

EDITOR'S PROFILE of this issue

from a historical perspective ...

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

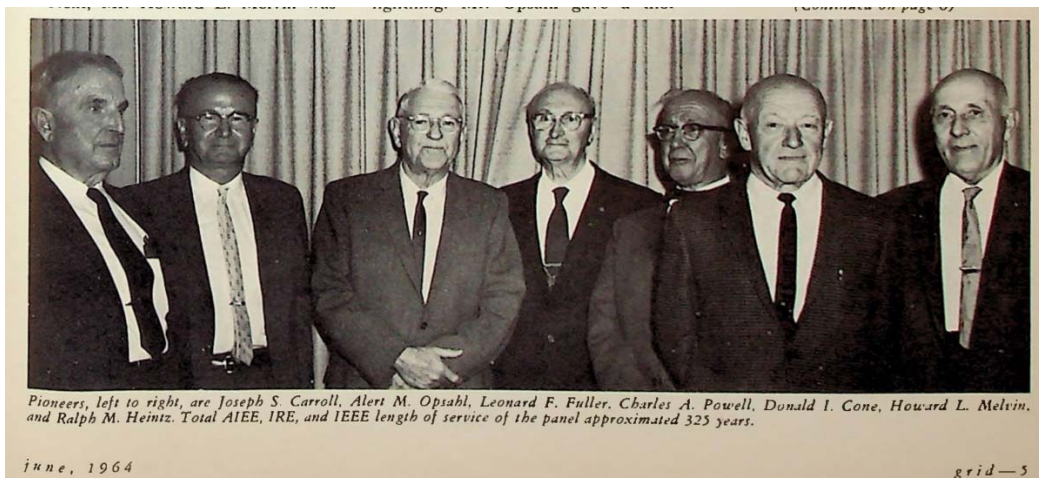
June, 1964:

Cover: The illustration shows retrorockets propelling the solid-propellant boosters away from the Titan III-C upper stage. United Technology Center in Sunnyvale builds the boosters.

Page 4: Stanford's professor of chemistry Eric Hutchinson speaks on science and responsibility; the article talks about humanistic and moral values, and how engineers need to sometimes consider their deepest convictions and reflect on how they apply to the engineering work they do. I had him as my chemistry instructor, and admired his approach to teaching and mentorship. In 1977, he designs the gowns and insignia used at Stanford's commencement and other formal occasions. The emblem for the school of engineering is shown below.

Page 4: The IRE's divisions were called "Professional Groups" (PGs). Following the AIEE/IRE merger, this designation was expanded to "Professional Technical Groups" (PTGs), since they were clearly technical in nature. Well, this got too long (and pretentious), so they dropped the "PT" part, and now they're simply called "Groups" (in the future, "Societies"). Progress is being made toward simplification.

Page 5: A photo (below) shows seven of the early pioneers of electric/electronics technologies in the SF Bay Area, gathered for the Santa Clara Valley Subsection's dinner meeting. Leonard Fuller, grandfather of a friend of mine and a professor and department head at UC-Berkeley, was the panel moderator. He discussed early radio development including the eventual dominance of the vacuum tube; in addition to his work with radio at Federal Telegraph, he had pioneered carrier-current telephone communication for the high-voltage lines to several remote hydroelectric facilities, outside San Francisco, for control purposes, expanding this to a Los Angeles-to-Hoover Dam system. Ralph Heintz, an early HF radio pioneer, talked about issues with early air-to-ground HF communication, and the frequency that was set aside for such use.



Pioneers, left to right, are Joseph S. Carroll, Aleri M. Opsahl, Leonard F. Fuller, Charles A. Powell, Donald I. Cone, Howard L. Melvin, and Ralph M. Heintz. Total AIEE, IRE, and IEEE length of service of the panel approximated 325 years.

June, 1964

grid-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*

JUNE 1964

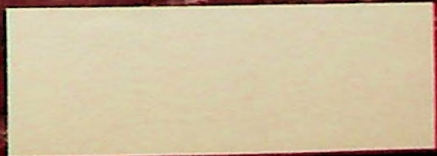
SAN FRANCISCO SECTION
INSTITUTE OF ELECTRICAL
AND
ELECTRONICS ENGINEERS



reminder

June 9 (Tuesday) P
June 10 (Wednesday) SCVSS
June 17 (Wednesday) BME
June 18 (Thursday) EMC
June 23 (Tuesday) CT/EC

POSTMASTER: RETURN REQUESTED—SUITE 2210, 101 WELCH ROAD, PALM HAVEN, FLORIDA, CALIFORNIA



high-speed

**Tektronix Oscilloscope
with general-purpose
convenience**

Type 585A / 82 unit features

- **Dual-Trace Operation** with 4 operating modes and independent controls for each channel—for individual attenuation, positioning, inversion, and ac or dc coupling as desired.
- **Passband typically DC-TO-85 MC** (3-db down) at 100 mv/cm (12-db down at 150 Mc), and typically DC-TO-80 MC (3-db down) at 10 mv/cm.
- **Calibrated Sensitivity in 9 steps** from 100 mv/cm to 50 v/cm, and in *10X Amplifier Mode*, from 10 mv/cm to 5 v/cm, variable between steps.
- **Internal and External Triggering** to 150 Mc.
- **Sweep Range from 10 nsec/cm to 2 sec/cm.**
- **Single-Sweep Photography** at 10 nsec/cm.
- **Calibrated Sweep Delay** from 2 microseconds to 10 seconds.

- **Bright, High-Resolution Display** with small spot size.
- **Conventional Passive Probes** for convenience.

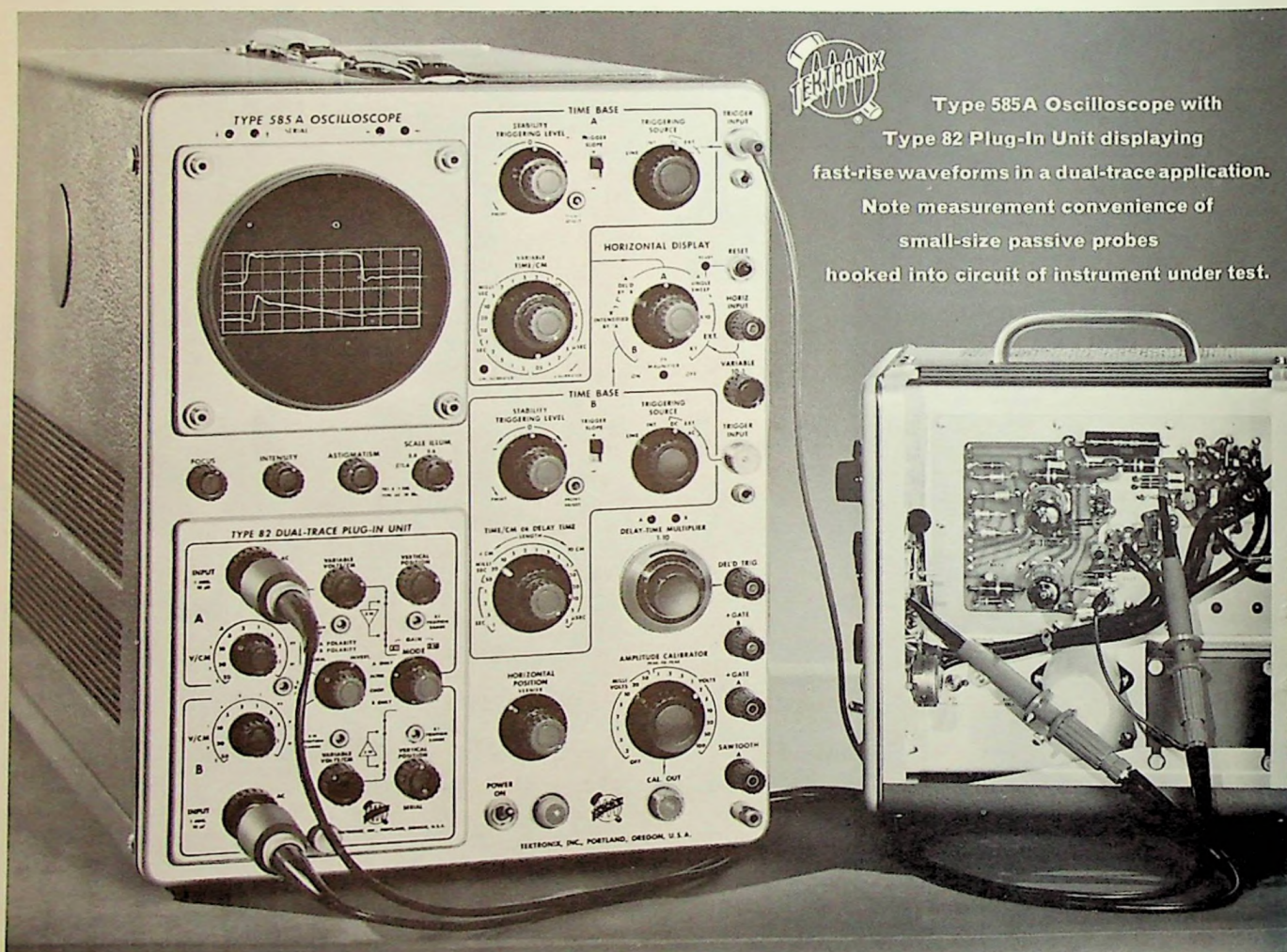
plus

- **Compatibility with 17 Letter-Series Plug-Ins** to permit differential, multi-trace, sampling, other laboratory applications—when used with Type 81 adapter.

Type 585A Oscilloscope	\$1725
Type RM585A Oscilloscope	\$1825
Type 581A Oscilloscope	\$1425
No sweep-delay capabilities, but other features similar to Type 585A.	
Type 82 Dual-Trace Unit	\$ 650
Type 86 Single-Trace Unit	\$ 350
Type 81 Plug-In Adapter	\$ 135
Allows insertion of 17 Tektronix letter-series plug-ins. Band-width (up to 30 Mc) and Sensitivity depend upon plug-in used.	

U. S. Sales Prices, f.o.b. Beaverton, Oregon

For a demonstration, call your Tektronix Field Engineer.



**Type 585A Oscilloscope with
Type 82 Plug-In Unit displaying
fast-rise waveforms in a dual-trace application.**
Note measurement convenience of
small-size passive probes
hooked into circuit of instrument under test.

