

# EDITOR'S PROFILE of this issue

*from a historical perspective ...*

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

February, 1965:

Cover: This early LIDAR unit, developed at the Stanford Research Institute (SRI) labs, uses maser radar to study weather. More 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

# IEEE *Grid*

February 1965  
SAN FRANCISCO SECTION  
INSTITUTE OF ELECTRICAL  
AND  
ELECTRONICS ENGINEERS



## meeting reminder

February 9 (Tuesday) Antennas and Propagation

February 16 (Tuesday) Automatic Control, Biomedical Engineering, Reliability

February 17 (Wednesday) Military Electronics

February 18 (Thursday) Audio

February 23 (Tuesday) Computers, Microwave Theory and Techniques, Product Engineering and Production, Space Commerce and Telemetry

February 24 (Wednesday) Electron Devices, Engineering

Writing and Speech, Electromagnetic Compatibility, Instrumentation and Measurement, S.F. Bay Area Engineering Council

February 25 (Thursday) Santa Clara Valley Subsection, Information Theory

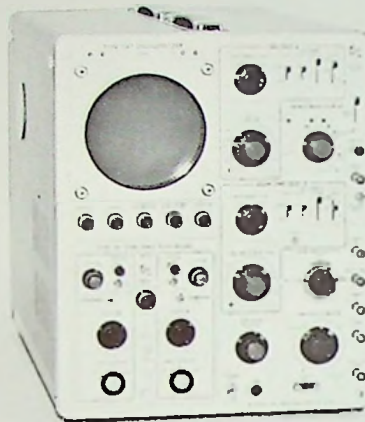
March 1 (Wednesday) Nuclear Science, Power

March 22 (Monday) San Francisco Section East Bay Subsection

March 24 (Wednesday) Instrumentation and Measurement

# yours

## INTRODUCING AUTOMATIC DISPLAY SWITCHING in the Tektronix Type 547



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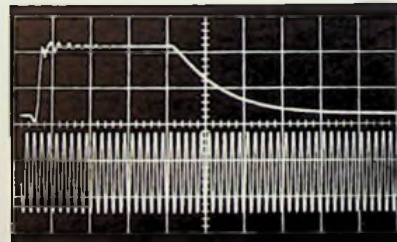
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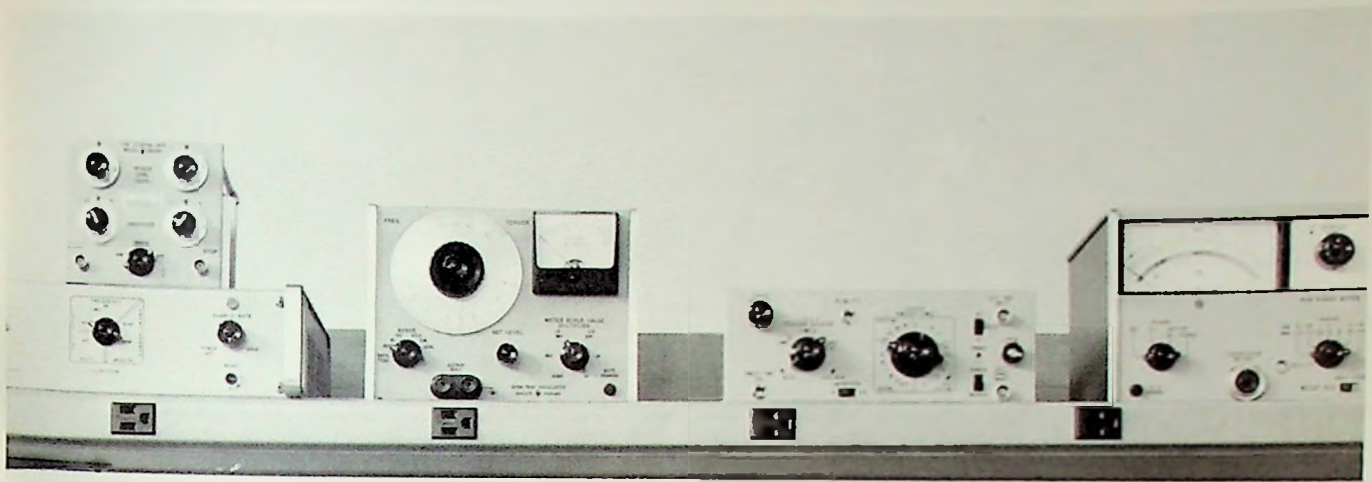
Your local Tektronix Field Office has this complete booklet on how the Tektronix Type 547—a single-beam oscilloscope—can provide dual-beam performance for most applications. A dc-to-50 Mc oscilloscope with automatic display switching, the Type 547 features two time bases. Either time base can be used for horizontal deflection of the crt beam. Or the beam can be driven first by one time base then the other, automatically, on alternate sweeps.



