J[u] = \rho(x(T))$$

where  $\rho(x)$  is a convex function of  $x$ . We furthermore constrain both the state and input vectors to lie inside the region

$$\begin{cases} q^-(t) \leq u(t) \leq q^+(t) \\ p^-(t) \leq x(t) \leq p^+(t) \end{cases}$$

Dr. Rosen first rephrased the problem in terms that made it amenable to attack by programming methods. When attention is limited to the case

where the equations for  $\dot{x}$  are linear but  $\rho$  is allowed to be nonlinear, explicit solutions can be found for  $x$  as a function of  $u$ . In this continuous case, however, the solution for the minimum becomes an infinite-dimensional programming problem.

In order to reduce the dimensionality, a finite-dimensional approximation is made. The interval  $0 \leq t \leq T$  is broken into  $m$  equal lengths  $\Delta t$ . Using this approximation and taking advantage of an efficient convex programming method, rapid solutions can be obtained on present-day computers such as the IBM 7090.

Slides were presented which showed the results of solutions of problems with  $n = 4$  and  $n = 8$  using  $m = 25$  and  $m = 50$ . One point that evoked considerable interest was the fact that the solutions are not "bang-bang"; that is, they do not necessarily lie on the control or state vector constraints for all  $t$ , because of the type of cost function used.

Dr. Rosen remarked that the program had been run some 25 times

(Continued on page 13)



Dole



Dodds



Morris



Kaisel

tion meetings. He is supervising electrical engineering and design of the electrical part of thermal electric power plants and metropolitan substations.

A. R. Dole is chairman of the Communications Division, technical program committee. He is a senior engineer with P.T. & T. in the chief engineer's department, protection group.

Douglas D. Dodds is chairman of the attendance committee, responsible for encouraging attendance, arranging transportation, arranging dinner meetings, and handling tickets at special events. He is district engineer for Westinghouse Electric Corp. and concerned with apparatus applications for industrials.

E. W. Morris is chairman of the technical conference committee, responsible for recommending conferences of interest to the membership. He is a Fellow, a past national director, a past secretary of District 8, and was chairman of the Los Angeles Section in 1946-47. He is Pacific zone engineer, electric utility department, Westinghouse Electric Corp.

Chairman of the IRE/IEEE joint merger committee is Dr. Stanley F. Kaisel, president of Microwave Electronics Corp. Serving on his committee are Albert J. Morris, president of Radiation at Stanford; Dr. Peter Lacy, section chairman and president of Wiltron Co.; Peter Sherrill, West Associates; and James D. Warnock, section executive secretary.



**ZERO-SUM GAMES**

On January 24, 1963, at the Philco Auditorium, Dr. William L. Root of the University of Michigan addressed a PGIT audience of forty on "Communication Through Unspecified Additive Noise."

In the face of heavy and completely unstructured interference, as contrasted with additive noise of known statistics or the multiplicative noise of multipath, the theory of two-person zero-sum games is pertinent. One player is the communicators; the second player is nature or a jammer, whichever is producing the interference. If the interference is bounded at a level A and the minimum signal level is 1, then A is the maximum noise-to-signal ratio and is assumed to be greater than one.

The payoff for the game is simply the probability of making a correct decision. Since coin tossing at the receiver gives a probability of correct decision of one-half, the communication system must give a payoff larger than one-half to be useful. For simplicity, the theory is derived for a binary system using an off-on signal with energy detection and with equal a priori probabilities for the two signals. The interference actually present is B in the range  $0 \leq B \leq A$ . Hence B is the strategy parameter for nature.

Let the communicator use a decision rule  $d_c(x)$ , with c as his strategy parameter. With  $d_c$  equal to 1 when the decision is mark (signal) and  $d_c$  equal to zero when the decision is space (no signal), the payoff is

$$P(c,B) = \frac{1}{2} [d_c(1 + B) + 1 - d_c(B)]$$

If nature uses the mixed strategy of distributing B uniformly from 0 to A, the expected value of the payoff is  $E[P(c,B)] = (1/A) \int_0^A \frac{1}{2} [1 + d_c(1 + B) - d_c(B)] dB$

which reduces to

$$E[P(c,B)] = \frac{1}{2} + (1/2A)$$

where  $d_c(x)$  has been taken as 1 for  $A \leq x \leq 1 + A$  and equal to 0 for  $0 \leq x \leq 1$ .

*(Continued on page 18)*

on problems of various sizes using the "gradient projection" method for convex programming. Solution times were of the order of two or three minutes even for problems of large dimension.