Tektronix, Inc. SAN FRANCISCO FIELD OFFICES

3944 FABIAN WAY • PALO ALTO, CALIF. • Phone: 326-8500
1709 MT. DIABLO BLVD. • WALNUT CREEK, CALIF. • Phone: 935-6101
From Oakland, Berkeley, Richmond, Albany and San Leandro: 254-5353

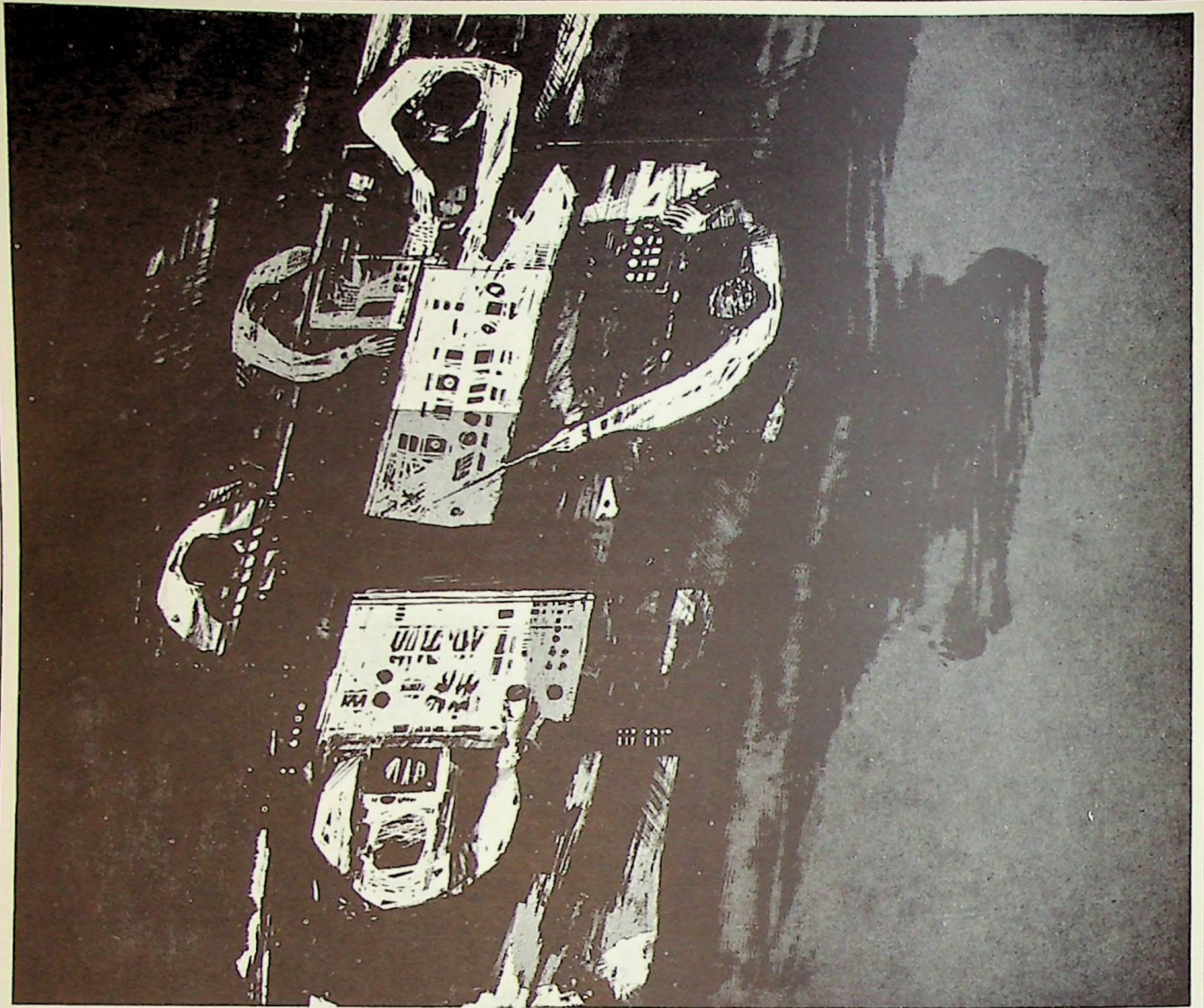


Factory quality service for the life of your instrument

NEELY 
ENTERPRISES

Exclusive sales and service for the Hewlett-Packard companies

NORTH HOLLYWOOD	3939 Lankershim Blvd., (213) 877-1282
SAN DIEGO	1055 Shafter Street, (714) 223-8103
SAN CARLOS	501 Laurel Street, (415) 591-7661
SACRAMENTO	2591 Carlsbad Avenue, (916) 482-1463
SCOTTSDALE	3009 North Scottsdale Road, (602) 945-7601
TUCSON	232 South Tucson Blvd., (602) 623-2564
ALBUQUERQUE	6501 Lomas Blvd., N.E., (505) 255-5586
LAS CRUCES	114 South Water Street, (505) 526-2486



Togas in the Board Room. Automation changes many things in a plant. The manufacturing area becomes neater, cleaner. The offices hum brightly, quietly, uncluttered. But the meaningful changes are occurring in the executive quarter: Increasingly, management is being relieved of debilitating detail by electronic information processing systems which automatically handle programmed decisions—setting minds free to contemplate tomorrow's opportunities, instead of wrestling with today's problems. This not only increases profits but heightens management's awareness of its civic and social responsibilities as well: for what man can long contemplate the future without becoming himself a philosopher?



COSTELLO & COMPANY

technical representatives

SOUTHERN CALIFORNIA & SOUTHERN NEVADA/2740 So. La Cienega Blvd., Los Angeles, California 90034/Phone: 213 UP 0-8537/TWX 213 836-0464
NORTHERN CALIFORNIA & NORTHERN NEVADA/535 Middlefield Rd., Palo Alto, California 94300/Phone: 415 DA 1-3745/TWX 415 492-9205
ARIZONA & NEW MEXICO/ 15 North 40th Place, Phoenix, Arizona 85000/Phone: 602 275-1197/TWX 602 255-0387

Whether you are designing systems for the factory, the office, or the executive suite we can help relieve you of debilitating detail. Costello & Company is ten competent sales engineers serving the digital computer and aerospace industries and representing the following manufacturers in California, Arizona, New Mexico and Nevada: BARNES* / BRYANT / COLLECTRON / COMMUNICATION ELECTRONICS / CORNING ELECTRONICS / DECKER* / DIGITAL DEVICES / FABRI-TEK / INLAND MOTOR / MAC PANEL* / RIXON / ROYAL-McBEE / THERMAL SYSTEMS / UPTIME.

*Not represented in all states listed

Published monthly except July and August
 by San Francisco Section,
 Institute of Electrical and Electronics Engineers

executive editor:

JAMES D. WARNOCK

advertising assistant:

MRS. RITA EARNSHAW

editorial assistant:

MRS. JEAN HELMKE

address all mail to

IEEE, Suite 2210, 701 Welch Road
 Palo Alto, California 94304

Mailing office of publication:
 363 Sixth Street, San Francisco 94103
 Second class postage paid at San Francisco

subscriptions:

\$4.00 (members); \$6.00 (others);
 overseas, \$7.00 per annum

Send address change promptly to
 IEEE, Box A, Lenox Hill Station, New York, N.Y.
 Send copy of letter to Section Office

contents

- Chairman's Report—3
- Meeting Calendar—4
- Meetings Ahead—4, 5
- Meeting Reviews—5, 6, 8, 12, 14
- WEMA News—6
- WESCON News—10
- Papers Calls—14, 16
- Mfg./Rep. Index—15
- Grid Swings—16
- Classified Advertising—16
- Advertisers Index—16

*san francisco
 section officers*

Chairman: William A. Edson
 Vice Chairman: John C. Beckett
 Secretary: Jack L. Melchor
 Treasurer: Gerard K. Lewis
 Membership Co-chairmen:

Fred MacKenzie,
 Stanford Research Institute, 326-6200
 William Warren,
 Shell Development Co., OL 3-2100

Publications Advisor:
 Howard Zeidler,
 Stanford Research Institute, 326-6200

Executive Secretary:
 James D. Warnock,
 Section Office, Suite 2210, 701 Welch Road
 Palo Alto, California, 321-1332

advertising

Bay Area & National: E. A. Montano, IEEE,
 701 Welch Rd., Palo Alto, Calif. (415) 321-1332
 East Coast: Cal Hart, Martin & Hart,
 25 W. 43rd St., New York, N.Y., LW 4-1290
 Southern California: Jack M. Rider & Associates,
 1709 W. 8th St., Los Angeles 17, HU 3-0537

from the chair

CHAIRMAN'S REPORT

My service as chairman of the section ending on June 30, I look back upon several section accomplishments during 1963-64. The chairmanship, which is always demanding, was further enlivened this year by the growing pains of merger. Needless to say, I look forward to July 1, when I turn the helm over to Jack Beckett.



Bill Edson

Plans ably laid last year by Pete Lacy, Vic Kaste, Stan Kaisel, Bob Grady, and the merger committees have worked out well. A merged approach to such important committees as awards, membership, and education and student relations, with co-chairmen bringing their knowledge to bear on interim problems, has been productive of mutual understanding and solutions.

The addition of two elected directors at large has served the Operating Committee and the section well. The new bylaws of the section, which title the governing committee the "Executive Committee," will make for conformity with national bylaws and a tighter operation. The former Executive Committee will be retitled "Executive Council" and will serve as an advisory body to the governing committee.

Three subsections were reorganized and have conducted active programs. Under the new bylaws, their chairmen are ex-officio members of the Executive Committee. Two AIEE divisions were merged with existing group chapters: Instrumentation and Controls, and Communication. Circuit

(Continued on page 16)

cover

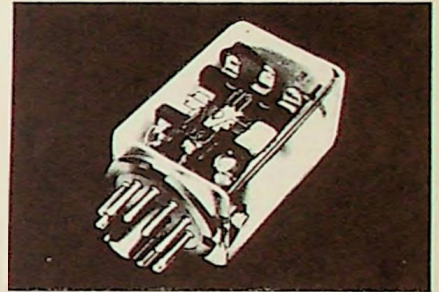
Saluting organization of the S.F. Chapter of IEEE Aerospace Group by Bob Sumner of Westinghouse (325-2226), clusters of retrorockets propel 250-ton solid-propellant boosters away from upper stages of the Titan III-C standard space launch vehicle. Retrorockets will be produced for the Martin Co. by United Technology Center, Sunnyvale, which also builds the boosters.

