1966
Region Six
ANNUAL CONFERENCE

Theme: Future engineering for earth and space

TUCSON 26-27-28 APRIL

meeting reminder

Aerospace & Electronic Systems, Tuesday, April 5, Tuesday, May 16
Antennas & Propagation, Tuesday, April 12
Automatic Control, Tuesday, April 19
Circuit Theory, Tuesday, April 19
Computer, Tuesday, April 12
Communication Technology (EWS/SCVSS) Wednesday, May 11
Electron Devices, Wednesday, April 13
Engineering in Medicine & Biology, Tuesday, April 19
Engineering in Writing & Speech (Comtech/SCVSS), Wednesday, May 11
Fresno Subsection, Tuesday, April 19
Information Theory, Thursday, April 28
Instrumentation & Measurements, Wednesday, May 11
Microwave Theory & Techniques, Thursday, April 21
Nuclear Science, Tuesday, April 19, Tuesday, May 16
Parts, Materials & Packaging, Tuesday, April 26
Power, Wednesday, April 20
Reliability, Monday, April 18
San Francisco Section (SCVSS) Wednesday, April 20, Wednesday, June 15
Santa Clara Valley Subsection (SFS) Wednesday, April 20, (Comtech/EWS), Wednesday, May 11
Vehicular Communications, Tuesday, May 3

IEEE
APRIL 1966
SAN FRANCISCO SECTION
INSTITUTE OF ELECTRICAL AND
ELECTRONICS ENGINEERS
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Here's Hewlett-Packard quality in a low-cost, solid-state, battery-operated multi-function meter, the new hp 427A!

And you can get it for the lowest cost—check it against any comparable instrument!

Minimum zero drift. For dc measurements you get 1 mv resolution. The ac meter is average-responding, calibrated in rms volts. Only one zero set for dc and resistance measurements...no need to re-zero when switching from dc to ohms measurements...seldom "zero" on the 1 v range and above.

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Up in Seattle, we make basic tools for precision electronic measurement. We make them well. If you think you’d like to help us make them even better and live in the Great Northwest too, let’s talk.

For almost a generation, we (The John Fluke Mfg. Co., Inc.) have been one of the world's leaders in metrology. Recently, the demand for our quality instrumentation has created a number of unusually fine professional employment opportunities.

So if you want to join a medium size, well-respected company where your contribution stands out and your identity means something to everyone from the president on down, this is a grand opportunity. Our engineers work in a sophisticated technical environment with great personal freedom to pursue design problems as they see fit. We pick up the total tab on a company-sponsored graduate program for eligible personnel at the University of Washington (now widely regarded as one of the 10 best universities in the Nation).

But, though the job is the main thing, living in the Pacific Northwest shouldn’t be ignored either. About 85% of our employees live on wooded acres within 10 minutes of the plant. You can buy twice the house in Seattle for the same dollars you spend in San Francisco or Los Angeles. And the taxes aren’t too steep either (there is no state income tax).

Schools are good. The State of Washington ranks among the first three in literacy and number one in terms of college graduates per thousand population. Art, theatre and music flourish in the great new Seattle Center, built for the World’s Fair.

If the outdoors is your after hours bailiwick, Washington State offers great skiing (with short lift lines), the nation’s best boating, outstanding hunting and fishing (sometimes, the other guy on the stream is five miles away), and fine hiking and climbing.

The company offers in addition to your salary (which is as good or better than anywhere else) profit sharing, medical insurance, and retirement benefits. So if all this excites you and you fit one of the job descriptions below, write our Engineering Manager, Mr. Ted Thomsen, in confidence. Interviews will be arranged in Los Angeles, San Francisco, or Seattle at your convenience. Please address Mr. Thomsen at P.O. Box 7428, Seattle, Washington.

**Design or Senior Engineers** with communication theory background and/or interest in digital circuits. Preferably an MSEE. Minimum experience, two years. Should be familiar with digital circuit design and frequency calibration techniques.

**Associate Engineer** with good scholastic record and BSEE. No experience necessary. Applicant should have an interest in analog and/or digital circuit design and knowledge of solid state circuitry.

**Electronic Package Design Engineer** with either BSEE or BSME. Applicant should be familiar with packaging methods in the MHz to 10 GHz region. Two to six years’ experience with good mechanical design aptitude required.

**Industrial Engineer** with three years’ experience in electronics or associated industry. Should possess a BSIE. A BSEE or BSME is acceptable if applicant has industrial experience. Candidate must have knowledge of methods, value, and process analyses, and work simplification.

**Senior Production Engineer** with four years’ experience. Should be a mechanical engineer familiar with electronics or an electronic engineer familiar with mechanical engineering. Applicant must possess a BSME or BSEE. Must be able to carry new product from design to production.

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the section

MEMBERSHIP

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

- D.C. Andrus
- R.H. Auld, Jr.
- R.B. Berry
- W. Burnett-Jones
- R.A. Carberry
- B.R. Clegg
- J.E. Edwards, Jr.
- E.V. Giddings
- D.A. Griffiths
- C.D. Gronlund
- R. Hassun
- R.H. Hazen
- C.E. Hechathorn
- A.B. Holbrook
- H.A. Keep
- K.N. Levitt
- R.L. Manildi
- R.B. McCullough
- R.C. Nicol
- W.A. Ryland
- O.J. Tveit
- I.W. Wolf

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

- R.L. Anderson
- J.S. Capps
- J.B. Chown
- P.B. Clark
- W.E. Daly
- J. Drexler
- H. Dunlap, Jr.
- R.B. Earl
- S.A. Erickson, Sr.
- D.K. Fibush
- R. Gaebel
- R.A. Hirschfeld
- J.S. Kolp
- D.J. Leonard
- M.C. Mains
- P.H. Nathes
- I. Matthews
- D.E. Nelson
- B.F. Price
- A.A. Recupero
- R.E. Sheldon
- K.E. Sladky
- P. Surnasky
- D.J. Veka

The San Francisco Section covers 22 northern counties of California.

cover

Designed by G. B. Athey of Burr-Brown Research Corp., Tucson, the cover is descriptive of the research-oriented activities to be found in Region Six. Tucson and Kitt Peak have become noted astronomical and solar research centers; space explorations are planned and controlled from Pasadena and Alamogordo. Development of advanced concepts and equipment for air transport is in progress in several California locations and in Seattle. Future air-combat equipments are tested at Edwards AFB, California, and future ground and avionics equipment are tested at Fort Huachuca, Arizona.

San Diego is a center of undersea research, while a large percentage of electronic instrumentation originates in the Portland and San Francisco Bay areas. Solid-state circuit research and computer development are carried on in several locations in the region. An atomic overtone to all the above activities is supplied from various sites in Nevada, Idaho and New Mexico, and the entire region is linked with power-transmission networks which employ the most advanced engineering principles.