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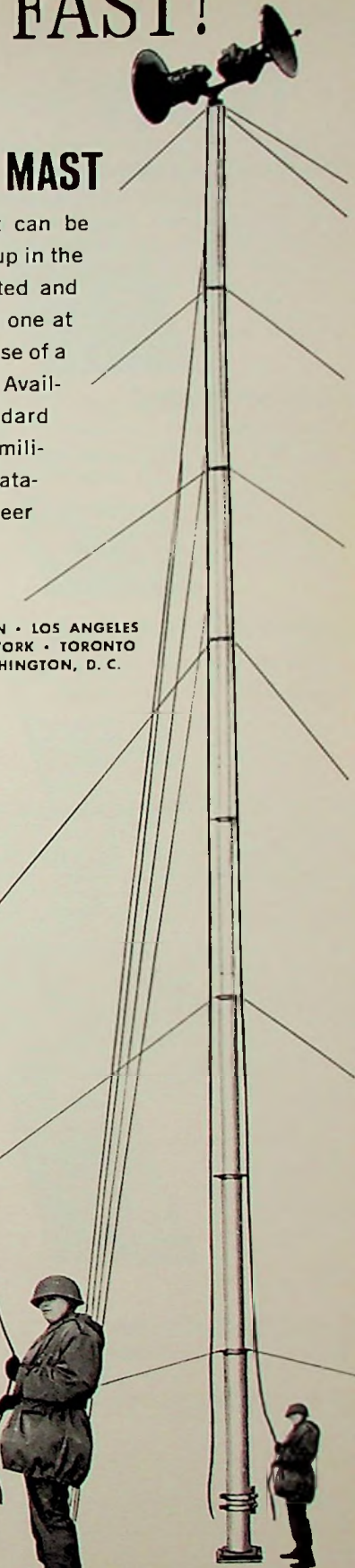
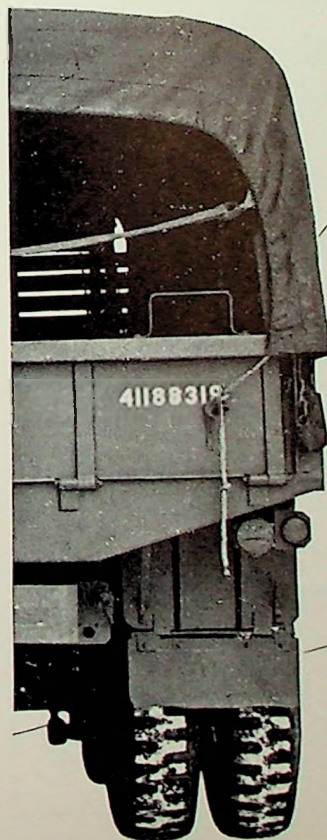
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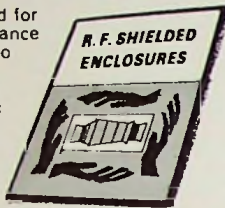




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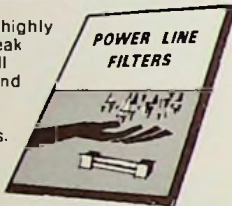
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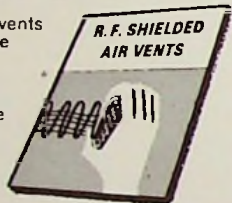
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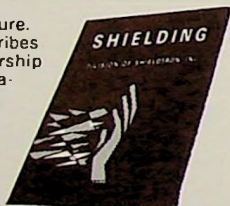
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## consolidation notes

### PUBLICATIONS POLICY

For the benefit of those who may have missed it, we are reprinting a letter which appeared in the November PROCEEDINGS from Messrs. Patrick E. Haggerty and B. Richard Teave, Jr., many queries on the subject having been received by the Section Office:

To the Members of IRE and AIEE:

Numerous inquiries have been received concerning the publications policy to be followed after the merger of AIEE and IRE. Although this policy was published as Article XIV of the "Proceedings of Consolidation" in the supplement to the April issues of the IRE PROCEEDINGS and ELECTRICAL ENGINEERING, it seems wise to restate it briefly for the benefit of all members.

IEEE will publish for a transition period of one year (the calendar year 1963) ELECTRICAL ENGINEERING and PROCEEDINGS OF THE IRE in substantially their present form, with additional material on IEEE news, abstracts, and other information of interest to the general membership.