★ ★ ★ ★ ★ ★ ★ ★
BRILL ELECTRONICS

NOW!

POPULAR
P & B

POTTER & BRUMFIELD



KAP
 RELAYS

AVAILABLE
 OFF-THE-SHELF FOR
 IMMEDIATE DELIVERY



32 years the West's
 leading electronic parts distributor

BRILL ELECTRONICS

OAKLAND — 610 E. 10th St. Phone 834 5888
 MOUNTAIN VIEW — 855 Terra Bella Phone 961 1500

★ ★ ★ ★ ★ ★ ★ ★

SCIENCE AND RESPONSIBILITY

When viewing Nagasaki from the harbor shortly after the city's devastation in 1945, the strains of a dance tune flowed from a ship's speaker. The tune was, "Is You Is Or Is You Ain't Ma Baby." The poignant implications of this title expresses one of mankind's aged dilemmas, that of the two-edgedness of the power of science—for good or for evil.

This event begot the poetic book written by Dr. J. Bronoski, "Science and Human Values," from which the anecdote was taken. Perhaps it represents an extreme example compared with possible consequences of choices placed before scientists today; perhaps not. In any event, scientists, who are citizens and homo sapiens as well, have choices and they may very well be crucial.

"Scientific Blinkers" are important for most of us in honest pursuit of our work; however, it is vital that we not only recognize that they are on, but be able to remove them at propitious moments. Otherwise, there are real prospects of intellectual death; the very thing we hoped to avoid by putting them on. Bigotry or fanatical devotion to "our cause" in science is self-defeating. So points out both Philip Abelson in a recent editorial in *Science* and Arthur Bronwell in the last issue of the *IEEE Spectrum*.

John W. Gardner, president of the Carnegie Foundation, expresses his belief in his new book, "Self-Renewal: the Individual and the Innovative Society," that the vitality of societies is essentially the vitality of their individuals and institutions. He further questions our educational system and speaks in rather frank and humanistic terms about his theme: "Many moderns would rather walk barefoot over hot coals than utter an outright expression of moral concern. They have to say it obliquely, mix it with skepticism or humor, or smother it with pessimism. But embarrassment about the expression of moral seriousness is a disease of people far gone in affectation and oversophistication. Unaffected people will regard it as normal to consult their deepest values and to exhibit allegiance to those values."

Our speaker on June 17, Dr. Eric Hutchinson, has frequently spoken about convictions that he believes are important to the scientist:

that the scientist devote more attention to the responsibility he bears;
that he question the values he is living by and for;
that there is no public misrepresentation of decisions labeled, "scientific"; that is, that political decisions

MEETING CALENDAR

SANTA CLARA VALLEY SUBSECTION

6:00 P.M. • Wednesday, June 10

Plant tour and social meeting

Place: Paul Masson Vineyards, off Pierce Rd., Saratoga
Dinner: At the plant, about \$3.50 per person, ladies welcome
Reservations: Mrs. Jenny George, 735-2226 by June 5

GROUP CHAPTERS

Bio-Medical Engineering

8:00 P.M. • Wednesday, June 17

Science and responsibility

Dr. Eric Hutchinson, professor, department of chemistry, Stanford University
Place: Room M-104, Stanford Medical School, Stanford
Dinner: 6:15 p.m., Red Cottage Inn, 1706 El Camino Real, Menlo Park
Reservations: Con Rader, 326-1970, ext. 327, by June 16

Circuit Theory

8:00 P.M. • Tuesday, June 23

(Joint with PTGEC—see below)

Cellular logic with applications to integrated circuits

Robert Minnick, senior research engineer, SRI

Place: G.E. Computer Lab, 310 De Guigne Ave., Sunnyvale
Dinner: 6:30 P.M., Old Plantation, El Camino and Bernardo, Sunnyvale
No reservations required

Electromagnetic Compatibility

8:00 P.M. • Thursday, June 18

Instrumentation for wide-band spectrum analysis

Presented by H. L. Halverson and A. Fong, Microwave R&D Labs, Hewlett-Packard Co.

Place: Hewlett-Packard Auditorium, 1501 Page Mill Road, Palo Alto
Tour of Hewlett-Packard plant to follow; reservations are necessary
Dinner: 6:00 P.M., Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto
Reservations: Glenn Gillett, RE 9-4321, ext. 24834 or 23268, by June 16

Electronic Computers

8:00 P.M. • Tuesday, June 23

(Joint with PTGCT—see above)

Power

7:30 P.M. • Tuesday, June 9

Symposium and round table discussion: EHV in the West

E. G. Lambert, supervising electrical engineer, Pacific Gas & Electric Co.
E. W. Lewis, Pacific Coast zone electric utility engineer, Westinghouse
J. B. Tice, manager, application engineering, electric utility sales division, GE Co.
Place: Engineers' Club of San Francisco, 206 Sansome St., San Francisco
Dinner: Cocktails 5:30 P.M., Dinner: 6:30 P.M., \$3.75
Reservations: GA 1-3184 by Friday, June 5

student branch news

HEALD COLLEGE OFFICERS

Recently elected officers of the IEEE student branch at Heald College, San Francisco, are Frank Frankos, chairman; Harry Jung, vice chairman; Herbert R. Zajac, secretary; Tom Bellucci, treasurer; and Harvey Edmark, membership chairman. Roy O. Hurd is faculty adviser.

are not couched under the scientific bailiwick;

that he clarify his realization that science does not itself constitute reality, rather of its consistency of many truths about reality.

section news

PT DROPPED

The IEEE board of directors voted on April 23 to change the name "Professional Technical Groups" to "Groups," effective immediately. Local chapters will therefore be referred to in the Grid and elsewhere as the San Francisco Chapter of the IEEE Automatic Control Group, for example.

We expect this to be a stimulating meeting and hope that all interested, whether a member of the BioMedical Engineering Group or not, will attend.

WILLIAM HALPERN

SPECTRUM ANALYSIS

Harley Halverson and Arthur Fong of Hewlett-Packard microwave R&D laboratory will address the Electromagnetic Compatibility chapter at its June 18 meeting. They will discuss instrumentation for wide-band spectrum analysis to view simultaneously many signals, such as those encountered in electromagnetic compatibility and spectrum signature investigation.

A spectrum analyzer will be shown which displays frequency spectrums from 30 kc to 2 gc wide at scan rates of 1 per 30 seconds to 30 per second. Center frequencies of 10 mc to 40 gc can be analyzed.

Practical applications, such as adjustments of signal sources, harmonic generators, parametric amplifiers, and other laboratory devices, will also be discussed.

Halverson is project supervisor in charge of the RF work on the analyzer and is a graduate of South Dakota



Shown with the H-P spectrum analyzer, 8551A/851A, are (left to right) George C. Jung, who supervised development of display unit; Harley L. Halverson, who supervised development of R-F unit; Arthur Fong, section manager; and Howard C. Poulter, engineering manager. At lower right is typical spectrum, 0 to 200 MC.

State College and Stanford. Fong is manager of the section in which the analyzer was developed and is a graduate of University of California and was formerly on the staff of MIT

Radiation Laboratory.

A tour of Hewlett-Packard facilities will follow. Reservations are needed for the tour to determine the number of guides.

meeting review

SECTION/SUBSECTION APRIL DINNER MEETING HONORS EE PIONEERS

"Pioneers' Night," held at the Lamplighter in Sunnyvale on April 22, was very well attended with approximately 135 members and guests present.

Leonard F. Fuller, noted for his work on early carrier systems and telegraph, did an excellent job as panel moderator for the evening. His first introduction was Charles A. Powell, past president AIEE 1945, a pioneer in early utility systems. Mr. Powell reminisced on the early days of power industry, way back when 50 watts was good for 16 candle power! He described the Buffalo Light and Power Plant of 1896 which was the first to be installed at Niagara Falls.

Next, Mr. Howard L. Melvin was

introduced. Mr. Melvin went into very interesting details of early distribution systems, the kinds of insulators they used "in those days," and how the small power companies formed pools through interconnection of their respective lines. This was undoubtedly the formative era for the large and extensive power companies as we know them today. When asked from the floor if he could relate any differences of opinion between Mr. Edison favoring DC and Mr. Westinghouse favoring AC, he hedged by saying that this was a matter of record.

Mr. Alert M. Opsahl was introduced as a pioneer in the study of lightning. Mr. Opsahl gave a thor-

oughly energetic presentation on some of his lightning studies and experiences and went into detail of the first oscillograph in the USA, designed by him. It would almost fill a small room! Mr. Opsahl ended an excellent presentation with a slide showing a patented lightning "fireball trap." (This was not Mr. Opsahl's patent and he explained why it wouldn't work anyhow!)

Next, Joseph S. Carroll was introduced, his work including early power and corona studies. Mr. Powell gave an excellent explanation of corona phenomena and of the high losses that were experienced on long transmission

(Continued on page 6)



Pioneers, left to right, are Joseph S. Carroll, Alert M. Opsahl, Leonard F. Fuller, Charles A. Powell, Donald I. Cone, Howard L. Melvin, and Ralph M. Heintz. Total AIEE, IRE, and IEEE length of service of the panel approximated 325 years.

High purity,
low vapor pressure

VPOF*

Brazing Alloys

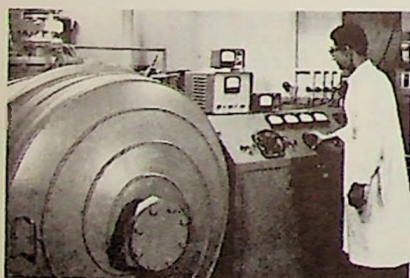
*Vacuum Processed Oxide Free

Much of the relatively high oxide and impurity content of conventional brazing alloys is a result of melting and processing in air or other gaseous atmosphere. This requires the introduction of "deoxidizers" such as phosphorus, silicon, and aluminum, most of which are undesirable impurities themselves. The unique Wesgo-developed vacuum melting process excludes impurities from alloys from the very start by cleaning the atmosphere in which they are produced. The result: brazing alloys that are "clean" at the ingot and all the way to the finished product.