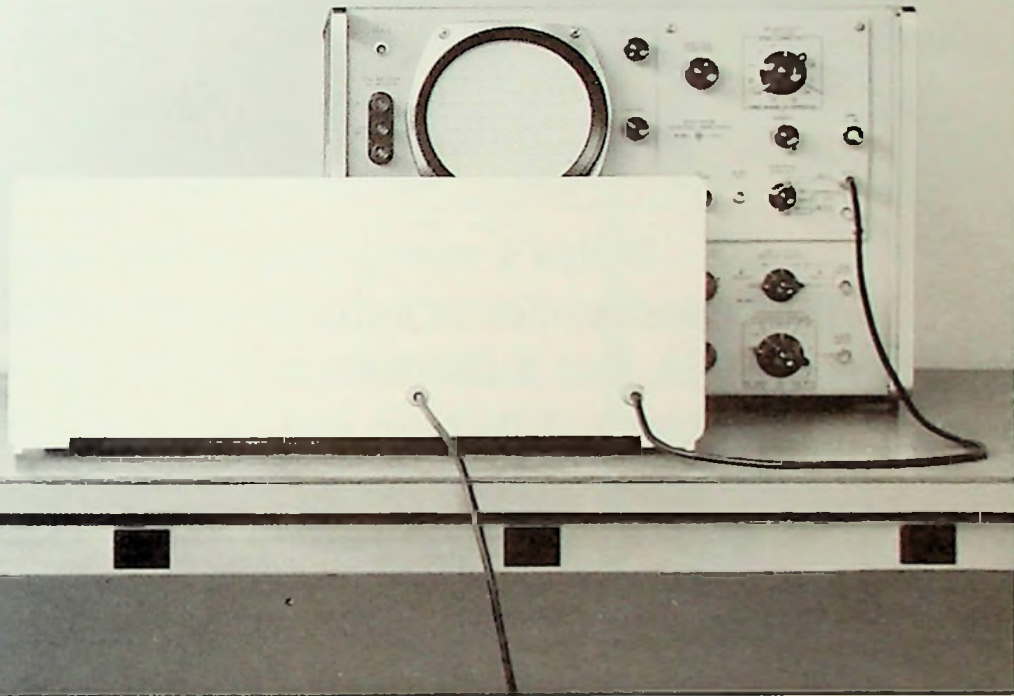
The single-beam oscilloscope display shows two different signals, each at a different vertical sensitivity and sweep speed. Single-exposure photograph.

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from the chairs

**WESCON FOR '65**

WESCON, the Western Electronic Show and Convention, is in San Francisco in 1965 and, as usual, will be held during the latter part of August—more exactly, August 24 through 27.

WESCON is jointly sponsored by the 6th Region of the IEEE and the Western Electronic Manufacturers Association (WEMA) and has been held every year since 1953 under the present arrangement. Since this year it is held in San Francisco, the re-



Meyer Leifer

sponsibility for organizing and carrying out its functions is handled by hundreds of local volunteers organized through 14 committees reporting to the executive committee of the board of directors, assisted by the WESCON business office.

The executive committee consists of two representatives of WEMA, John Chartz of Dalmo Victor and Phil Gundy of Technical Systems, Inc., and two members elected by the San Francisco Section of the IEEE, John McCullough of Litton Electron Tube Division and Meyer Leifer of Energy Systems, Inc. The last-named individual was elected to replace Dr. Ed Herold, who resigned late last year to return to the RCA Laboratories in Princeton. For the '65 WESCON, McCullough is the convention director, Gundy the show director, Chartz the chairman of the executive committee, and Leifer chairman of the board of directors.