This transition period may be extended for an additional period of up to one year by the IEEE Board of Directors. During this transition period, members of IRE at the time of merger will receive only the PROCEEDINGS, and members of the AIEE at that time will receive only ELECTRICAL ENGINEERING. Members of both Institutes at the time of merger, and new members of the IEEE, will receive one of these two publications at their choice. Any member may subscribe to the alternative publication.

The policy to be followed subsequent to this transition period will be the subject of intensive study by an Editorial Committee to be appointed by the IEEE Board of Directors immediately following the date of merger. The objective of this study will be to devise policy and procedures to satisfy the needs of the IEEE membership for publications of high technical quality and broad general interest.

The IEEE will publish TRANSACTIONS produced by the Professional Technical Groups (including the pres-

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ent IRE Professional Groups and the AIEE Institute Technical Groups) and will also publish periodicals sponsored by the IEEE Technical Operating Committee (the successor to the AIEE Technical Operating Department). IEEE will publish a periodical for student members, containing technical material and news items. Other publications, such as a Directory of Members with lists of manufacturers, products, and supplies, Convention and Conference Records, Cumulative Indexes, Standards, etc., will be published when warranted.

This policy is intended to maintain and strengthen, during the transition period, the present high standard of service rendered by the publications of the two Institutes. All members will be informed promptly in the pages of ELECTRICAL ENGINEERING and the PROCEEDINGS when the IEEE Board of Directors decides on the policy to be followed after the transition period.

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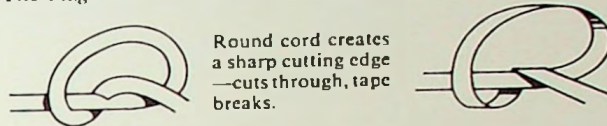
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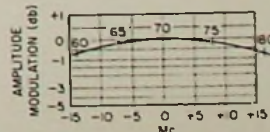
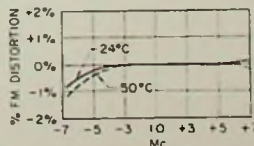
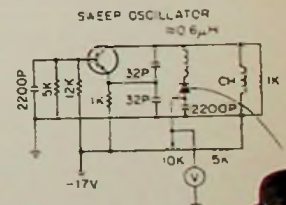
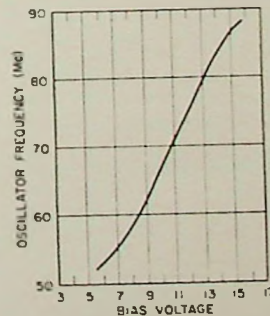
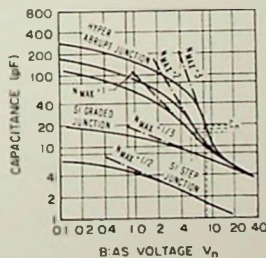
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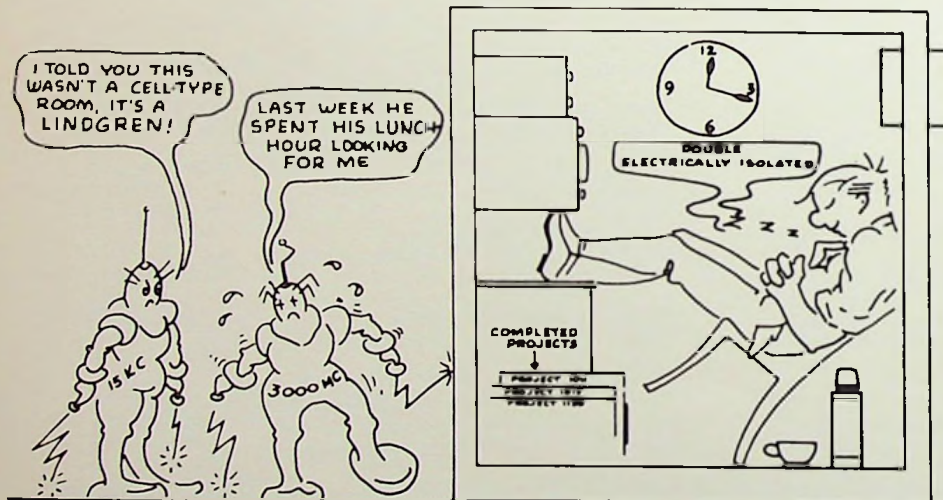
If the communicator's freedom is reduced by requiring him to use a threshold decision rule and integer values for that threshold, then the optimal strategies are a uniform distribution for nature and equal probabilities for the thresholds 1, 2, . . . , [A + 1], the largest integer in A + 1. In this case the expected value of the payoff is

$$E\{P(c,B)\} = 1/2 + (1/[A + 1])$$

Dr. Root stated that this minimax approach can probably be extended to detection schemes other than energy detectors. Some of his earlier work on this problem was reported in the March 1961 issue of Information and Control.