*VPOF ingots, being free of embrittling impurities, are more ductile. They can be processed into wire or sheets with far fewer surface imperfections—cracks, slivers, and other mechanical defects—which in ordinary alloys act as reservoirs for extraneous materials such as organic lubricants, oxides, or dirt particles. As a result, a brazed joint made with a VPOF alloy is sound throughout, with no impurities to float to the surface and cause a "leaker," or to vaporize and cause a contaminated product.

*VPOF alloy brazes are free from the troublesome "spitting" characteristic of conventional alloys during hydrogen furnace brazing. The problem arises from entrapped oxides, which form water vapor in the hydrogen atmosphere, expand rapidly, and cause unwanted spattering.

*VPOF brazing alloys contain less than 0.002% lead and phosphorus, less than 0.001% zinc and cadmium. Other impurities are correspondingly low. Send for complete specifications today.



Wesgo vacuum processing furnace for oxide free brazing alloys

WESTERN GOLD & PLATINUM COMPANY
525 Harbor Boulevard, Belmont, California

w e m a n e w s

LEVELING OFF CONTINUES FOR WESTERN ELECTRONICS

Growth of the total electronics industry in the West appears to have reached a plateau that will carry through 1964, according to the Western Electronic Manufacturers Association (WEMA).

Figures compiled by WEMA in its annual survey of the industry indicate that consolidated sales of western companies this year will show no significant gain over the 1963 record of \$3,875 billion.

WEMA President Burgess Dempster, president of Electronic Engineering Co. of California, Santa Ana, pointed out that despite the general leveling-off, a majority of the companies are forecasting increased sales for the year.

"The aggregate growth in the West, however, is offset by considerable downturns foreseen by one out of four companies," he said.

Dempster attributed the slowdown to lagging U.S. military expenditures in the western states. "The companies experiencing the biggest sales dips are those which are most dependent on government contracts," he declared.

He explained there have been no major projects awarded to the West by the Department of Defense or the National Aeronautics and Space Administration since Apollo in 1962.

In addition, some of the big jobs begun three or four years ago are now phasing out. Others, such as Skybolt

and DynaSoar, have been canceled altogether.

"On top of reductions in the defense dollar," Dempster said, "we are faced with changes in government buying policies which increase costs, and pressures to 'spread the work' which tend to direct business away from our area."

While 1963 sales volume in the West was up 8.1 percent over the 1962 level of \$3,585 billion, year-end employment in the industry was off 4,800 from the 255,000 people employed at the end of 1962.

"A good deal of the employment drop can be explained by individual company efforts to step up efficiency and by tighter management controls," Dempster said. He foresees slight additional employment cuts, even though sales levels should remain the same.

The WEMA president is confident that the West will re-establish its growth curve in 1965 and, possibly, by the latter part of this year.

"Fortunately," he said, "the commercial and overseas markets for electronic equipment are expanding and will account for an increasing share of the industry output.

"Of greater importance, a number of dramatic technological advances, such as integrated circuits and lasers, are moving into the production phase."

MORE PIONEERS REVIEW

lines. It was not too long ago, for example, that on lines crossing the desert, hot weather losses of 10 KW per mile were noted. He also detailed some of the early work at Ryan Labs where giant water resistors were used between lines in order to accurately measure power.

Donald I. Cone was the next speaker, a real pioneer in early telephone systems. Mr. Cone gave a very enlightening and humorous talk on inductive hum picked up in the telephone lines when the power companies and the telephone companies each use the same poles. From what he said, there was considerable difference of opinion between the power and phone companies, but everything was straightened out to mutual benefit!

Next, Ralph M. Heintz disclosed some of the early problems in aircraft-to-ground radio. Initially, a spark transmitter was used; later when RF was feasible, 33.33 meters was sort of set aside as a "miracle frequency"—it really worked well. Only one problem developed on the early airplanes and

that was, where do we hang the ground wire? Finally, out of desperation, someone suggested it be fastened to the air frame. It worked.

As the final speaker, Mr. Fuller, the panel moderator, reminisced over some early RF generators that preceded the vacuum tube. Back in 1902 the DC arc was the thing; next came the radio frequencies—Goldschmidt alternators, frequency multiplying transformers, and so on. There were all sorts of mechanical gimmicks—tone wheels, rotary tickers, etc., used to generate RF until the vacuum tube obsoleted all of this equipment quite the same way the solid state devices are obsoleting the vacuum tubes today.

The above gentlemen, all truly pioneers in the electrical and electronic arts, were warmly applauded. It is most gratifying to see men like this willing to share their experiences and at the same time retain very lively senses of humor. It is hoped that Pioneers' Night can be made an annual affair.

ROBERT W. SUMNER

BARNES
ENGINEERING COMPANY
STAMFORD, CONNECTICUT

*extends a cordial invitation to
those attending the*

INFRARED INFORMATION SYMPOSIUM (IRIS)

to observe demonstrations of our latest

ELECTRO-OPTICAL TRACKING SYSTEMS

at our suite

CABANA MOTOR LODGE

Palo Alto

June 17 through 19, 1964



NOW a new, low cost FREQUENCY RECEIVER

- Simplified Operation
- Accurate Measurement
- Minimum Circuitry



60 K C

Model SR-60

PHASE COMPARATOR RECEIVER

FOR FREQUENCY STANDARDIZATION TO
THE NATIONAL BUREAU OF STANDARDS

The Model SR-60 is the first low cost VLF Phase Comparison Receiver designed to permit phase comparison measurements between a local oscillator and the National Bureau of Standards transmitted 60 Kc's from WWVB, Fort Collins, Colorado. The receiver is a straight-forward Tuned Radio Frequency receiver and can be used in any location in the United States with highly satisfactory results.

The SR-60 permits accuracy measurements to parts in 10^5 , with relative short measurements. Phase difference is displayed on a front panel meter or on a strip chart when more precise measurements are made over a long period of time. Since the phase difference is a "beat," lower accuracies can be monitored aurally, using the sound from the speaker. As the local standard gets closer, the visual "beat" on the front panel meter is most useful. When this meter is moving too slowly for reasonable timing, the "beat" can then be monitored on the recorder.

SPECIFICATIONS:

Input Frequency:
W W V B 60 Kc/s

Local Standard Input:
100 Kc (other frequencies available).

Sensitivity:
1 μ v to antenna coupler provides usable output for strip chart recording and visual monitoring.

Bandwidth:
2 Kc for 3 db.

Input Impedance:
High impedance or 50 Ohms.

PRICE
\$850

Phase Output:

Sine wave corresponding to fractional error of local oscillator.

Outputs:

Phase output for external recorder;
Audio
Received 60 Kc output
Multiplied 60 Kc output—300 Kc
Multiplied local oscillator output—300 Kc

Recorder:

Rustrak Model 88, supplied with chart paper and gear train for $7\frac{1}{2}$ " per hour speed. Other gear trains available.

Oscilloscope:

One inch tube for quick indication of frequency drift and the direction of drift.

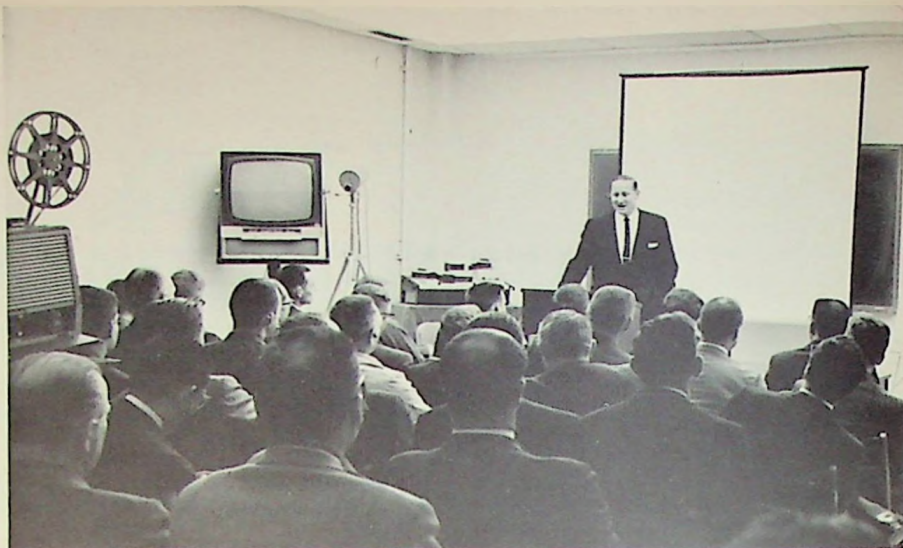
Size:

$5\frac{1}{4}$ " x 19" Rack Panel
 $17\frac{1}{2}$ " Depth behind Panel
17" Width behind Panel

Write for detailed information
SPECIFIC PRODUCTS

P.O. BOX 425 21051 COSTANSO ST.
WOODLAND HILLS, CALIF.
DIAMOND 0-3131 AREA CODE: 213

Prices & specifications subject to change



Charles Wilson describing planning and development of Ampex VR-1500 video tape recorder (recorder is to the left of speaker).

meeting review

PEP GROUP HEARS AMPEX R&D SUCCESS STORY

Ampex Corporation was the host for the January meeting of the PTC-PEP chapter. In an opening film, Ampex's founder and chairman of the board, Alexander M. Poniatoff, recalled the early beginnings of tape recording. One of the first uses of tape recordings was during World War II when Hitler recorded messages to his troops. These were later played during air raids to build troop morale by giving the impression Hitler was in the city. From this early beginning, tape recording has advanced to pictures as well as sound. Video tape recording is currently used in education, military training, sports training, and Pilot Landing Aid Television (which allows pilots to visually review their landings).

After the film, Charles E. Wilson, fabrication manager at Ampex, described what it took to put the VR-1500 video recorder into production, in his talk "Breadboard to Breadwinner." First, a group surveys the market potential and plans a product, complete with cost and time estimates. These plans are reviewed by management, and if approved proceed to the development cycle, which includes theory, breadboard, engineering model (no castings), and prototype. The Ampex normal development cycle target is 18 months; however, this was not met in the VR-1500 due to several specification changes.

One of the most important decisions involves when to release the product to production. Marketing interests dictate an early release, while lab instinct would tend to engineer the product to death. After the production release the normal manufacturing cycle is eight months; however, this was com-

pressed to two months in the case of the VR-1500 due to competitive reasons. Materials are ordered at the same time operation, fabrication, and method sheets are being written. Work orders are then scheduled to be completed when the purchased parts arrive. Next, units are built and debugged. The assembly part of the cycle has been shortened by a photographic technique which records exploded assembly pictures on a drawing format. Previously this involved time-consuming artist's hand drawings. Finally, thorough testing is performed before shipping.