The primary objective of WESCON is the advancement of the elec-

(Continued on page 12)

*cover*

Dr. Myron G. H. Ligda, manager of the aerophysics lab of the electronics and radio science division of Stanford Research Institute, demonstrates LIDAR, a maser radar, newest instrument of the weatherman. For more on this new application, see page 5.

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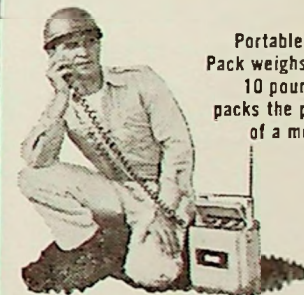


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**ENGINEERS' WEEK SPEAKER**

William F. Raborn, Jr., retired rear admiral, sometimes called "father of the Polaris," and now vice president for program management of Aerojet General Corporation at El Monte, Calif., will be speaker at this year's dinner in San Jose celebrating National Engineers' Week, February 21 through 26.

Admiral Raborn will speak to the national theme, "Engineering . . . for Human Needs," at Lou's Village Thursday evening, February 25. A social hour at 6:30 p.m. will be followed by the dinner, with the admiral speaking about 9 o'clock. The event is jointly presented by the Santa Clara Valley Engineers Council and the Santa Clara Valley Subsection of IEEE.

Harry R. McLaughlin, Lockheed, Palo Alto, is a member of the banquet committee, and Oswald Wedekind, Underwriters Laboratories of Palo Alto, is on the coordinating committee. Ten other societies are joined with IEEE in the Santa Clara Valley Engineers Council, celebration sponsor.

The banquet is open to the public. Reservations may be obtained from any of the engineering societies or from R. J. Jodoin, Bio-Form Corp., chairman of ticket sales.

## meeting ahead

**NOISE IN AMPLIFIERS**

David B. Jepsen, electronic engineer in the development section of the Los Gatos facility of Ampex Consumer and Educational Products Division, Elk Grove Village, Ill., will discuss optimizing the noise figure in transistor audio amplifiers at a joint meeting of the Audio chapter and the Audio Engineering Society on February 18.

Transistor manufacturers will supply data describing the noise figure of a specific transistor versus other transistor parameters. To operate a transistor as an active and stable device, base biasing resistors and, sometimes, unbypassed emitter resistors are necessary. Additionally, feedback may be applied to either the base or the emitter of the transistor. The effects of these external resistances as well as of source impedance on the transistor noise figure are investigated.

Jepsen received the B.S.E.E. degree from San Jose State College in 1958, and the M.S.E.E. degree from the University of Santa Clara in 1961.

**MEETING CALENDAR****S.F. BAY AREA ENGINEERING COUNCIL**

7:00 P.M. • Wednesday, February 24

**Engineers' Week awards banquet**

Place: Palace Hotel Gold Ballroom

Tickets (\$6.00) may be purchased from Herman Spaeth, Pacific Fire Rating Bureau, San Francisco; SU 1-8828

**SAN FRANCISCO SECTION**

8:00 P.M. • Monday, March 22

(Joint with East Bay Subsection, see below)

**The electronics of San Francisco Bay Area Rapid Transit**

Speakers and place to be announced

Reservations and information: Mrs. Jean Helmke, Section Office, 327-6622

**SANTA CLARA VALLEY SUBSECTION**

7:30 P.M. • Thursday, February 25

(Joint with Engineers' Council, Santa Clara Valley; ladies included)

**Engineers' Week Banquet: Human engineering aspects of the Polaris program**  
*Vice Admiral William F. Raborn, Jr., USN, Ret., vice president, program management, Aerojet-General Corp.*

Place: Lou's Village, 1465 W. San Carlos Street, San Jose

Social hour: 6:30 P.M.

Dinner: 7:30 P.M.

Reservations: R. J. Jodoin, 294-4130, or Ed Stahl, 354-7540, by February 23

**EAST BAY SUBSECTION**

8:00 P.M. • Monday, March 22

(Joint with San Francisco Section)

**GROUP CHAPTERS****Antennas and Propagation**

8:00 P.M. • Tuesday, February 9

**Synthesis of high performance dual reflector antenna systems***Phillip D. Potter, Jet Propulsion Lab, CalTech*

Place: Ph 101, Stanford University

Dinner: 6:30 P.M., Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto

Reservations: 845-6000, Ext. 3539, by February 8

**Audio**

8:15 P.M. • Thursday, February 18

(Joint with Audio Engineering Society)

**Optimizing the noise figure in transistor audio amplifiers***David B. Jepsen, development section, Ampex consumer and educational products division (Los Gatos facility)*

Place: SRI conference room B, 333 Ravenswood Avenue, Menlo Park

Cocktails: 6:00 P.M.