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TURBULENT PLASMA

Dr. Harold Guthart, research engineer, electromagnetics science labs, SRI, will discuss scattering from an underdense turbulent plasma at the April 12 meeting of Antennas & Propagation chapter.

The bistatic radar cross section of an underdense, inhomogeneous turbulent plasma was measured at X-band and the results were compared with a theoretical model. The turbulent plasma is formed by seeding a premixed ethylene-oxygen flame in a combustion chamber and exhausting through an expansion nozzle into a low-pressure vessel. The theoretical scattering model was constructed using the Born approximation and the results of a diagnostic measurement program. Electrostatic probes, biased for ion collection were used to map the variation of the mean and rms electron density throughout the turbulent regions, as well as to measure the correlation coefficient of the plasma fluctuations.

Good agreement between theory and experiment has been obtained for the dependence of cross section on bistatic angle and for the spectrum of fluctuations of the scattered microwave signal. The predicted cross section underestimates the measured cross section by 6 to 11 dB when the measured cross sections are in the range from 10 to 10^3 square meters. The measured cross section was observed to have a square law dependence on electron density in agreement with the Born model for densities up to one percent of the critical electron density. For densities beyond this multiple scattering occurred and the cross section dependence on electron density became linear.

In September, 1959, Dr. Guthart joined the staff of Stanford Research Institute. At the present time, he is investigating electromagnetic interactions with turbulent plasmas, electromagnetic shock tube phenomena, and electromagnetic interactions with finite temperature plasmas. His previous work included studies of the quantum limitations of electromagnetic wave propagation, voltage breakdown phenomena, multidimensional antenna pattern synthesis, and high-power microwave filters.

Meeting Calendar

APRIL 5, TUESDAY, 8:00 PM — Aerospace & Electronic Systems
Joint with AIAA, AAS and Chemical Engineering Society
Supersonic transport (SST)
Richard Heppe, chief engineer for SST, Lockheed; William T. Hamilton, chief engineer for SST, Boeing; moderator: Ray D. Kelly, director of technical development, United Air Lines, retired
Place: Stanford University Memorial Auditorium (opposite Hoover Tower)
No dinner

APRIL 12, WEDNESDAY, 8:15 PM — Antennas & Propagation
Scattering from an underdense turbulent plasma
Dr. Harold Guthart, research engineer, electromagnetics science labs., SRI
Place: Lockheed Auditorium, Bldg. 202, 3251 Hanover St., Palo Alto
Dinner: 6:00 PM, Rick's Swiss Chalet
Reservations: Claes Elfving, 966-3551, by April 11

APRIL 12, TUESDAY, 8:00 PM — Computer
Magneto-optics and thermo-magnetic recording
Dr. C. D. Mec, magnetic storage manager, advanced technology program, IBM
Place: Room cc-134, McCullough Bldg., Stanford University
No dinner

APRIL 13, WEDNESDAY, 8:00 PM — Electron Devices
Some recent developments in traveling-wave amplifier tubes and backward-wave oscillators
Dr. William E. Waters, Varian Associates
Place: PH 101, Stanford University
Dinner: 6:00 PM, Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto
Reservations: Mrs. Beverly House, 326-4000, Ext. 2304 by April 12

APRIL 18, MONDAY, 6:30 PM — Reliability
Panel discussion: Failure mode analysis
Richard C. Cornwell, supervisor, reliability/maintainability design support, Sylvania, Mountain View; Rolfie A. Folsom, Jr., vice president, senior scientist/engineer, Sigma Corp., Los Altos; Ervin S. Dean, LMSC staff engineer, Sunnyvale
Place: Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto
Dinner: 6:30 PM at Rick's
Reservations: Dr. Stuart Bessler, 327-4212 by April 15

APRIL 19, TUESDAY, 8:00 PM — Automatic Control
Social impacts of feedback control systems
R. P. Loomba, associate professor of EE, San Jose State College
Place: Engineering Center, 551 University, Santa Clara
Dinner: 6:30 PM, Lucca's, 3160 The Alameda, Santa Clara
No reservations required

APRIL 19, TUESDAY, 8:00 PM — Engineering in Medicine & Biology
Artificial kidneys and cardiac pacers
Richard Dewey, M.D. and Noel Thompson, M.D.
Place: Room M-112 — Stanford Medical School
Dinner: 6:15 PM, Red Cottage, El Camino Real, Menlo Park
Reservations: Con Rader, 326-1970, Ext. 328, by noon April 19

APRIL 19, TUESDAY, 7:30 PM — Fresno Subsection
Engineering and maintenance of navigation aids
O. B. Cox, chief, airways facilities section — FAA
Place: FG&E Bldg., 1401 Fulton, Fresno
No dinner

Student News

Heald Officers

Newly elected officers of the student branch at Heald Engineering College, San Francisco, are Ronald K. Johnson, chairman; Ronald A. Harkleroad, vice-chairman; William I. Russell, secretary; Phil Stevens, treasurer; and Keith A. Crockett, membership chairman.
APRIL 19, TUESDAY, 8:00 PM — Nuclear Science
X-Ray the Egyptian Pyramids
Dr. Luis W. Alvarez, University of California, Berkeley
Place: LRL Auditorium, East end of Hearst Ave., Berkeley
Dinner: 6:30 PM. Splinger’s Fish Grotto, 1919 - 4th St., Berkeley
Reservations: 447-1100, Ext. 7821 by April 15

APRIL 20, WEDNESDAY, 8:00 PM — Circuit Theory
Frequency multiplication & division for use in integrated circuits
William G. Howard, Jr., research assistant, University of California, Berkeley
Place: Ampex Cafeteria, 401 Broadway, Redwood City
Dinner: 6:30 PM, Red Cottage, El Camino, Menlo Park
Reservations: Jan Mulvihill, 367-3169 by April 19

APRIL 20, WEDNESDAY, 7:30 PM — Power
Engineering the intertie
W. R. Johnson, chief electric generation & transmission engineer, PG&E Co., S.F.
Place: Engineers’ Club of San Francisco, 206 Sansome St., S.F.
Cocktails: 5:30 PM
Dinner: 6:30 PM, Engineers’ Club
Reservations: GA 1-3184 by April 19

APRIL 20, WEDNESDAY, 8:00 PM — Santa Clara Valley Subsection/SF Section
Pioneers’ Night/Ladies Night — The Good Old Days
Joseph Cox, retired manager Westinghouse Sunnyvale facility; Smith De France, retired director of NASA Ames Laboratory; Vernal Diggs, retired chief engineer, Ohio Bell Telephone; Frederick E. Terman, vice president and provost emeritus, advisor to the president, Stanford University; L. E. Reukema, professor of electrical engineering emeritus, University of California, moderator
Place: Holiday Inn, Sunnyvale (Bayshore)
Social hour: 6:30 PM
Dinner: 7:15 PM, $4.85 including tax & tip
Reservations: Mrs. Jean Helmkic, Section Office, 327-6622 by April 18