The VR-1500 was designed for a 3-megacycle bandwidth with $3\frac{1}{2}$ inches per second actual tape speed, or the equivalent of 650 feet per second tape versus head speed. This was achieved with a helical scan design where the tape scans two fixed heads.

After Wilson's talk, the audience was given a unique plant tour via video tape. Earlier in the day when the plant was in operation various shots of the manufacturing and assembly areas had been recorded on the VR-1500. Now the audience was able to view this activity without leaving their seats.

Finally, our hosts recorded and played back various shots of the audience via the VR-1500 recorder. This dramatized the immediate playback and editing capability of such recorders. In summary, the meeting presented an insight into the planning and development process necessary to bring a video tape machine into production, plus an effective demonstration of the machine itself.

RONALD K. CHURCH



"It says it's exactly one year old and wants a new supply of tapes of MYLAR® for its birthday."

What a coincidence . . . "Mylar"* is having a birthday, too. It's ten years old. In the decade since it was first introduced as a base for recording tape, "Mylar" has consistently been the most used, most trusted tape base for all EDP applications. And why not? "Mylar"

is strong (a tensile strength of 20,000 psi), stable (unaffected by temperature or humidity changes) and durable (can't dry out or become brittle with age). Celebrate the birthday of "Mylar" by giving yourself the gift of reliability. When reliability counts, count on "Mylar".



Better Things for Better Living
... through Chemistry

only DU PONT makes

MYLAR®
POLYESTER FILM

*Du Pont's registered trademark for its polyester film.

ENGINEERING MANAGERS and ENGINEERS

B.S., M.S., Ph.D.

*Exceptional Opportunities
for*

CIRCUIT DESIGNERS
SYSTEMS ENGINEERS

and

SALES ENGINEERS

in

Digital and Analog
Instruments and Computers
Data and Telemetry Systems

RF Instruments
and Systems

Communications Systems

Control and Servo Systems

Microwave Devices

Integrated Circuits

*for personal and
confidential referrals
to client management,
at no cost to you,
or further information
with no obligation,
phone for appointment or
submit résumé.*

NORTHERN CALIFORNIA PERSONNEL

(a technical agency)

220 CALIFORNIA AVE.

PALO ALTO

DA 6-7390

wescon news

1964 COMMITTEES NAMED

Thirty industry executives who will head the working committees of WESCON were named recently by S. H. "Penny" Bellue, Packard-Bell Electronics, who is chairman of the executive committee for the 1964 show.

WESCON will be held in Los Angeles August 25-28, with exhibit areas in Memorial Sports Arena and Hollywood Park racetrack, and technical sessions at the Statler-Hilton Hotel. Exhibits will total about 1,200 booths, nearly equal to previous years, Bellue announced.

WESCON committee chairmen and vice chairmen head 14 committees which will have an eventual membership of 300 volunteers. Half of these committees, more closely related to the "convention" side of WESCON, will report to the convention director, Ralph A. Lamm (Bendix Pacific); the other seven, more concerned with "show" activities, report to Hugh P. Moore (Technical Systems Inc.), who is show director. Bellue, Lamm, Moore, Manager Don Larson, and Edward C. Bertolet (Behlman-Invar), chairman of WESCON's board, make up the 1964 executive committee.

Bellue announced the following appointments:

Technical Program: Dr. Robert R. Bennett (TRW Space Technology Laboratories), chairman; Dr. George F. Smith (Hughes Research Laboratories), vice chairman.

Future Engineers: Charles M. Edwards (The Bendix Corporation), chairman; E. H. Schreiber (Pacific Telephone), vice chairman.

Exhibits: Ben Warner (Packard-Bell), chairman; Edward W. Watts (Instrument Specialists Inc.) and Robert Guss (Beckman), vice chairmen.

Distributor-Manufacturer-Representative Conference: Herb Becker (Herb Becker Co.), chairman; Homer Neilsen (Kierulff Electronics), vice chairman.

Banquet: John J. Guarrera (Guide Manufacturing Co.), chairman; John F. O'Halloran (O'Halloran Associates), vice chairman.

Cocktail Party: R. E. Darringer (Pacific Scientific Co.), chairman; Jack Beamish (Litton Industries), vice chairman.

Facilities: Einar Ingebretsen (Lockheed Missiles & Space Co.), chairman; Spence B. Varian (The Singer Co.)

and Benton Bejach (Mincom Div. MMM Co.), vice chairmen.

Hospitality: William J. Moreland (Conrac), chairman; Charles C. Olsefsky (Lockheed Missiles & Space Co.) vice chairman.

Industrial Design: Philip J. Quinn (Mincom Div. MMM Co.), chairman; George Akin (FI Industries), vice chairman.

Public Relations: David T. Traitel (Electro-Optical Systems), chairman; Don Flamm (Aeroneutronic), vice chairman.

Registration: T. L. Golmis (Hughes Aircraft), chairman; John E. Barker (Space and Information Div., NAA), vice chairman.

Technical Tours: John H. Ganzenhuber (Hughey & Phillips Inc.), chairman; V. J. Braun (System Development Corp.), vice chairman.

Visitors Services: Robert C. Tethrow (Arnold Engineering), chairman; Charles R. Fetty (WESTRON), vice chairman.

Women's Activities: Mrs. Dana Johnson, chairman; Mrs. Burgess Dempster, vice chairman.

Among other interesting findings in a recent study were that more than half of the WESCON visitors devote more than four hours to exhibit viewing, that most engineers plan their exhibit viewing in advance, and that most of them spend most of their time studying exhibits that are related to their own jobs or fields of interest.

Since most visitors "know where they are going in advance," there was confirmation of another finding in the study: that booth location has very little effect on the interest of the audience in that booth. In the study, such elements as the education, job title, age, and area of general technical interest were considered for every responding visitor.

It was also determined, Bellue said, that the relatedness of interest among categories—i.e., between components and automatic control, for example—are measurable with accuracy. The study design, prepared by Peter Sherrill of West Associates, former Grid publications advisor, included a correlational matrix which, through computer analytic techniques, compared each of 48 "gross" product categories with every other one in terms of specific interest by visitors.

"The nine categories of exhibits 'emerged' from factor analysis, and so did the optimum grouping of them at



"Penny" Bellue

the Sports Arena and Hollywood Park," Bellue commented.

Bellue said that WESCON's technical program will be transmitted on closed-circuit TV, so that a visitor to the exhibit arenas can participate in technical sessions. Special hookups will be provided for asking questions from the viewing rooms.

Shuttle buses will be scheduled on a continuous basis from downtown to both arenas, between both arenas, and from both arenas to the airport area.

The annual WESCON cocktail party will be held in the spacious clubhouse of Hollywood Park, Bellue said, and noted that unlimited parking at both the Sports Arena and Hollywood Park will be available. Full restaurant and refreshment facilities will be open at both locations, and registration of visitors will be undertaken at both arenas.

Here's your 500' SHELF

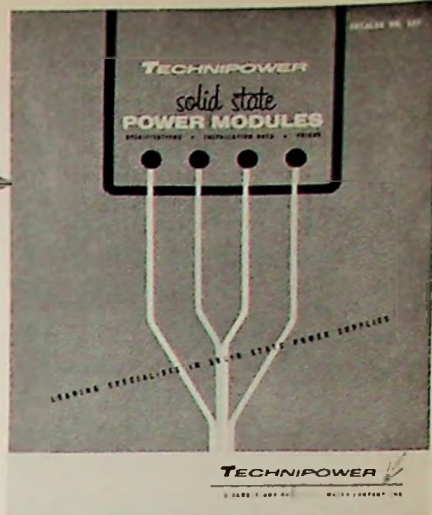
of solid state DC POWER MODULES

The 1964 Technipower catalog gives you a choice of more than 3600 standard modules, in practically any wattage and temperature rating your design requires. The several hundred most popular models are inventoried in depth, ready for immediate delivery! Included are:

REGULATED AC-DC MODULES — $\pm 0.05\%$ accuracy, 0.5 to 325 VDC, low ripple, temperature ratings 65°C to 115°C;

REGULATED DC-DC CONVERTERS — Wide range of outputs at 15, 30, 60 watts, 24 and 28 VDC input, $\pm 0.5\%$ accuracy;

DC-DC REGULATORS — Low cost, wide range of outputs, $\pm 0.05\%$ accuracy, ideal for local regulated DC from higher voltage bus;



UNREGULATED AC-DC MODULES—0.7 to 1000 VDC and to 1000 watts, low cost, 80°C temperature rating;

HEAVY CURRENT SCR MODULES — Regulated DC to 2000 watts.

The 1964 catalog also lists heat sinks, rack mounts, and gives complete installation and cooling data. Request your copy now.

TECHNIPOWER

INCORPORATED 18 MARSHALL STREET, SOUTH NORWALK, CONNECTICUT

A SUBSIDIARY OF BENRUS WATCH COMPANY, INC.
Represented by Smith-Dietrich Sales Co., 210 Town & Country Village, Palo Alto, Calif. (415) 321-4321

WIDEBAND FM RECEIVERS

For FM TELEMETRY And
HIGH RESOLUTION
FM TV



Model CR 303-9-1
RF 960 mc
IF 20 mc wide
Baseband 8 mc

RHG builds the widest selection of special purpose receivers. RHG will custom build a system to your specifications. Such features as wideband FM with basebands to 15 Mc, gain and phase matched IF channels, and IF laboratory receivers at 30, 60, 70, 105 and 200 Mc are standard. Available in solid state or tube versions. Write or call for full details.

RHG ELECTRONICS

WALTER ASSOCIATES

P.O. BOX 790 • MENLO PARK, CALIFORNIA
415-DA-3-4606



WORKING ON
Projects
INVOLVING
Antennas
AND ANTENNA EQUIPMENT?

Andrew can help you solve your problems in this specialized field of antennas and transmission lines. You are invited to write for catalogs in area of your interest.

Telemetry, Catalog T—Ground to air antenna systems for 25-3000 Mc, rotators and coaxial patch panels.

Hubloc Antennas, Catalog D—Setting new standards in large parabolic antenna design, sizes to 60 ft. dia. Technical data on antenna feeds, radomes, tower mounts.

Microwave, Catalog M—Parabolic antennas for use in 800 Mc to 12 Gc range with associated equipment; mounts, radomes, waveguides.