Dinner: 6:30 P.M., Ramor Oaks, El Camino Real, Atherton

Reservations: Marc Brun, 742-9387

**Automatic Control**

8:00 P.M. • Tuesday, February 16

(Joint with Biomedical Engineering, see below)

**Biomedical Engineering**

8:00 P.M. • Tuesday, February 16

(Joint with Automatic Control, see above)

**A new class of pulse-frequency modulated feedback systems and its application to neural nets***Dr. E. I. Jury, professor, University of California, Berkeley*

Place: Stanford Medical School, Room M-112

Dinner: 6:15 P.M., Red Cottage Restaurant, El Camino Real, Menlo Park

Reservations: Dr. J. Bliss, 326-6200, Ext. 3488, by February 15

**Computer**

8:00 P.M. • Tuesday, February 23

**Isodata: novel data analysis technique with applications to pattern recognition and data analysis***Geoffrey H. Ball and David J. Hall, staff members, SRI*

Place: General Electric Computer Lab, 310 DeGuigne Drive, Sunnyvale

Dinner: 6:15 P.M., Old Plantation, El Camino and Bernardo, Sunnyvale

Reservations: None required

# MEETING CALENDAR

## Electromagnetic Compatibility

8:15 P.M. • Wednesday, February 24

(Joint with Instrumentation and Measurement, see below)

## Electron Devices

8:00 P.M. • Wednesday, February 24

### Interactions between light and sound

*Dr. Robert Adler, vice president, research, Zenith Corp., Chicago*

Place: Ph 101, Stanford University

Dinner: 6:00 P.M., Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto

Reservations: R. Borghi, 854-3300, Ext. 557, by February 23

## Engineering Writing and Speech

8:00 P.M. • Wednesday, February 24

### Proposal philosophy; a new angle in market development

*Frank Mansur, senior sales representative, LMSC, Sunnyvale*

Place: 3251 Hanover Street, Palo Alto—Lockheed Auditorium, Bldg. 202

Dinner: 6:00 P.M., Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto

Reservations: Robert Howland, 324-0768, evenings; 399-2951, days; or Douglas W. Matthews, Area Code 408, 739-4510, Ext. 2301

## Information Theory

8:10 P.M. • Thursday, February 25

### On the measurement and use of time-varying channels

*Prof. W. L. Root, University of Michigan*

Place: Philco Auditorium, 3825 Fabian Way, Palo Alto

Dinner: 6:15 P.M., Riekeys Hyatt House, El Camino Real, Palo Alto

Reservations: Mrs. D. Saltzman, 326-4350, Ext. 4101, by February 25

## Instrumentation and Measurement

8:15 P.M. • Wednesday, February 24

(Joint with Electromagnetic Compatibility, see above)