APRIL 21, THURSDAY, 8:00 PM — Microwave Theory & Techniques
Status of microwave acoustic developments, 1966
Dr. Frank A. Olson, head of solid state R&D, Microwave Electronics, Palo Alto
Place: Hewlett-Packard Auditorium Room 1A, 1501 Page Mill Road, Palo Alto
Dinner: 6:30 PM, Rick’s Swiss Chalet, 4085 El Camino Real, Palo Alto
Reservations: Ruth Thor, 854-3300, Ext. 196 by April 20

APRIL 26, TUESDAY, 8:00 PM — Parts, Materials & Packaging
Automatic design engineering (ADE)
Thomas C. Bean, manager; E. A. Crosse and N. D. Vandever, automatic design engineering, Lenkurt Electric Co., San Carlos
Place: Lenkurt Electric Co., Inc., 1105 County Road, San Carlos, Calif.
No dinner

APRIL 28, THURSDAY, 8:15 PM — Information Theory
Waveforms & receivers for message estimation in pulse amplitude modulation
Donald W. Tufis, assistant professor, Harvard University
Place: Conference Room B, Bldg. 1, SRI, 333 Ravenswood Ave., Menlo Park
Dinner: 6:30 PM, L’Auberge, 2826 El Camino Real, Redwood City
Reservations: Miss Shirley Jackson, 966-3865 by April 27

MAY 3, TUESDAY, 8:00 PM — Vehicular Communications
Efficient loud speakers for mobile communications intelligibility
Paul Klipsch, president, Klipsch Associates, Hope, Arkansas
Place: Room 103, Physics Hall, Stanford University
Dinner: 6:00 PM, Rickey’s Hyatt House, 4219 El Camino Real, Palo Alto
No reservations required

(Continued on page 6)
An approach to frequency multiplication and division suitable for use in integrated circuits will be presented by William G. Howard, Jr., research assistant, dept. of electrical engineering, UC, Berkeley at the April 20 meeting of the Circuit Theory chapter.

Frequency multiplication of single-frequency, sinusoidal signals requiring minimal output filtering can be obtained using integrable electronic analog multipliers. The design of systems of this type is discussed.

Frequency division is possible in systems employing the above multiplication property. A narrow bandwidth method, based on a differential equation approach, is of relatively simple construction, whereas a phase-locked loop method allows multiplication over wider bandwidths at the expense of an increase in circuit complexity.

Experimental findings will be cited which verify the theoretical results obtained.

MORE COMPUTER CHAPTER

This approach satisfies some—although not all—of the requirements for future systems.

Dr. Mee speaks from a very extensive background in the magnetics field. As early as 1951, he was concerned with research on soft magnetic materials at the magnetic laboratory of the steel Company of Wales, England. Since then, he has been associated with recording aspects of magnetics for the MSS Recording Company in England, for the CBS Laboratories, and for IBM. He is presently magnetics storage manager for the advanced technology program of the IBM systems development division laboratory, San Jose.

The meeting will be held at 8:00 pm in Room cc-134 of the McCullough Building on the Stanford University Campus. This building is located on Lomita Drive opposite the west side of the main Quad, to the south (toward the foothills), of the Physics Lecture Hall (round structure). Entrance to the building will be via the door opening to the covered walk between the building and the lecture hall.

MORE AUTOMATIC CONTROL CHAPTER

who were laid off by various companies in the San Francisco Bay Area during 1964.

Concurrent with his full-time duties at the college, Dr. Loomba is also a part-time staff member at Stanford Research Institute.

Before coming to San Jose, Dr. Loomba worked at the Jet Propulsion Laboratory, California Institute of Technology. Previous to joining the laboratory, he worked as a senior engineer at the laboratory for electronics in Boston.

Dr. Loomba received his B.Tech degree in 1957 from the Indian Institute of Technology, Kharagpur. He obtained his M.S. and Ph.D. degrees in electrical engineering from the University of Utah in 1959 and 1961, respectively. Dr. Loomba's strong interest in the social and political implications of technology has led him to do further graduate work at Stanford University; he received an M.A. degree in Communications in June 1964, and expects a Ph.D. in political communications in the near future.
ENGINEERING THE INTERTIE

W.R. Johnson, chief electric generation and transmission engineer, Pacific Gas and Electric Company, will speak on the systems engineering problems of the Pacific Northwest-Pacific Southwest high voltage Intertie system at the April 20 meeting of the Power chapter.

Previous reports have dealt mainly with structural and electrical design problems of the transmission facilities, many of which are now under construction. In addition to reviewing progress on this work, the speaker will also discuss briefly the organizational arrangements for coordinating engineering and operating matters.

The Pacific Northwest-Pacific Southwest Intertie has been described as "the biggest single electrical transmission program ever undertaken in this country" and involves the direct participation in construction and ownership of facilities of nine electric utilities or power agencies. Total construction costs have been estimated at $700 million. Principal transmission links include two 500 KV AC lines and two 750 KV DC lines.

Mr. Johnson is chairman of the intertie system technical studies task force which is carrying out many of the studies relating to the intertie electrical design and capability. He is also chairman of the Edison Electric Institute joint task force on DC transmission which is engaged in a research program on parallel operation of AC/DC transmission systems.

HELP THE SECTION GROW BY PLEDGING YOURSELF TO BRING IN A NEW MEMBER IN 1966.

SWITCHING SYMPOSIUM

The seventh annual symposium on switching and automata theory, sponsored by the University of California and the switching and automata theory committee of the Computer Group, will be held at the University of California, Berkeley, on October 26, 27 and 28, 1966. Papers describing original research results in the general areas of theoretical switching theory, logical design and automata theory are being sought.

Authors are requested to send six copies of detailed abstracts (no word limit) to: Prof. David E. Muller, Mathematics Department, University of Illinois, Urbana, Illinois 61803, by May 2. Authors will be notified of acceptance or rejection by June 17. For inclusion in the proceedings, a typed copy of each accepted paper is due at the above address by August 12.

Local arrangements will be handled by: HEAD, Engineering Extension, University of California, Berkeley, California.

MICROWAVE ACOUSTICS

Dr. Frank A. Olson, head of solid state R & D at Microwave Electronics, Palo Alto, will discuss the status of microwave acoustic developments, 1966, at the April 21 meeting of the Microwave Theory and Techniques chapter.

Microwave acoustics is a relatively new topic of microwave research dealing with generation, propagation, and control of acoustic waves in solids at microwave frequencies. Dr. Olson will discuss the principles of thin-film transducers, propagation in dielectric, ferrimagnetic and semiconductor crystals, and acoustic amplification. Miniature microwave components based on these principles, such as delay lines, dispersive filters, amplifiers and light modulators, will be described.