Heliac, Catalog H—Heliac, the flexible air dielectric copper cable in sizes up to 5" in 50, 75 and 100 ohms.

Transmission Lines, Catalog R—Rigid coaxial lines are available in sizes 7/8" to 14" in 50 ohm and other impedances. RF switches and other accessories available.

Fixed Station, Catalog F—Mobile radio service antennas, flexible foam Heliac cables for complete system installation.

Telescoping Masts, Catalog P—Offers a large selection of standard pneumatic masts for variable extended heights.

Call or write . . . Bill Sirvatka
 701 Welch Road
 Palo Alto, California 94304
 Phone: (415) 323-3139



Andrew

meeting review

DATA RETRIEVAL MACHINE

Jacob Goldberg and LeRoy Younker, senior research engineers at Stanford Research Institute, addressed the January meeting of the PTC chapter on Electronic Computers, describing the research and development leading to MIRF, a data retrieval machine using an associative memory.

The machine was designed to shorten the "user to documents to ideas to user loop" encountered in information retrieval, document abstracting being used to allow a greater number of articles to be searched. Coordinate indexing is used, which consists of a set of descriptors or key words for each document, conventional card indexing schemes having the problem of field indeterminacy resulting from the many possible locations of a descriptor in a string. This is solved by using the technique of superimposed coding, a single code or field describing a document. Retrieval is accomplished by comparing the code derived from an inquiry with all of the items in memory. This comparison in the MIRF is accomplished simultaneously, i.e., during a single memory cycle.

The feasibility model was designed to store the superimposed description code, an accession number, and associated data for up to 5,000 documents. Each document could have up to 8 descriptors with a maximum of 10

alphabetic characters each. A vocabulary up to 3,000 descriptor words was allowed.

The machine is comprised of two associative memories, a control section, and an input/output typewriter. One MIRF is used to store the document information while the other stores the dictionary for making the transformation from alphabetic descriptors to compact binary codes. The memories are comprised of split "C"-shaped cores with interlaced wiring forming a permanent memory. The information is wired into memory using a special machine which allows the information to be transferred from cards to wires. The wiring is done by hand, although it was suggested that it could be automated. The parallel interrogation is accomplished by activating the cores with the interrogation code and sensing the induced voltage on the wires.

A typical inquiry consists of the following sequence: (1) the set of descriptors is typed and converted to a search code, (2) the file is interrogated and a yes/no response produced in 5 μsec indicating if the file had any matching items, (3) if there were matching items the number of items responding is read out in microseconds, and finally (4) the accession numbers of the matching items are typed at a millisecond rate.

The primary advantage of the ma-

Professionals, In Sales And Service

Aerojet - General Corp.
 Commercial Products
 Azusa, Calif.

Boonton Electronics Corp.
 Parsippany, New Jersey

Datapulse, Inc.
 Inglewood, Calif.

EMI Electra Megadyne Inc.
 New York, N.Y.

Electrical Standard
 Repair Service Inc.
 North Hollywood, Calif.

Laboratory For Electronics
 Waltham, Mass.

Narda Microwave Corp.
 Plainview, L.I., N.Y.

Paradynamics, Inc.
 Huntington Sta., L.I., N.Y.

Sensitive Research Inst.
 Singer - Metrics
 Bridgeport, Conn.

Sorensen
 A Unit of Raytheon
 South Norwalk, Conn.

Spectra - Physics, Inc.
 Mountain View, Calif.
 Wiltron Co.
 Palo Alto, Calif.



O'HALLORAN ASSOCIATES

ELECTRONICS ENGINEERS • SALES REPRESENTATIVES
 11636 VENTURA BLVD., NORTH HOLLYWOOD, CALIFORNIA

- No. Hollywood, California Triangle 7-0173
- Palo Alto, California Davenport 6-1493
- Anaheim, California Jefferson 4-5818
- San Diego, California Academy 4-2824
- Phoenix and Tucson, Arizona Enterprise 1200



WEN BROWN

MBA Stanford
 1964 Member Million Dollar Round Table

701 WELCH ROAD, SUITE 2222, STANFORD PROFESSIONAL CENTER
 PALO ALTO, CALIFORNIA 326-1554 RES. 854-5509

**Assistance in
 PERSONAL ESTATE
 & FINANCIAL PLANNING**

(No fee for these planning services)

- Analysis of personal insurance, group and social security benefits
- Funding estate costs, taxes and death expenses, man or wife
- Family insurance trusts—lifetime family income
- "Split Dollar" Plans—executive travel coverage
- Mortgage protection in event of death or disability
- College education funding and children's plans
- Disability Income—Salary Continuation—deferred executive compensation
- Major medical and hospitalization coverage
- Private pension and annuities (HR-10 Keogh Bill)—retirement plans
- Business Insurance—sole proprietorship, partnership, corporation, keyman, stock redemption—Sect. 303, profit sharing & pensions

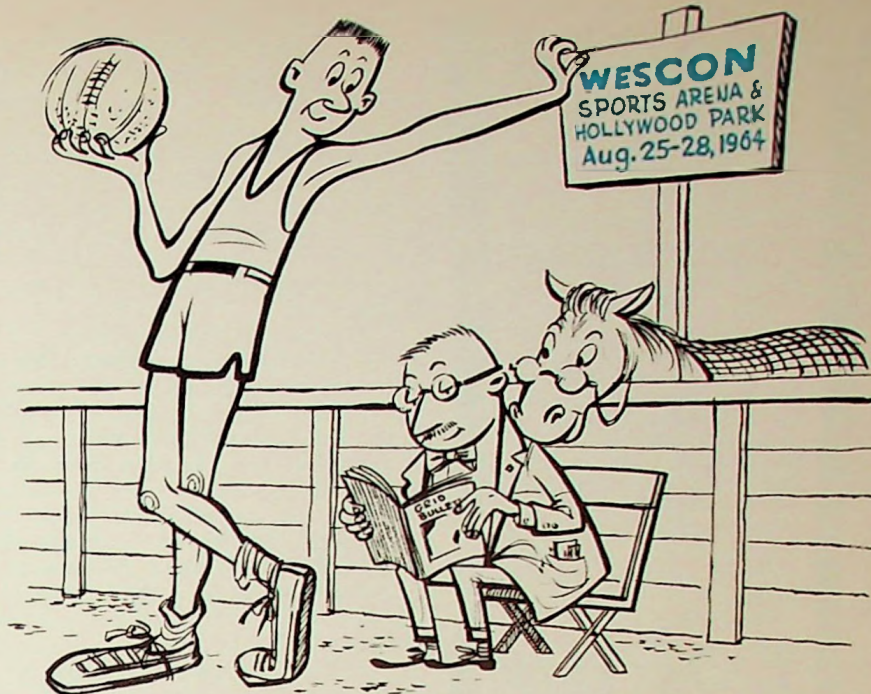
IEEE INSURANCE PROGRAM

Complete information kits on the IEEE insurance program, including the group life insurance plan for members and their eligible dependents (underwritten by New York Life Insurance Co.) and accidental death and dismemberment coverage for members and their spouses (underwritten by American Casualty Co.), may be obtained by writing to: Administrator, IEEE Insurance Program, 1120 Connecticut Ave., N.W.—Suite 920, Washington, D.C.

chine stems from the real time response which allows a search request to be modified based on the previous response. For example, if after making a request the machine indicates that there are 400 documents that satisfy the description, the operator would make a more specific request to screen out many of the documents.

The special problem of false response using the superimposed coding technique was discussed. The machine also had automatic correlation of synonyms and was able to handle cross references originating from the retrieved documents.

WILLIAM R. SMITH



WHEN YOU ADVERTISE IN **GRID-BULLETIN**
YOU GET LOTS OF BONUS* READERS

* Actually 3,000 of 35,000 copies are distributed at WESCON. All others are mailed to IEEE and WEMA members in 11 western states, using highly selected, controlled lists available only to the *Grid-Bulletin*—IEEE's own official WESCON magazine, jointly published by the SF and LA Sections only in July and August.

Rates are extremely low—\$17 per K readers. Space demands are high; if your firm wants in, let us know right away!

CLOSING DATES: June 19 for July issue, July 13 for August issue SEND insertion orders, copy, to:

IEEE GRID-BULLETIN, SUITE 2210, 761 WELCH ROAD, PALO ALTO
415-321-1332

SENIOR RF DESIGN ENGINEERS

Experienced engineers are needed for key positions in analysis and design. Current specialization in one or more of the following areas is required:

- RECONNAISSANCE - SURVEILLANCE
- DECEPTIVE ELECTRONIC COUNTER-MEASURES
- TELECOMMUNICATIONS

These positions, created by company expansion, require at least 5 years of design experience in advanced circuitry for complex RF systems. The ability to carry through the development of subsystems and to contribute to over-all system design is essential.

To the qualified engineer with BSEE or advanced degrees, ATI offers a challenging and rewarding opportunity for advancement with a growing, vigorous organization that specializes in complete design and manufacture of complex systems.

Excellent employee benefits program.

Direct your inquiry to:

Mr. Vernon Barker
Director of Administrative Services

APPLIED TECHNOLOGY, INC.

3410 Hillview Avenue
Palo Alto, California
Phone: (415) 321-5135

An equal opportunity employer

DIELECTRICS

Controlled dielectric constant materials machined to precise specifications.

At Custom Materials we specialize in all phases of manufacturing, engineering and machining of CMI dielectric materials. Extensive experience in machining of CMI silicone- and styrene-base dielectrics assures you of precision work at low cost on single units or production runs. Custom Materials also has complete inspection facilities including calibrated dielectric measurement equipment for quality control.

Large inventory of silicone- and styrene-base dielectrics, and R.F. load materials.

Precision controlled dielectrics available in sheets, rods or blocks.

Fabrication of prototypes and high-volume production. Complete literature available on request.

CUSTOM MATERIALS, Inc.
Alpha Industrial Park, Chelmsford, Mass.

Standard dielectric materials immediately available from West Coast stock, call: **JAY STONE & ASSOCIATES**
140 Main Street • Los Altos, Calif. • Area 415-948-4563

FORUM

Time . . . Talent . . .
Tact and Desire

The problem facing engineer and potential employer is one primarily of Time. Time to seek out the opportunity or the man . . . time to contact or be contacted . . . time to interview or be interviewed . . . time to plan and time to make a decision.