### The technique of spectrum analysis

*Arthur Fong, senior staff engineer, Hewlett-Packard, Palo Alto*

Place: HP Auditorium, 1501 Page Mill Road, Palo Alto

Dinner: 6:15 P.M., L'Omelette, 4170 El Camino Real, Palo Alto

Information: Renda Blackler, 948-0571

## Instrumentation and Measurement

8:15 P.M. • Wednesday, March 24

### Voltage references, old and new

*Dave Hilbiber, Fairchild Semiconductor, Palo Alto*

Place: Fairchild, 4001 Junipero Serra, Palo Alto

Dinner: 6:15 P.M., L'Omelette, 4170 El Camino Real, Palo Alto

No reservation required

## Microwave Theory and Techniques

8:00 P.M. • Tuesday, February 23

Third of three lectures on solid-state devices

### Hot carrier devices

*Richard Soshea, hp associates, Palo Alto*

Place: Room 1A, Hewlett-Packard, 1501 Page Mill Road, Palo Alto

Dinner: 6:30 P.M., Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto

Reservations: Bob Prickett, 326-7000, Ext. 2117, by February 22

## Military Electronics

8:00 P.M. • Wednesday, February 17

### Video file—a television record storage system

*Robert A. Miner, product planning staff, Ampex Corp.*

Place: Lockheed Auditorium, Bldg. 202, 3251 Hanover Street, Palo Alto

Dinner: 6:30 P.M., Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto

Reservations: Ralph W. Franks, 743-2778, by February 16

## Nuclear Science

8:00 P.M. • Wednesday, March 3

### The 200 BeV LRL accelerator design proposal

*Edward C. Hartwig, project engineer, Lawrence Radiation Lab, Berkeley*

Place: Granada Bowl, 1620 Railroad Avenue, Livermore

Dinner: 6:30 P.M.

Reservations: 447-1100, Ext. 8011, by March 1

(Continued on page 6)

meeting ahead

## LASER RADAR

Dr. Myron G. H. Ligda, manager of the aerophysics laboratory of Stanford Research Institute, will address the February 23 meeting of the Space Electronics and Telemetry chapter. He will discuss LIDAR, the weatherman's newest instrument, shown on the cover.

In the years since World War II, a number of new and powerful tools have been developed to help the weather forecaster solve the eternal question: "Is it going to rain tomorrow?" Thus, we have radar to observe storms and precipitation, rockets to probe the upper atmosphere, high-speed electronic computers to draw tomorrow's weather map, nuclear-powered automatic weather stations to float in midocean and report existing weather conditions, and artificial satellites to map the global cloud systems and measure the earth's radiation into space.

To this formidable array is now being added another—lidar, or laser radar. While the capabilities of this instrument are still incompletely determined, it has demonstrated applications to a number of important meteorological problems such as cloud height determination under adverse conditions, observation of atmospheric transmissivity and pollution, and continuous observation of the upper atmosphere.

The characteristics of some experimental equipment constructed at Stanford Research Institute, the observations which have been made, principal technological and scientific problems needing solution, and plans for future work will be discussed.

Dr. Ligda directs the Laboratory's research programs on radar meteorology, satellite meteorology, atmospheric analysis, and dynamic meteorology.

Dr. Ligda received the A.B. degree in astronomy and physics from the University of California in 1942, the S.M. in 1948 and Sc.D. in 1953, both in meteorology, from Massachusetts Institute of Technology. His minor for the Sc.D. was in astronomy, taken at Harvard University.

chapter news

## VEHICULAR COMMUNICATIONS

In an effort to activate the authorized but never organized San Francisco chapter of the IEEE Vehicular Communications Group, Ben K. Wright, Kaar Engineering, Palo Alto, and the section office have sent questionnaires to 80 local members with encouraging results. Those members not yet returning the forms are urged to do so promptly.



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**Power**

7:30 P.M. • Wednesday, March 3

(Joint with San Francisco Section of ASME)

Two years' operating experience with a mine-mouth plant

*John S. Anderson, superintendent of power, Utah Power & Light Co., Salt Lake City*

Place: Engineers' Club of San Francisco, 206 Sansome Street, 15th floor

Cocktails: 5:30 P.M.

Dinner: 6:30 P.M.

Reservations: Call 421-3184 by March 1

**Product Engineering and Production**

7:00 P.M. • Tuesday, February 23

Plant tour (limited to 54)

Place: General Motor Assembly Plant, 4550 Fremont Blvd., Irvington (south-east of Fremont). Ask at guard station for direction to visitors' parking. Use main building entrance.

Note: tour trains leave promptly at 7:00 P.M.

No dinner

Reservations: Required for tour. Call 326-7000, Ext. 2459—Dorothy Hittenberger or Ron Church; PEP members will receive preference until February 15

**Reliability**

8:00 P.M. • Tuesday, February 16

The control of gambling in Nevada (postponed from December 17)

*Edward A. Olsen, chairman, state gaming control board, Nevada Gaming Commission*

Place: Ph 101, Stanford University

Dinner: 6:30 P.M., Ed's Chuck Wagon, El Camino Real, Mountain View

Reservations: Stuart Bessler, 327-4212, by February 15. (NOT ladies night)

**Space Electronics and Telemetry**

8:15 P.M. • Tuesday, February 23

Lidar—the weatherman's newest instrument

*Dr. Myron G. H. Lidga, manager, aerophysics lab electronics and radio science division, Stanford Research Institute*