A graduate of Oregon State and Stanford Universities, Dr. Olson has been a research engineer at Sylvania microwave physics laboratory and the Air Force Cambridge research labora-
Final details of the 1966 annual conference of Region 6 in Tucson, April 26-28 have been announced. Advance registration/reservation forms and full details of the technical program may be obtained by calling the San Francisco Section office or writing IEEE Region 6 Conference, P.O. Box 12826, Tucson, Ariz. 85711.

ADVANCE REGISTRATION and RESERVATIONS

Advance registration will be in effect through April 30, 1966. Make checks or money orders payable to 1966 IEEE Region Six Conference.

Advance registration fees are: Member, $4.00; Non-member, $5.00; Student, $1.00; Student non-member, $2.00.

Regular registration fees are: Member, $6.00; Non-member, $7.00; Student, $1.00; Student non-member, $2.00.

Registration will be conducted on the mezzanine of the Pioneer International Hotel, Tucson, where a general information center for the conference will be established. The registration desk will be open at the following times:

- Monday, April 25 — 1 p.m. - 7:30 p.m.
- Tuesday, April 26 — 7 a.m. - 5:00 p.m.
- Wednesday, April 27 — 7 a.m. - 12 noon.

Wives of registrants in attendance need not register or pay fees unless they attend technical sessions. They may attend all luncheons, banquets and tours by merely paying the special fee associated with the particular activity.

The registration badge will be required of all members and non-members for entry to all official conference activities. This includes banquets and luncheons, as well as technical sessions.

TOURS

- Tuesday morning, April 26 — Tucson Gas and Electric Company.
- Tuesday morning, April 26 — Titan Missile Site.
- Wednesday morning, April 27 — U.S. Army Electronics Proving Ground, Fort Huachuca.

TECHNICAL SESSIONS

- Tuesday a.m., April 26
  - A — Circuit Theory (Part I)
  - B — Hybrid and Analog Computers
  - C — Reliability
  - D — Nuclear Generation of Power

- Tuesday p.m., April 26
  - E — Circuit Theory (Part II)
  - F — Computer Organization
  - G — Communications Systems
  - H — High Voltage DC Transmission of Power

- Wednesday a.m., April 27
  - I — System Theory
  - J — Solid State and Gaseous Plasmas
  - K — Engineering Education

- Wednesday p.m., April 27
  - L — Information Theory
  - M — Biomedical Engineering
  - N — Rotating Machinery
  - W — Military Electronics — Electromagnetic Compatibility (Part II)
    (Fort Huachuca)

- Thursday a.m., April 28
  - O — Automatic Control
  - P — Integrated Circuits
  - Q — Electromagnetics
  - R — Basic Sciences

- Thursday p.m., April 28
  - S — Optimal Control
  - T — Solid State Device Technology
  - U — Propagation of Pulses
  - V — Atmospheric Electricity

LUNCHEONS and BANQUET

- Keynote Luncheon — Pioneer Hotel ($2.75 per person). Tuesday, April 26. Noon - 1:45 p.m., Dr. Richard Bellman, Keynote Speaker.
- Region Six Banquet — Pioneer Hotel ($6.00 per person). Tuesday, April 26. 6:30-9:30 p.m., Dr. W. L. Everitt, Banquet Speaker.
- Lakeside Officers' Club Luncheon, Fort Huachuca ($2.00 per person). Wednesday, April 27, 7-10:30 p.m.
- Western Barbeque Dinner — Forty-Niner Guest Ranch ($3.50 per person). Wednesday, April 27, 7-10:30 p.m.
- Awards Luncheon, Pioneer Hotel ($2.75 per person). Thursday, April 28. Noon - 1:45 p.m., Dr. W. G. Shepherd, president, IEEE, luncheon speaker.

STUDENT ACTIVITIES

- Student Paper Contest — Pioneer Hotel, forenoon of Tuesday, April 26.
- Southern Arizona Future Engineers Show — Pioneer Hotel. Students exhibits will be on display in the mezzanine, the afternoons of Tuesday, April 26 and Wednesday, April 27. The judging will take place on April 27.

WOMEN'S PROGRAM

Many alternatives are offered the ladies during the three-day conference period. A ladies' lounge is maintained at the Pioneer Hotel which will be the central point from which all activities originate.

SPECIAL MEETINGS LOG

- Arizona Council of WEMA, Tuesday, April 26 — Evening banquet.
- Region Six Directors Meeting, Thursday, April 28.
- West Coast Subcommittee of IEEE Substations Communication.
- West Coast Subcommittee of IEEE Transmission and Distribution.

CONFERENCE RECORD

Each paper presented at the conference will be published. Conference Rec-
meeting ahead

3RD ANNUAL PIONEERS' NIGHT

Five eminent retired engineers, two of them educators, will participate as panelists and moderator at the 3rd annual pioneers' night jointly sponsored by the Santa Clara Valley Subsection and the San Francisco Section on April 20 at the Holiday Inn on Bayshore in Sunnyvale.

They are Joseph Cox, Smith De France, Vernal Diggs, Frederick E. Terman, and L. E. Reukema.

Joseph Cox graduated from MIT in 1923. He spent 35 years with Westinghouse including the service department in New York, the transmission department in East Pittsburgh and mercury arc rectifier in Pittsburgh. He is a Life Member of IEEE, and is the inventor of the ignitron. He holds 25 patents, most of which cover the ignitron. From 1946 to his retirement, he was engineering manager of Westinghouse in Sunnyvale.

Dr. Smith J. De France is a veteran of 45 years in aviation and space research. He recently retired as director of Ames Research Center at Moffett Field. Dr. De France was a combat pilot in World War I before he finished college, and when he earned his degree in aeronautics engineering, he remained in the most exotic areas of flight. He designed huge wind tunnels for research more than 30 years ago, and directed the Ames Center at Moffett Field since 1940; he made the transition into space research when NASA was created in 1958. His leadership and aims have brought about many engineering and scientific achievements in our country's aviation and space programs.

Vernal Diggs graduated from Purdue in 1913. With the exception of service in World War I as Signal Corps captain, he was employed by various divisions of the Bell system until retirement as chief engineer of Ohio Bell in 1958. From 1958-61, he was communications consultant to NATO in Paris. Since his return to the US, he has resided in Pebble Beach.

Dr. Terman, whose honors and awards are literally too numerous to mention, is generally recognized as the

(Continued on page 10)
UNUSUAL CAREER OPPORTUNITY

TECHNICAL LIAISON ASSISTANT

Henley and Co., a long established New York firm serving the metals and chemical needs of organizations and laboratories engaged in electronic and nuclear research and development, has a permanent requirement for a resident liaison representative in the Peninsula area.

This individual will serve as technical assistant to the president of our firm and perform various liaison assignments between the company's sales organization and clients in the California-Arizona area. In this capacity, he will call on organizations such as development and materials departments of firms engaged in semiconductor production, physics departments of universities, and research and developing groups concerned with transistor diodes, rectifiers, and devices for electronic instrumentation. His assignment will include at least one annual trip to the East coast and Europe. Position orientation will include a one-month visit early this summer to production facilities in Germany.