After receiving his Bachelor's and Master's degrees in electrical engineering, Dr. Root received his Ph.D. in mathematics from MIT in 1952. He was associated with MIT and Lincoln Laboratory until assuming his present position as professor of instrumentation engineering at the University of Michigan in 1961.

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*events of interest*

April 17-19—**SWIRECO** (Southwestern IEEE Conference and Elec. Show). Dallas Memorial Auditorium, Dallas, Texas. Exhibits: Hal Copeland, 810 Wilson Bldg., Dallas 1, Texas. Program: Prof. A. E. Salia, E.E. Dept., Arlington State College, Arlington, Texas. No Proceedings.

April 17-19 — Int'l Special Tech. Conf. on Non-Linear Magnetics. Shoreham Hotel, Washington, D.C. Program: J. J. Suozzi, BTL Labs., Whippany, N.J. \*DL-11-5-62. Proceedings: Order from IEEE Headquarters after Conference.

April 24-26—**6th Region Technical Conference**. San Diego, Calif. Program: George C., Tweed, Jr., 8080 Pasadena Ave., La Mesa, Calif. No Proceedings.

May 2-3—**4th Nat'l Symposium on Human Factors in Elec.** Marriott Twin Bridges Hotel, Washington, D.C.

May 7-9—**Electronic Components Conference**. Marriott Twin Bridges Hotel, Washington, D.C. Program: James Hannon, G.E. Co., 777-14 St., N.W., Washington, D.C. Proceedings: IEEE Headquarters after Conference.

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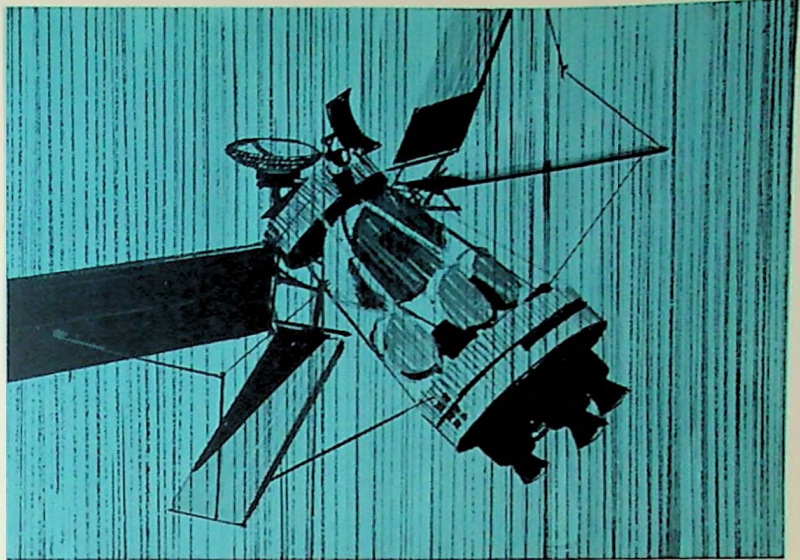
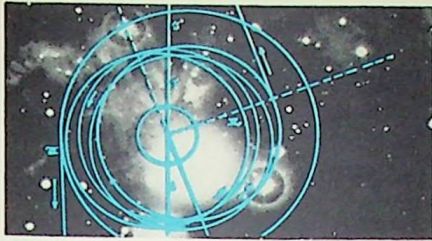


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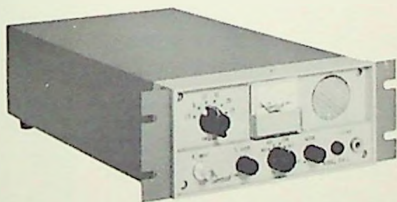
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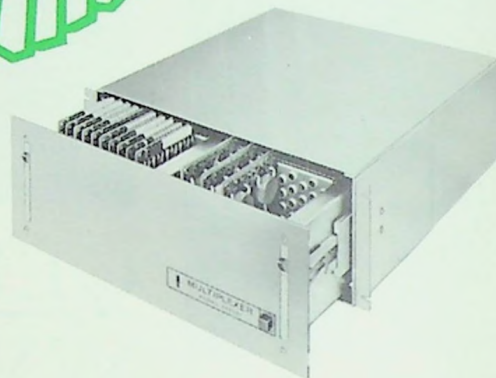
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