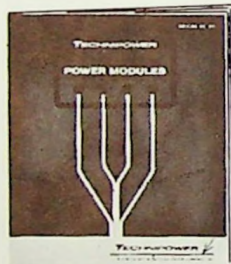
Place: Lockheed Auditorium, Bldg. 202, 3251 Hanover Street, Palo Alto

Dinner: 6:15 P.M., El Camino Bowl, 2025 El Camino Real, Mountain View

Reservations: Charles Jamgotchian, 697-7774, by noon, February 23

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Soshea

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*meeting ahead*

### HOT CARRIER DEVICES

Richard W. Soshea, hp associates, will deliver the third of three lectures on solid-state microwave devices at the February 23 meeting of the Microwave Theory and Techniques chapter.

The continuing need for faster switching diodes and better microwave devices has led to a renewed interest in the use of rectifying metal-semiconductor contacts (Schottky barriers). In a properly designed Schottky barrier diode most of the current consists of injection of majority carriers into the metal; thus, the rectification at high frequencies is not limited by minority carrier lifetime. The electrons or holes are injected into the metal with energies much greater than the thermal equilibrium energies, hence the designation "hot carrier." Hot carrier diodes are replacing point contact diodes in many mixer and detector applications.

This talk will include a brief review of the principles of hot carrier devices; the design, application, and performance of optimum hot carrier microwave diodes; and a report on the current status of the hot electron triode (metal base transistor).

The speaker earned the Ph.D. in electrical engineering at the University of Minnesota. He spent two years in the research department of Rheem Semiconductor Corp., Mountain View. He presently heads the exploratory development department of hp associates, Palo Alto.

*meeting ahead*

### ANTENNA SYSTEMS

Phillip D. Potter, supervisor, antenna and microwave group, Jet Propulsion Laboratory, Cal Tech, will address the February 9 meeting of the Antennas and Propagation chapter. He will discuss the synthesis of high performance dual reflector antenna systems.

The speaker received his B.S.P.H. and M.S.E.E. degrees in 1954 and 1955 from the California Institute of Technology. Since that time he has been employed at the Jet Propulsion Laboratory in Pasadena. His primary area of work for the past two years has been low-noise feed systems for large paraboloidal antennas.

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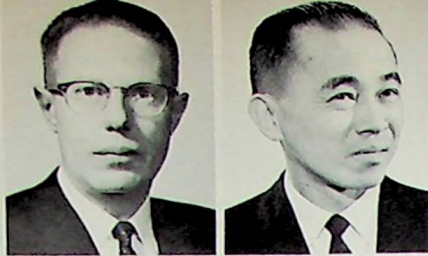
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*meeting ahead*

#### LIGHT AND SOUND

Dr. Robert Adler, vice president and director of research of the Zenith Radio Corp., Chicago, will discuss interactions between light and sound at the February 24 meeting of the Electron Devices chapter.

Dr. Adler, who received the Ph.D. in physics in 1937 from the University of Vienna, joined Zenith in 1941 and was named director of research in 1963. The electron beam parametric amplifier is one of the products of Dr. Adler's group in recent years. Earlier work in the vacuum tube field includes the development of the phasitron modulator, of receiving tubes such as the 6BN6 and 6AR8, and of transverse field traveling wave tubes. Dr. Adler has also been active in the development of mechanical filters and of ultrasonic remote control devices.

Dr. Adler has been a Fellow of the IRE since 1951. His abstract follows: When a light beam traverses a beam of ultrasound, conspicuous diffraction phenomena appear. These can be explained in terms of simple classical physics; they can also be interpreted as parametric processes or as quantum interactions. A lower frequency form, the Debye-Sears effect, has been well known for many years. A simpler form, observable at higher sound frequencies, has recently received much attention, and many interesting experiments have been made with laser light and with sound ranging from 40 mc to X-band. A variety of applications have been suggested; some of these await the discovery of materials with larger interaction coefficients.

*meeting ahead*

#### SPECTRUM ANALYSIS

Arthur Fong, senior staff engineer, Hewlett-Packard Co., will briefly review the history of spectrum analysis at the February 24 meeting of the Instrumentation and Measurement chapter.