Since the scope and responsibilities of the position are broad, we will give serious consideration to applicants from various disciplines or technical areas. While we feel that the ideal candidate would have technical experience in semiconductor production research or engineering, we also encourage inquiries from individuals from the academic field with experience in the area of materials such as germanium, silicon, etc. A degree in physics or physical chemistry is helpful but in no way essential; experience in our field of interest is more desirable than academic qualification.

Salary open, dependent on experience. Excellent employee benefits include profit sharing, pension plan, life insurance. Position presents opportunity to move into assignment of greater responsibility. Applicants may send confidential detailed resume with salary history to

Albert T. Henley
308 Bank of America Bldg.
San Jose 13, California

meeting ahead

X-RAYING PYRAMIDS

The master architects who planned the pyramids of Egypt—and perhaps managed to outwit countless generations of grave-robbers, explorers, vandals, archeologists, and idee-fixed Victorian clergymen—may bow before a twentieth-century physicist with a spark chamber.

The pyramids' secrets, secure for the past 4500 years, will be secrets no more if an ingenious plan proposed by LRL physicist Luis Alvarez ever bears fruit. He will discuss his plans at the April 19 meeting of the Nuclear Science chapter.

Alvarez' idea calls for using cosmic rays and spark chambers to "X-ray" the pyramids to search for presently undiscovered burial chambers. The project is the outcome of a long love-affair with archaeology and Egyptology which began in his boyhood and blossomed during a visit to Egypt three years ago.

Luis W. Alvarez received his Bachelor of Science Degree from the University of Chicago in 1932, a Master of Science Degree in 1934, and his Ph.D. in 1936. Dr. Alvarez joined the Radiation Laboratory of the University of California, where he is now a professor, as a research fellow in 1936.

Dr. Alvarez is now engaged in high energy physics, using the 6 billion electron volt Bevatron at the University of California Radiation Laboratory. His main efforts have been concentrated on the development and use of large liquid hydrogen bubble chambers, and on the development of high speed devices to measure and analyze the millions of photographs produced each year by the bubble chamber complex. The net result of this work has been the discovery of "fundamental particle resonances."

education news

UC VISITING PROFS

Among engineering professors from other institutions spending their sabbatical leaves or leaves of absence teaching at Cal are F.B. Tuteur, Yale; Norman Balabanian, Syracuse; J.A. Brzozowski, Ottawa; Ruey-Wen Liu, Notre Dame; A.C. Soudack, University of British Columbia; Vaidyeswaran Rajaraman, Indian Institute of Technology, Kanpur; and Nathan Rynn, Princeton.

meeting ahead

INSTRUCTIONAL TV

Television for instruction and a tour of San Jose State's facilities will be featured at the May 11 joint meeting of the Santa Clara Valley Subsection, the San Jose State Student Branch, and the Communications Technology and Engineering Writing & Speech chapters. Glen Pensinger, technical director, Instructional Television Center, San Jose State College, will describe various uses of television for instruction at the college. The talk will be augmented with slides, and videotape recordings. After the speech, a tour of the college facilities is planned.

Mr. Pensinger has been a television operating engineer for stations KNTV, KTAM, and the ABC network. He is consultant in instructional television systems planning and has been associated with the ITV Center at San Jose State since its founding in 1956.

MORE PIONEERS' NIGHT

Woman responsible for making the San Francisco Bay Area a leading international center of electronics research and industry, largely through his leadership in engineering education. Past chairman of the San Francisco Section (IRE) and past president of IEEE (IRE), he has been awarded the society's Founders Award and Medal of Honor, among other honors.

The moderator, Lester E. Reukema, professor of electrical engineering emeritus, University of California, taught at that institution from 1923 through 1958, following undergraduate and graduate work there and at the Technical Institute of Munich. Well-known for his atomic research, his most recent papers have been on recent developments in atomic energy and man's future physical and physiological environment. He is a research scientist in electro-magnetic radiation for the U.S. government.

THE GRID

...is the best electronic/electrical engineering recruiting medium in northern California. Use it when you need manpower.
FAILURE MODE ANALYSIS

The approaches to and techniques for performing a failure mode analysis will be explored by a panel of experts at the April 18th meeting of the Reliability chapter. Failure mode analysis can be defined as the enumeration of the physical ways or modes in which a part, component or complete system can fail, the estimation of the expected frequency of failure in each mode, and the comparative assessment of the consequences of potential failures.

The ultimate objective of a failure mode analysis may be to determine critical failure modes which have the highest likelihood of occurrence, so that the effects of failures in these modes can be minimized. Other objectives may be simply to make an item “fail safe” or to eliminate to the extent possible the unsafe failure modes. When redundant equipment or circuits are to be used, a failure mode analysis may be used to determine the optimum techniques for automatic detection and circumvention of those equipment failures which may be critical to the system’s performance.

The panelists for the meeting will be Richard C. Cornwell, supervisor for the design support reliability/maintainability organization at Sylvania Electronics Systems West; Rolfe A. Folsom, Jr., vice president and senior scientist/engineer with Sigma Corp., Los Altos; and Ervin S. Dean, LMSC staff engineer, Program 241, chief systems engineering office.

IEEE NEWS

BIOMEDICAL SYMPOSIUM

"From diagnosis to therapy" is the theme of the 1966 San Diego Symposium for Biomedical Engineering. The four day symposium, now in its sixth consecutive year, will be held June 6-9, 1966. Topics to be explored in both tutorial and state-of-the-art papers are: microanalytic diagnostic techniques (in vitro and in vivo), therapeutic effects of extreme environments, and prosthetics, artificial versus transplanted.

The symposium will be jointly sponsored by the San Diego Section and 117 societies, universities, foundations and agencies.

Captain Fred George, M.D., MC USN, U.S. Naval Hospital at San Diego, will serve as program chairman. Captain George should be contacted about all questions concerning submission of papers.

For further information contact: LL. T. Gregg, publicity chairman, 2063 Cardinal Drive, San Diego, 92123.

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TRANSPORTATION MEET

The National Transportation Symposium, sponsored by the ASME, IEEE and ASCE, is to be held at the Jack Tar Hotel in San Francisco, May 2-6. The Ninth ASME/IEEE Joint Railroad Conference is to be held concurrently at the same location on May 4-6, 1966. The railroad conference is sponsored by the railroad division of ASME and the land transportation committee of the Industry and General Applications Group of IEEE.

The Transportation Symposium is an effort to bring together the various facets of the transportation industry; i.e., manufacturers, operators, legislators and administrators for an appraisal of the present situation and a projection of future possibilities for airways, highways, railways and waterways. The objective is to utilize the base of systems analysis to integrate related inputs in order to provide information toward the solution of the urgent problems in transportation.

This meeting will be of interest and value to all individuals and organizations concerned with improving our transportation systems. Field types related to each transportation medium will supplement the technical program, which will feature prominent speakers.