Forum buys you this Time. Forum has the engineering oriented counselors with the talent to evaluate a man and his potential. Forum has the tact to conduct all of its work in the strictest confidence and Forum has the desire to place professional people with equally professional firms.

If you are currently employed, have two or more years experience, and earning in excess of \$8,000, let us take the time to move you ahead.

FORUM

PERSONNEL AGENCY



378 Cambridge
Palo Alto
California
321-6582
Affiliates in
major cities
throughout
the country.

meeting review

PHASE MEASURING

On January 22, the PTCMTT chapter heard two speakers describe microwave phase measurement systems. The first was Dr. Peter Lacy of Wiltron Co., followed by Dr. Seymour Cohn of Rantec Corp. A panel consisting of Richard Borghi, Bernard P. Hand, Richard Honey, and Vernon Price then discussed the two systems described.

Dr. Lacy explained a phase-measuring technique using a slotted line and a carriage containing two probes. A reference signal is fed into one end of the line, and the unknown signal into the other end. The resulting nulls can then be located with the probes, and phase determined from this location. In some applications carriage travel provides the desired information, as when measuring a differential phase shift. The slotted line can also serve as the indicator in a phase bridge.

These systems cover several octaves in coaxial lines and full bands in waveguide, and can provide an accuracy of 0.2° . The signal being measured can be either pulsed or modulated at one kc/sec. The same system can also measure delay time. In this application it can resolve delay distortion of one nanosecond.

In the device described by Dr.

events of interest

IEEE PAPERS CALLS

June 8—1st Annual Conf. on Industry & Comm. Power Systems, Oct. 6-8, Philadelphia, Pa., I&CPS/TC. A. M. Killin, Union Carbide, Ashtabula, Ohio.

June 8—East Coast Conf. on Aerospace & Navig. Elec. (ECCANE), Oct. 21-23, Baltimore, Md., PTC-ANE/Baltimore Sect. Richard Allen, Martin Co., Mail 683, Baltimore 3, Md.

Cohn the rf signal is split into two branches, one of which contains the unknown. After one signal is modulated at a one kc/sec rate, the two signals are recombined in a phase discriminator. The discriminator circuit produces signals proportional to $\sin\theta$ and $\cos\theta$, and $\tan\theta$ is then found by a ratiometer which is calibrated to display the angle, θ .

When making cw measurements with this device the output of the test component can be as low as -50dbm , but this advantage is lost when making pulsed measurements. Since the phase discriminator produces signals equal to $\sin\theta$ and $\cos\theta$, the basic equipment can be used to make a Smith chart plotter, and both phase indicators and impedance plotters have been built.

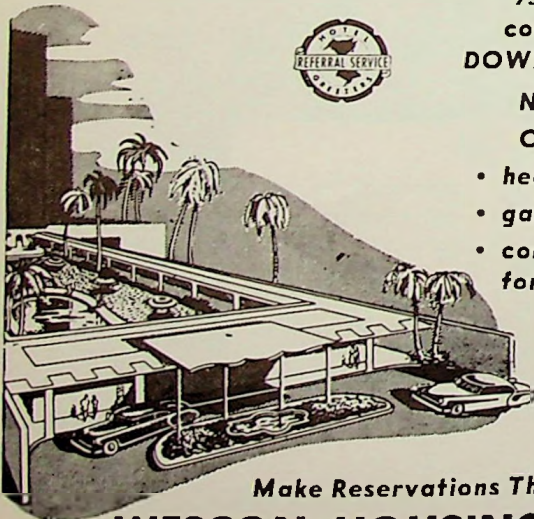
R. J. PRICKETT

During WESCON

plan to stay at the

HOTEL FIGUEROA

most convenient to the Sports Arena and Technical Meetings



939 S. Figueroa Street
corner of Olympic Blvd.
DOWNTOWN LOS ANGELES

NEW COFFEE SHOP
COCKTAIL LOUNGE

- heated swimming pool
- garden, patio
- convenient guest entrance for motorists

AMPLE PARKING

Make Reservations Through

WESCON HOUSING BUREAU

using blue forms mailed to IEEE members

LOS ANGELES
WESCON
AUGUST
25-28

It's that time again!

We are staffed to aid you with production of your advertising material—from its inception through the printed literature you will need—or any part of it.

THE NATIONAL PRESS

designers • lithographers
printers • publishers

850 Hansen Way • Palo Alto, California

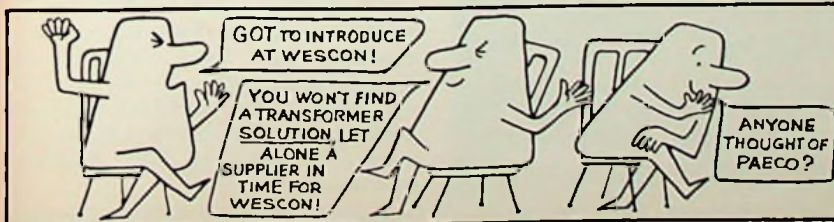
Telephone (415) 327-0880

MANUFACTURER / REPRESENTATIVE INDEX

<p>Obbey Electronics Corp. McCarthy Assoc. Accutronics, Inc. G. S. Marshall Co. Advanced Development Lab Jay Stone & Assoc. Aero Geo Astro Corp. Costello & Co. Aeritech Jay Stone & Assoc. Airborne Instruments Lab. Wright Engineering Alfred Electronics Moxon Electronics American Electronics Labs Perlmuth Electronics Antlab, Inc. Jay Stone & Assoc. Applied Magnetics Corp. The Thorson Co. Applied Research, Inc. Jay Stone & Assoc. Astrodata, Inc. Moxon Electronics Autronics Corp. The Thorson Co.</p>	<p>Fabri-Tek, Inc. Costello & Co. Fabricast Inc. Costello & Co. Fairchild Semiconductor G. S. Marshall Co. Fifth Dimension, Inc. Perlmuth Electronics</p> <p>Gertsch Products, Inc. Dynamic Associates</p> <p>Hammer Electronics McCarthy Assoc. Holex, Inc. The Thorson Co. Holt Instruments Laboratories W. K. Geist Co. Honeywell-Denver Div., Lab Standards Geist Hyletronics Corp. The Thorson Co. Hyperion Industries, Inc. McCarthy Assoc.</p>	<p>Pentrix Corp. Wright Engineering Phaotron Instrument & Elect. Co. Tech-Ser, Inc. George A. Philbrick Researches, Inc. Tech-Ser, Inc. Polarad Electronics T. Louis Snitzer Co. Potter and Brumfield Elliott Recht Assoc. Precision Mechanisms Corp. Components Sales</p> <p>Quan-Tech Labs Jay Stone & Assoc.</p> <p>Rawson Electrical Instrument Co. McCarthy Assoc. Ray Proof Corp. McCarthy Assoc. Raytheon-Rayspan Perlmuth Electronics Renco Dry Box Glove Company White & Co. Rixon Electronics, Inc. Costello & Co. Rohde & Schwarz Sales Co. W. K. Geist Co. Rowan Controller Co. Artwel Electric Royal McBee Corp., Ind. Prod. Div. Costello Rutherford Electronics Moxon Electronics</p>
<p>Barnes Engineering Co. Costello & Co. Bausch & Lomb, Inc., Elect. Sect. Perlmuth Beckman/Berkeley Division V. T. Rupp Co. Beckman/Computer Operations V. T. Rupp Co. Behlman/Invar Electronics T. Louis Snitzer Co. Blaw-Knox The Thorson Co. Bryant Computer Products Costello & Co. Burmec Electronics McCarthy Assoc. Burr-Brown Research Corp. W. K. Geist Co.</p>	<p>Impact-O-Graph Corp. White & Co. Ireland Motor Corp. Costello & Co.</p> <p>Keithley Instruments T. Louis Snitzer Co. Kewaunee Scientific Equipment White & Co. Kemet Co. G. S. Marshall Co. Kepeco, Inc. V. T. Rupp Co. Kinetics Corporation The Thorson Co. Knights Co., James G. S. Marshall Co. Kollmorgen Corp. W. K. Geist Co. KRS Electronics V. T. Rupp Co.</p>	<p>Sage Laboratories The Thorson Co. Sandefur Engineering Co., Inc. Tech-Ser, Inc. Sangamo Electric, Elect. Sys. Div. Perlmuth Scott, Inc. H. H. W. K. Geist Co. Sequential Electronic Systems White & Co. Sierra Electronic Div., Philco T. Louis Snitzer Co. Sonex Corp. Perlmuth Spectra-Physics, Inc. O'Halloran Assoc. Sperry Microwave Company McCarthy Assoc. Stewart Engineering Co. Perlmuth Electronics Systems Research Corp. Moxon Electronics</p>
<p>Century Electronics & Instruments V. T. Rupp Co. Clairex Corp. Moxon Electronics College Hill Industries (form. Speidel) Perlmuth Comcor, Inc. Moxon Electronics Computer Instruments Corp. Components Sales Computer Measurements Co. Moxon Electronics Consolidated Ceramics & Metalizing Jay Stone Custom Materials, Inc. Jay Stone & Assoc. Corning Delay Lines Costello & Co.</p>	<p>Landis & Gyr, Inc. Recht Assoc. Lavole Laboratories, Inc. McCarthy Assoc. Lind Instruments, Inc. The Thorson Co. Lindgren & Associates, Erik A. White & Co. LTV Military Electronics Div. Tech-Ser, Inc. Ling-Temco-Vought, Inc. Tech-Ser, Inc.</p>	<p>Tally Corp. Moxon Electronics Telonic Industries & Eng. T. Louis Snitzer Co. Tenney Engineering, Inc. The Thorson Co. Test Equipment Corp. V. T. Rupp Co. Thermal Systems, Inc. Costello & Co. Trak Microwave Corp. Wright Engineering Trygon Electronics, Inc. Moxon Electronics</p>
<p>Data Equipment Co. Moxon Electronics Datamec Corporation Moxon Electronics Decker Corporation Costello & Co. Diamond Antenna & Microwave Corp. Wright Di/An Controls, Inc. Wright Engineering Digitronics Corp. Components Sales Calif.</p>	<p>Magnetic Shield Div., Perfection Mica Perlmuth Marconi Instruments Moxon Electronics McLean Engineering Labs T. Louis Snitzer Co. McLean Syntorque Corporation T. Louis Snitzer Co. Melcor Electronics Corp. Components Sales Calif. Metex Electronics Corp. Perlmuth Electronics Metron Instrument Co. Components Sales Calif. Micro Instrument Co. Jay Stone & Assoc. Microsonics, Inc. Perlmuth Electronics Microwave Associates Elliott Recht Assoc. Microwave Electronics Corp. Jay Stone & Assoc. Mid-Eastern Electronics, Inc. W. K. Geist Co. Millitest Corp. Components Sales Calif. Motorola Com. & Elect. Div. Perlmuth</p>	<p>United States Dynamics White & Co. Utah Research & Development Co. The Thorson Co.</p> <p>Velonex (Div. Pulse Eng.) T. Louis Snitzer Co. Vernistat Div. Perkin-Elmer Corp. Artwel Electric Vidar Corporation Moxon Electronics Vitramon, Inc. G. S. Marshall Co.</p>
<p>Eckel Corporation White & Co. Electro-Mechanical Research T. Louis Snitzer Electron Products G. S. Marshall Co. Electronic Components Div. Burroughs Corp. Tech-Ser, Inc. Electronic Products, Inc. Jay Stone & Assoc. Electronic Research Associates, Inc. Tech-Ser, Inc. Emcor, Ingersoll Products Div. T. Louis Snitzer Co. Eppley Laboratory, Inc. W. K. Geist Co.</p>	<p>Navigation Computer Corp. T. Louis Snitzer Co. Northeast Scientific Corporation White & Co.</p> <p>Optimization, Inc. McCarthy Assoc. Oregon Electronics Mfg. Co. White & Co.</p>	<p>Waters Corp. White & Co. Watkins-Johnson Co. Perlmuth Electronics Wayne-George Corp. Wright Engineering Weinschel Engineering, Inc. Jay Stone & Assoc. Weldmatic Div.—Unitek Corp. Tech-Ser, Inc. Western Microwave Laboratories, Inc. Jay Stone Wiltron Co. O'Halloran Assoc.</p>