The relationship between the frequency and time function will be developed and the formation of the display by scanning and contiguous filters will be described. The discussion will cover instrumentation requirements affecting the choice of

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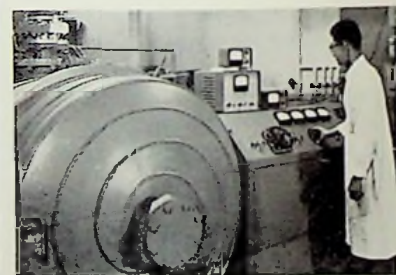
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meeting ahead

### VIDEOFILE

Robert A. Miner, product planning staff of Ampex Corp., will discuss Videofile, a television record storage system, at the February 17 meeting of the Military Electronics chapter.

Television pictures of documents—pictures which can be stored on magnetic tape and conveyed from one point to another over a pair of wires—present intriguing possibilities for mechanized record systems. The total television art is at an evolutionary point today, wherein many of these possibilities can be reduced to practice in the form of Videofile systems. The functional capabilities of such systems and their applications will be discussed in this paper.

Miner has been a member of the firm since October, 1950. He joined Ampex as a development engineer and became successively service manager, southeastern district sales manager, national sales manager, professional products division marketing manager, and video products division market planning manager. Over the past five years he has been actively engaged in analyzing and planning activities for the "television micro-storage" field.

meeting ahead

### TIME-VARYING CHANNELS

Prof. W. L. Root, University of Michigan, will address the February 25 meeting of the Information Theory chapter on the measurement and use of time-varying channels.

The theory of bounded integral operators is used to characterize linear time-varying channels. The problem of measuring such channels to various degrees of approximation will be considered.

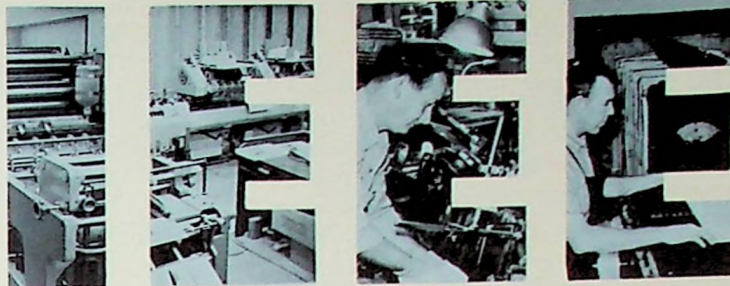
Root received his Ph.D. in mathematics from the Massachusetts Institute of Technology, where he also worked at the Lincoln Laboratories from 1952 to 1961. Since that time, he has been professor of instrumentation engineering at the University of Michigan, Ann Arbor. He is co-author (with W. Davenport) of the well-known book, "Introduction to the Theory of Random Signals and Noise." Professor Root has recently been made a Fellow of the IEEE.

scan rate and filters, new applications, and future trends of spectrum analysis instrumentation.

A graduate of the University of California, Fong is currently doing graduate work at Stanford University. He was formerly a staff member of the MIT Radiation Laboratory.

february, 1965

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meeting ahead

### MARCH POWER MEETING

A joint meeting of the San Francisco Chapter of the IEEE Power Group and the ASME San Francisco Section will be held on March 3 at the Engineers' Club. The subject is "Naughton Steam Electric Station—Two Years' Operating Experience with a Mine-Mouth Plant" and the speaker is John S. Anderson, superintendent of power, Utah Power and Light Company, Salt Lake City.

The Naughton SES is located four miles southwest of Kemmerer, Wyo., and Unit No. 1 has a nominal capability of 150 mw. Coal is supplied by the Kemmerer Coal Company from the adjacent strip mine over a coal conveyor system of approximately a mile in length. A unique coal stacker and handling facilities on the plant site complete the coal system.

Being in an area where water is scarce, the make-up water system presented unusual design problems and involves a 7½-mile underground pipeline. Condenser circulating water is cooled in a cooling tower, which has presented some interesting operating problems. The data logging system, control room design, and plant personnel problems will also be discussed.

Integration of the remote plant into the system of the Utah Power and Light Company has caused a number of unexpected and interesting operating situations. Anderson will present slides and discuss in some detail the unusual design, construction, and operating problems associated with the Naughton plant development.