The theme of the Ninth Joint Railroad Conference is rapid transit. Tremendous activity has taken place in the past year, resulting in the initial construction of new systems. Technology has been allowed to penetrate this long-dormant industry and technical papers will be presented on new concepts of propulsion, braking systems, truck design and automatic train control. Some of these are presently being demonstrated and will be the subject of a field trip to the Bay Area Rapid Transit System’s test track at Concord. Current papers on locomotive equipment design improvements and maintenance aids will round out the program.

Because of the increasing importance and awareness of adequate and balanced transportation, railroad and transit people are urged to attend the Transportation Symposium as well as the Railroad Conference.

Principals involved in planning the arrangement details for both meetings are: Co-chairmen: Frank Kurz (ASME), Southern Pacific Company, 65 Market Street, San Francisco, Calif. 94105, 362-1212, Ext. 21661; and J. E. Barkle (IEEE), Bechtel Corporation, P.O. Box 3965, San Francisco, Calif. 94119, 433-4567, Ext. 3651.

Further information, registration forms and programs may be obtained from the publicity co-chairmen: F. Hatch (ASME), Shell Oil Company, 100 Bush Street, San Francisco, California, 392-5400; and M. W. McLaren (IEEE), Bechtel Corporation, P.O. Box 3965, San Francisco, Calif. 94119, 433-4567, Ext. 3651.

Call the above chairman of the San Francisco Section office for details of the technical program.

Fifteen technical sessions will deal with such topics as urban systems planning, future power systems, traffic control, education and manpower for transportation systems, national transportation agencies plans and programs, advanced vehicles, interface problems...one preferably unused Star-Lever Cylinder Stone Lithographing Press of the Mitterer Design

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A special technical conference on underground distribution will be held September 27-29 at the Palmer House in Chicago, sponsored by the Power Group. Authors submit a title, together with a brief outline of their proposed paper to technical program chairman, J. C. Graham, Rome Cable Division of Alcoa, Rome, New York for consideration by the program committee. All submitters will be advised as soon as possible as to the recommended disposition of the proposed paper. Closing date for any papers accepted will be June 1, 1966.

sand solutions, legislation, research and financing, and flow control.

More than 2000 transportation specialists, engineers, government personnel and city planners are expected to attend the meeting.

Special field trips to the Bay Area Rapid Transit District Facility, the Pacific Motor Trucking Terminal, and the United Air Lines Maintenance Base are scheduled as part of the symposium.

A special policy session will present viewpoints of the United States, United Kingdom, and the European Common Market.

Members of ASME, ASCE, AIECIE and members of the following reciprocating societies ASEE, AWWA, AICE, ASME, AACE, AIChE, ASAE, SAME, AIEEE, ASTM, ASQCE, CEC, AIME, ASHRAE will be admitted at the member rate, also cooperating societies and associations.

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<td>Members</td>
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<td>Non-member</td>
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Payment of the one fee will admit conference sessions listed in this program.

The registration desk will be located on the mezzanine of the Jack Tar Hotel and will be open during the following hours: Sunday, May 1, 4:00 p.m. to 9:00 p.m.; Monday thru Thursday, 8:00 a.m. to 5:00 p.m.

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Requires 2 years formal electronic schooling or equivalent industrial or military experience. Work involves testing, trouble-shooting, and calibration of electronic instruments. Must have strong background in solid state circuitry and theory.

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**EFFICIENT LOUD SPEAKERS**

Paul Klipsch, president of Klipsch & Associates, Inc., Hope, Ark., manufacturer of loud speakers, will address the May 3 meeting of the Vehicular Communications chapter. He will discuss efficiency distortion and acoustical requirements of loud speakers as they affect intelligibility in mobile communication systems.

The speaker is the author of numerous papers and holds patents in the fields of geophysics, acoustics, firearms, etc. He is a Fellow of IEEE and the Audio Engineering Society.

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**WAVEFORMS & RECEIVERS**

Prof. Donald W. Tufts, Harvard University, will present a paper on waveforms and receivers for message estimation in pulse amplitude modulation at the April 28 meeting of the Information Theory chapter.

Intersymbol interference, additive noise and inexact synchronization, or timing jitter, are three common sources of distortion in data transmission systems. For pulse amplitude modulation communication links, the combination of transmitter waveform and linear receiver which minimizes the overall mean-square error arising from these sources is determined. Mean-square error vs. signal-to-noise ratio performance characteristics of the optimal systems are determined explicitly for several examples. These characteristics are compared both with those of certain suboptimal systems and with the optimum performance theoretically achievable (OPTA) derived from Shannon's theory of rate-distortion functions. The optimal PAM systems, which can be interpreted as the ideal combination of infinite memory convolution encoders and decoders, are seen to perform very close to the OPTA for low signal-to-noise ratios. For high signal-to-noise ratios, however, the optimal PAM system mean-square error decreases in proportion to the signal-to-noise ratio, while OPTA generally decreases exponentially. Accordingly, there exists a potential for realizing significant improvement at high signal-to-noise ratios by resorting to complex nonlinear coding techniques.

Dr. Tufts, a graduate of Williams College and M.I.T., is an assistant professor of applied mathematics and consultant to several electronics companies in the Boston area.

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**SECTION ANNUAL MEETING**

Dr. Frederick E. Terman, vice president and provost emeritus, and advisor to the president, Stanford University, will be the principal speaker at the section annual meeting scheduled for June 15 at the Bold Knight, Sunnyvale. He will present a report on his recent tour of engineering colleges in the U.S.S.R. The annual event will honor 1966 Fellows and 1966-67 officers of the section, subsections and chapters. In addition to reservations for couples, tables of eight may be reserved for subsections, chapters, committees and companies by calling Mrs. Jean Helmke, 327-6622. Price of the dinner will be $4.50, including tax and tip, with cocktails at 65 cents.

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AUTOMATIC ENGINEERING

The requirement to provide one-of-a-kind custom assemblies by use of standardized modules is common, particularly in electronics manufacturing. The ADE system (Automated Design Engineering) has made it practical to "teach" a computer to accept a customer-oriented specification and by the use of stored engineering logic test the specification for completeness and consistency and actually select all the modules required to satisfy the specification. Three ADE engineers will describe the system at the April 26 meeting of the Parts, Material and Packaging chapter.

By the use of random access file data these selections are physically positioned in shelves and on racks to provide a complete design. In addition, pricing, accounting and manufacturing data is accumulated and summarized. Comments are generated by the machine pointing out unusual aspects of the specification or commenting on areas that have given difficulty in past circumstances.

The system is currently being used in the design of microwave and multiplex systems and has reduced the time from several days engineering down to minutes of computer time. This has also provided higher accuracy, improved consistency and substantial reduction in engineering clerical effort.

The system has been expanded to provide file-oriented processing of manual designs, enabling engineers to select units by check-off lists that are machine processed against the central magnetic file. The file performs the same pricing and detailing function and presents to the engineer a completely edited list of panels and parts, with critical items flags, worksheet notes selected and various bits of data needed to complete the design organized and presented on worksheets. Once again substantial reduction in clerical work has been achieved.

ADE and its associated files provide an ideal interface between a sales/marketing oriented functional numbering system and the digitized stock-numbering system required by automated production control.

The ADE system was programmed by engineers without previous computer experience. The project took about two years to bring it to its present stage. The presentation will be made by Thomas C. Bean and two of the engineers primarily responsible for the entire project. N.D. Vandevier will discuss the use of decision tables as a tool for capturing and programming engineering logic, using actual examples from his work with the micro-

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from the chairs
PROFESSIONAL INVENTORY BY SECTION MEMBERS URGED

April is a month that many people use to take inventory. Business firms are concerned with property tax calculations while individuals like you and I worry about income taxes.

It's a good idea to "take stock" once a year to see what we've accomplished and to plan what we hope to achieve.

One measure of our professional achievement is our relationship with IEEE.

- Have we written or presented technical papers?
- Have we attended and participated in technical meetings, conferences or symposia?
- Have we done our "homework"—by reading the Spectrum, the Proceedings, the Transactions and other pertinent publications?
- Have we served on committees or as officers of various IEEE organizations in an effort to promote the welfare of electrical and electronics engineering?
- Have we advanced in technical experience and professional maturity, as evidenced by advancing our grade of membership?

Each of these points is an important one. If we haven't done very well during the past years, let's resolve to do better this year!

Why not start—right now—by examining your membership status with IEEE? What is your grade of membership?

If you have interest in electrical or electronics engineering, you may qualify as an Associate Member.

If you have a BS in EE from a school of recognized standing or have been regularly employed in the fields of electrical or electronics engineering for a period of six years, you may qualify as a Member.

If you are an engineer, scientist, educator or technical executive with ten years of experience in the fields of electrical or electronics engineering, you may qualify as a Senior Member.

Holding this grade enhances your prospects of serving on important headquarters committees and being elevated to Fellow.

How do you transfer to a higher grade of membership? Simply fill out an application form available from your company membership representative or the Section Office and forward it to IEEE, Suite 2210, 701 Welch Road, Palo Alto, Calif. 94304.

The dues for Associate Member, Member and Senior Member are the same, $15.00 per annum.

Upgrading your IEEE membership is a positive step you can take toward professional advancement in 1966! Do it right now before you forget.

JOHN B. DAMONTE
Membership Chairman
San Francisco Section
Bernard Shoor has been named vice president and general manager of Endevco Laboratories, Mountain View, a division of the Pasadena headquarters firm, world's largest designer and manufacturer of piezoelectric instrumentation.

Michael A. McNeilly has been appointed technical director for Apogee Chemical, Inc., Richmond, responsible for product development for the plastic and electronics industries.

Medical electronics sales increased 7% in 1965, according to Electronics, which predicted a 10% increase for 1966 to $263.3 million and 1969 sales of $280 million. Patient monitoring equipment is expected to increase by 40% this year to reach $5 million.

Ampec Corp., Redwood City, has been awarded a $2.5 million Canadian Broadcasting System contract for high band color video-tape recorders; a $400,000 JPL contract for magnetic tape recorders; a $500,000 Harvey Radio contract for stereo tape duplicating equipment; and a $1.4 million Columbia Broadcasting System contract for high band color video tape recorders.

John Fluke Mfg. Co., Inc., Seattle, reported sales of $2,004,521 and earnings of $133,159 for the first quarter ended December 31, compared to $1,867,530 and $68,642, respectively, for the same period of 1964.

Lear Siegler, Santa Monica, reports sales of $115,880,463 and earnings of $4,311,962 for the six-month period ending December 31, highest in its 11-year history.

Data Technology Corp., Mountain View, has signed a licensing agreement with Tek Elec, Sevres, France, for estimated European sales of $200,000 over three years of its digital voltmeter and plug-in units.

Marshall Laboratories, Torrance, has been awarded a NASA contract for a neutron proton spectrometer which will determine how much radiation danger exists for commercial SST passengers at 70,000 feet.

United Technology Center, Sunnyvale, has been awarded a $111,015,049 Air Force contract to manufacture 100 million pounds of napalm.

*Several recent surveys in depth verify that those attending WESCON (a predicted 45,000 this year) spend most of their viewing time at exhibits they planned in advance to see!*

**HOW TO GET THE WORD TO THEM ABOUT YOUR EXHIBIT—IN ADVANCE?**

There is no more effective medium than the Grid-Bulletin, IEEE's own official WESCON magazine, jointly published by San Francisco and Los Angeles IEEE. About 30,000 IEEE members in Region 6, the eleven western states, receive it through specially controlled lists in July and again early in August, when they're deciding how they'll budget their time at WESCON and whether or not they'll see your exhibit and talk to your people. An additional 3000 visitors pick up the August issue as they come in the door.

Rates are lower than any comparable magazine in the field—$17 per K readers. PLAN AHEAD! If your firm wants in, let us know right away!

**CLOSING DATES:** June 17 for July issue, July 15 for August issue. You save $90 on a page ad if you contract for both the July and August issues. **CONTRACTS AND ORDERS:** IEEE Grid-Bulletin, 701 Welch Rd., Suite 2210, Palo Alto, 94304, (415) 327-6622. **MOUNTED PLATES, COPY TO SET:** IEEE Grid-Bulletin, 3600 Wilshire Blvd., Los Angeles, 90005, (213) 387-1203.
Fred J. Haines has joined Granger Associates, Palo Alto, to fill the new position of manager of video products, was formerly with Sylvania Electric Products, Batavia, and General Electric Co., Syracuse.

David R. Kneeland has joined the technical sales staff of The Cyclotron Corporation, Berkeley, was formerly associated with High Voltage Engineering Corp.

General Micro-Electronics, Inc., Santa Clara, has been acquired by Philco Corp. from Pyle-National Co. for approximately $4,350,000.

Vacu-Blast Co. has acquired Tronic Corp., San Carlos, manufacturer of ultrasonic cleaning and vapor degreasing equipment.

Hewlett-Packard Co., Palo Alto, will build a $1 million, 65,000 sq. ft. facility in Mountain View to house its Delcon division and western service center.

General Transducer Co., Santa Clara, has acquired the temperature-measuring and controlling instrument line of Royco Instruments, Menlo Park.

Jean E. Lape has been named manufacturing engineering and quality control manager for Utek Corp., Palo Alto, was formerly with the analytical instruments division of Varian Associates, Palo Alto.

James V. Bitner, a corporate vice president of Lear Siegler, Inc., Santa Monica, has been named president of the company's astronics division and will continue to serve as president of the instrument division at Grand Rapids, Mich.