The meeting at 7:30 p.m. will be preceded by a cocktail hour at 5:30 p.m. and dinner at 6:30 p.m.

meeting ahead

### ACCELERATOR PROPOSAL

E. C. Hartwig, project engineer, Lawrence Radiation Laboratory, Berkeley, will discuss the present status of the engineering study of the proposed 200 BeV proton accelerator at the meeting of the new Nuclear Science chapter on March 3.

The machine, as presently envisioned, would be a major national research facility to be constructed by 1972. In order to achieve the desired energy, the accelerator would be about a mile in diameter. In addition, provision would be made for later addition of storage rings to the basic accelerator. One of the sites being considered for the accelerator is Parks Air Force Base in Pleasanton. For comparison, the present Bevatron at the Lawrence Radiation Laboratory in Berkeley operates at an energy level of 6.2 BeV and has a diameter of 100 feet.

Hartwig has been a member of the LRL electronics engineering department since 1952. Until recently he was project engineer assigned to the Bevatron, and at present is also project engineer for the new accelerator engineering study.

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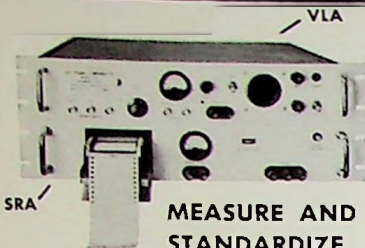
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## section news

### NOMINATING COMMITTEE NAMED

Section Chairman Jack Beckett has appointed a committee to nominate a slate of section officers (chairman, vice chairman, secretary, and treasurer) for the 1965-66 operating year. Also to be nominated is a Section/WESCON director to serve until November 30, 1969.

Members are Dr. William A. Edson, chairman, William R. Johnson, Victor Kaste, Dr. Peter Lacy, and Prof. John R. Whinnery. They may be contacted to recommend nominations.

Section bylaws provide that "additional nominations by petition may be submitted no later than April 1 to the section executive committee for inclusion on the ballot. To be valid, such petitions shall carry the signatures of no fewer than 25 voting members of the section and include a statement of the willingness of the candidate to serve. Election shall be by mail ballot and shall be completed by May 15. The incoming officers shall assume the duties on or before July 1 on a date fixed by the outgoing executive committee."

## section inputs

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WESCON also has a number of secondary benefits which are of special interest to the IEEE. It furnishes financial support to all sections of the 6th Region, it is the principal support of the Western Electronic Education fund, and it provides an unexcelled opportunity for establishment of professional standing in our own community.

MEYER LEIFER  
Section/WESCON Director

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OFFSET: VARIABLE TO 2 VOLTS, EITHER POLARITY  
DUTY FACTOR: GREATER THAN 50%  
WAVESHAPE: LESS THAN 5% P-P ALL FORMS OF DISTORTION, EXCEPT ON 100:1 ATTENUATOR SETTING LESS THAN 8%.  
RISE TIME: 6 NS TO 100  $\mu$ S RISE AND FALL, INDEPENDENTLY VARIABLE RAMP. LINEAR TO BETTER THAN 5% ALL SETTINGS.  
WIDTH: 20 NS TO 300  $\mu$ S, CONTINUOUSLY VARIABLE.  
DELAY: 50 NS TO 100  $\mu$ S, CONTINUOUSLY VARIABLE.  
TRIGGER JITTER: LESS THAN 0.1% + 50 PS.  
PRICE: \$1,275 - RACK MOUNTING \$20 EXTRA.

## EH PULSE GENERATOR MODEL 139 SPECIFICATIONS:

# written &

(specs on the published data sheet)

# unwritten.

(specs which give a comfortable performance margin)

The written specifications on any E-H instrument never indicate its maximum performance. Each instrument has a comfortable performance margin we don't tell you about—the "unwritten" set of specifications.

One reason E-H units more than live up to their specs is our insistence on the use of high reliability, precision components, and our habit of rating them conservatively. As a result, E-H instruments are remarkably free of internal adjustments and have an unmatched mean life to failure record.

Call your E-H representative and see the new E-H pulse generators • microwave sweep generators  
microwave amplifiers • electrometers • switching time meters • signal generators.



**E-H RESEARCH LABORATORIES, INC.**

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