Mike Economy, former manager of reliability assurance for Raytheon's semiconductor division, Mountain View, has been named manager of the reliability analysis and components department of space vehicle operations at Philco's WDL division, Palo Alto.

Frauman Associates, Menlo Park, has been named representative for Optical Electronics, Tucson.
Manufacturer | Representative Index

- *Motorola* Corp., W. K. Geist
- *IBM* Corp., W. K. Geist
- *TRW* Corp., V. T. Rupp
- *Honeywell* Corp., W. K. Geist
- *Siemens* Corp., W. K. Geist
- *Philco-Ford* Corp., T. Louis Snitzer
- *Ford* Corp., T. Louis Snitzer
- *L closet* Corp., T. Louis Snitzer
- *Emcor-Borg-Warner* Corp., T. Louis Snitzer
- *Singer-Metrics/Getzsch* Corp., T. Louis Snitzer
- *Proscenium* Corp., T. Louis Snitzer

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  - Menlo Park, 322-8461
  - Foster City, 968-1608
  - San Francisco, 587-2091

- **Frauman Associates**
  - P. O. Box 357, Menlo Park, 322-8461

- **Geist Associates**
  - 13160 Terra Bella Avenue, Millbrae, 961-8760

- **Dietrich-Helfner Associates**
  - 22555 Park Blvd., P. Alto, 321-4321

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Sedillo Co., San Jose, has been named representative for Sigma Systems Corp., Dallas.

Montgomery Bros., Inc., Burlingame, has been named representative for the EIMAC division of Varian Associates.

MORE AUTOMATIC DESIGN

wave program. E.A. Crosetti will talk on the file orientation of the system showing the power of a centrally maintained high-speed access magnetic file for rapid reaction to changes and for ease of maintenance.

events of interest

WELDING CONFERENCE

The American Welding Society’s western welding technical conference, sponsored by the Santa Clara Valley Section, will take place May 5-7, at Rickey’s Hyatt House, Palo Alto, with technical sessions on electronics, aerospace, fabrication and non-destructive testing.

Registration fees are $20 for AWS members, $25 for non-members, $10 for students, and $15 for one-day attendance. For additional information, registration forms, call M.J. Higgins, technical conference director, 591-7161.

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Montgomery Bros., Inc., Burlingame, has been named representative for the EIMAC division of Varian Associates.
New Tektronix Type 556

DUAL-BEAM DC-to-50 MHz Oscilloscope

with 10 ns/cm sweep rate on both beams and many new operating and convenience features

CHARACTERISTICS

- New Dual-Beam CRT (with illuminated internal graticule) — provides “zero-parallax” viewing of small spot size and uniform focus over the 8 cm by 10 cm display area.
- Calibrated Sweep Delay — extends continuously from 0.1 microsecond to 50 seconds, to permit expansion of a selected portion of the sweep.
- Independent Sweep Systems — provide 24 calibrated steps from 0.1 μs/cm to 5 μs/cm; the X10 Magnifier extends the fastest sweep rates to 10 μs/cm.
- Single-Sweep Operation — enables one-shot displays for photography of either normal or delayed sweeps.
- 2 Independent Triggering Systems — provide stable displays over the full bandwidth.

and to beyond 50 MHz. Both vertical amplifiers supply trigger signals to both of the time-base triggering systems.

Meets interference specifications of MIL-I-6181D over the following frequency ranges — Radiated (with CRT mesh filter installed): 150 kHz to 1 GHz; Conducted (power line): 150 kHz to 25 MHz.

Other Specifications — size is 15" by 17" by 24"; weight is ≈ 80 pounds without plug-in units; power requirement is 100-130 V or 200-260 V, 50-60 Hz, ≈ 850 watts.

Type 556 Dual-Beam Oscilloscope $3150
Rack Mount Type RS56 Oscilloscope $3250

Plug-ins illustrated
Type 1A1 Dual-Trace Unit $600
(Dual-Trace: 50 mV/cm at DC-to-50 MHz, 5 mV/cm at DC-to-28 MHz. Single-Trace: 500 µV/cm at 2 Hz-to-15 MHz. 5 Display Modes: Channel 1, Channel 2, Alternate, Chopped, Added Algebraically. Front-panel signal output.)

Type 1S1 Sampling Unit $1100
(DC-to-1 GHz, internal triggering, built-in delay line. Sweep Rates: 100 ps/cm to 50 ps/cm, with ±3% accuracy, normal or magnified (up to X100). DC Offset Range: greater than ±1 V. 4 Display Modes: repetitive, single sweep, manual scan, or external scan.)

Plug-ins illustrated
Type 1A1 Dual-Trace Unit $600
(Dual-Trace: 50 mV/cm at DC-to-50 MHz, 5 mV/cm at DC-to-28 MHz. Single-Trace: 500 µV/cm at 2 Hz-to-15 MHz. 5 Display Modes: Channel 1, Channel 2, Alternate, Chopped, Added Algebraically. Front-panel signal output.)

Call your nearby Tektronix field engineer for complete information or write Tektronix, Inc., P. O. Box 599, Beaverton, Oregon 97005.

Tektronix, Inc.
The growth of world-wide demand for Varian products in commercial, military, and industrial markets is providing new career opportunities for engineers. The following positions are among those now available:

### SENIOR ENGINEER
A background in Scientific instrument development and design of complicated systems necessary. Must be able to contribute to a team effort in product engineering. Should have MS in EE or Physics and mechanical background in design or development. Knowledge of spectrometers or similar instrumentation necessary.

### RESEARCH AND DEVELOPMENT ENGINEERS
BS & MS levels in circuits and systems. Transistors, servo, RF, or microwave experience desired. Background or interest in Physics or Chemistry helpful.

### ELECTRONIC MANUFACTURING ENGINEER
Engineer with ME, EE, or IE Degree. Experience in manufacture of electronic and electro-mechanical equipment, printed circuit assemblies and cabling. Requires understanding of production methods and cost reduction, and MIL Specs and NASA Standards.

### DEVELOPMENT ENGINEER
Responsible for design and development of precision electronics equipment. Should have aptitude for advanced concepts important to frequency standards. Hydrogen masers and magnetometers. BS or MS in Physics or EE and desire to progress in growing division.

### TUBE ENGINEERS
Experience in design, development, or manufacture of klystrons, BWOs, or TWTs. Should be familiar with microwave techniques and vacuum tube engineering. Experience in systems and evaluation helpful.

### MICROWAVE ENGINEER
MSEE or equivalent. Requires understanding of electromagnetic and semiconductor device theory. Determine properties of and design techniques for microwave semiconductor devices.

Many other technical and professional openings also exist and all inquiries will be welcomed. Successful candidates for these positions will work with technical staff members noted in the industry. Varian is one of the leading employers in Northern California, noted for its unique living, cultural, and educational environment.

For consideration of your qualifications, submit a resume in confidence to:

Technical Employment Manager

611 Hansen Way • Palo Alto, California

an equal opportunity employer