REPRESENTATIVE DIRECTORY

<p>Artwel Electric, Inc. 1485 Bayshore Blvd., San Francisco; 586-4074</p>	<p>Geist Co., W. K. Box 746, Cupertino; 968-1608, 253-5433</p>	<p>O'Halloran Associates 3921 E. Bayshore, Palo Alto; 326-1493</p>	<p>Snitzer Co., T. Louis 1020 Corporation Way, Palo Alto; 968-8304</p>
<p>Components Sales California, Inc. Palo Alto; 326-5317</p>	<p>Marshall Company, G. S. 890 Warrington Road Redwood City; 365-2000</p>	<p>Perlmuth Electronics Mt. View; 961-2070 1285 Terra Bella Ave.,</p>	<p>Stone & Assoc., Jay 140 Main Street, Los Altos; 948-4563</p>
<p>Costello & Company 535 Middlefield Road, Palo Alto; DA 1-3745</p>	<p>McCarthy Associates 1011-E Industrial Way, Burlingame; 342-8901</p>	<p>Recht Associates, Elliott 175 S. San Antonio Road, Los Altos; 941-0336</p>	<p>Tech-Ser, Inc. 800 San Antonio Rd., Palo Alto; 326-9800</p>
<p>Dynamic Associates 1011-D Industrial Way, Burlingame; 344-2521</p>	<p>Moxon Electronics 15 - 41st Avenue, San Mateo; 345-7961</p>	<p>Rupp Co., V. T. 1182 Los Altos Avenue, Los Altos; 948-1483</p>	<p>The Thorson Company 2443 Ash Street, Palo Alto; 321-2414</p>
<p>Walter Associates Box 790, Menlo Park; 323-4606</p>	<p>White & Company 788 Mayview Ave., Palo Alto; 321-3350</p>	<p>Wright Engineering 126 - 25th Ave., San Mateo; 345-3157</p>	



Phone-close service is what Paeco offers, along with design know-how and production capability to solve your transformer problem fast, economically, dependably. Pick up the phone and see. If you don't make it to Wescon, it won't be because of Paeco. A load off your mind. For more information call Lloyd Burkhardt at 326-5360.



PAECO
620 Page Mill Road
Palo Alto, California 94304

Classified Advertising

ADVERTISING RATES:
 Members: \$15 for 1st col.-inch, \$10 for 2nd, \$5 for each additional. Non-members: \$20 for 1st col.-inch, \$15 for 2nd, \$10 for each additional. 10% frequency discount for 10 consecutive ads.

Consultants

RHO ASSOCIATES Incorporated

Dr. Robert H. Okada
 Consultants in
 Solid State Circuitry, Systems
 917 Terminal Way, San Carlos, Calif.
 593-7570

JORGEN P. VINDING

CONSULTANT

MICROWAVE 18780 WITHEY ROAD
 COMMUNICATIONS MONTE SERENO, CALIF.
 INSTRUMENTATION 354-9150

Position Available

PROJECT ENGINEER

Unusual opportunity to share in the stable growth of a manufacturer of spin resonance spectrometers and related devices. The position involves solution of microwave signal detection problems, complex modulation, and feedback amplifier circuitry. Interested applicants with a degree in Physics or Engineering contact

R. P. MacKenzie
 Alpha Scientific Laboratories, Inc.
 940 Dwight Way
 Berkeley, California, TH 8-5355

Advertisers Index

Andrew Corp.	12
Applied Technology Inc.	13
Barnes Engineering Co.	7
Brill Electronics	3
Wen Brown	12
Costello & Co.	2
Custom Materials	13
Dupont—Mylar Div.	9
Forum Personnel	14
General Radio Co.	Cover 4
Gertsch Products, Inc.	Cover 3
Grid-Bulletin	13
Hotel Figueroa	14
National Press	14, 16
Neely Enterprises	1
Northern California Personnel	10
O'Halloran Associates	12
Paeco Div.—Hewlett-Packard Co.	15
RHG Electronics Laboratory, Inc.	11
Specific Products	8
Technipower, Inc.	11
Tektronix, Inc.	Cover 2
Western Gold & Platinum Co.	6

BIOLOGICAL ENGINEER

Engineer to be a full-time member of research group working on the physiology of the smooth muscle. Background in biological research valuable. Knowledge of instrumentation and computer programming needed.

BOX A - GRID

Educational Opportunity

SOLID STATE ELECTRONICS FOR UPGRADING ELECTRONICS ENGINEERS

This noncredit program will be presented on campus through lectures and workshop periods by a special faculty of professors and design engineers. The four-weeks vigorous program of mathematics, basic theory, basic devices and circuits, switching and logic circuits, modern devices, their application and circuits, is being presented by San Jose State College from July 13 through August 7, 1964. Enrollment fees \$600. Brochure available.

Inquiries should be directed to the
 Dean of Engineering
 San Jose State College
 San Jose, California 95114

grid swings

IT IS REPORTED:

William S. Price is one of three engineers who have joined the power systems engineering group of Bechtel Corp., San Francisco. A well-known authority on extra high voltage transmission systems and substation insulation coordination, he is currently serving on ten IEEE technical working committees and is chairman of one. He was formerly manager of electrical research for American Electric Power Service Corp. Wendal A. Morgan was formerly a special projects engineer for a power company in the Pacific northwest. Jack B. Sullivan spent the past 15 years in design and construction of transmission lines in the mid-west.

events of interest

IEEE PAPERS CALLS

June 30—NEREM (Northeast Elec. Res. & Engineering Mtg.), Nov. 4-6, Boston, Mass., Region 1. Dr. James E. Storer, Boston Sect., 313 Wash. St., Newton 58, Mass.

July 1—11th Nuclear Science Symp.—Instrum. in Space & Laboratory, Oct. 28-30, Philadelphia, PTGNS. W. A. Higinbotham, Brookhaven Natl. Lab., Upton, L.I., N.Y.

July 15—1st Natl. Conf. on Automotive Electrical & Elec. Eng., Sept. 22-23, Detroit, Mich., E. A. Hanysz Labs. Gen. Motors Res., G.M. Tech. Center, Warren, Mich.

MORE CHAIRMAN'S REPORT

Theory and Power chapters were organized and activated; Vehicular Communications and Aerospace organization is under way. Two former AIEE groups—Industrial, and Science and Electronics—continue as local units without benefit of portfolio from New York. Moves are afoot which might give these two a national body to relate to. Meantime, the unofficial meetings of the Industrial chapter have attracted turnouts as good as most of the chapters and subsections, an average over-all attendance figure of 59.3, highest in the history of the section, having been achieved in calendar 1963.

The principal continuing problems of the section are the handling of communications and mailing lists by headquarters, and financial problems resulting from local cutbacks and growing competition for the advertising dollar. I am confident that Jack Beckett and his fellow officers can cope with these and other problems which may arise.

WILLIAM A. EDSON

LOS ANGELES
 WESCON
 AUGUST
 25-28

It's that time again!

We are staffed to aid you with production of your advertising material—from its inception through the printed literature you will need—or any part of it.

THE NATIONAL PRESS

designers • lithographers
 printers • publishers

850 Hansen Way • Palo Alto, California

Telephone (415) 327-0880

NEW GERTSCH PHASE ANGLE VOLTMETER



—measures in-phase voltages, quadrature voltages, and phase angles

This versatile instrument accommodates up to 3 frequencies, employing plug-in filters and networks to 10 KC. You can order a single-frequency unit—then add or change frequencies as they are needed.

Variable gain control permits full-scale setting of any voltage from 1 mv to 300V, allowing equivalent angular error to be read directly in degrees and minutes. Ideal for synchro and resolver testing.

Band-pass filtering of both the signal and reference voltages minimizes effects of harmonic distortion, and noise.

Instrument can also be used as a standard VTVM (50 cps to 50 KC), and a phase-sensitive null indicator ($5\mu\text{v}$ sensitivity).

Available with isolation transformers for both signal and reference channels.

“Go”—“no-go” testing — enabled by optional full-scale meter relay.

Complete information on all Gertsch synchro/resolver test instruments is available. Write for bulletins on Synchro Bridges, Resolver Bridges, Synchro Standards, Resolver Standards, and/or Dividing Heads.

=Gertsch=

GERTSCH PRODUCTS, INC.

3211 S. La Cienega Blvd., Los Angeles 16, Calif. • Upton 0-2761 • Vermont 9-2201
Represented by Dynamic Associates

IS YOUR WAVE ANALYZER OUTDATED?

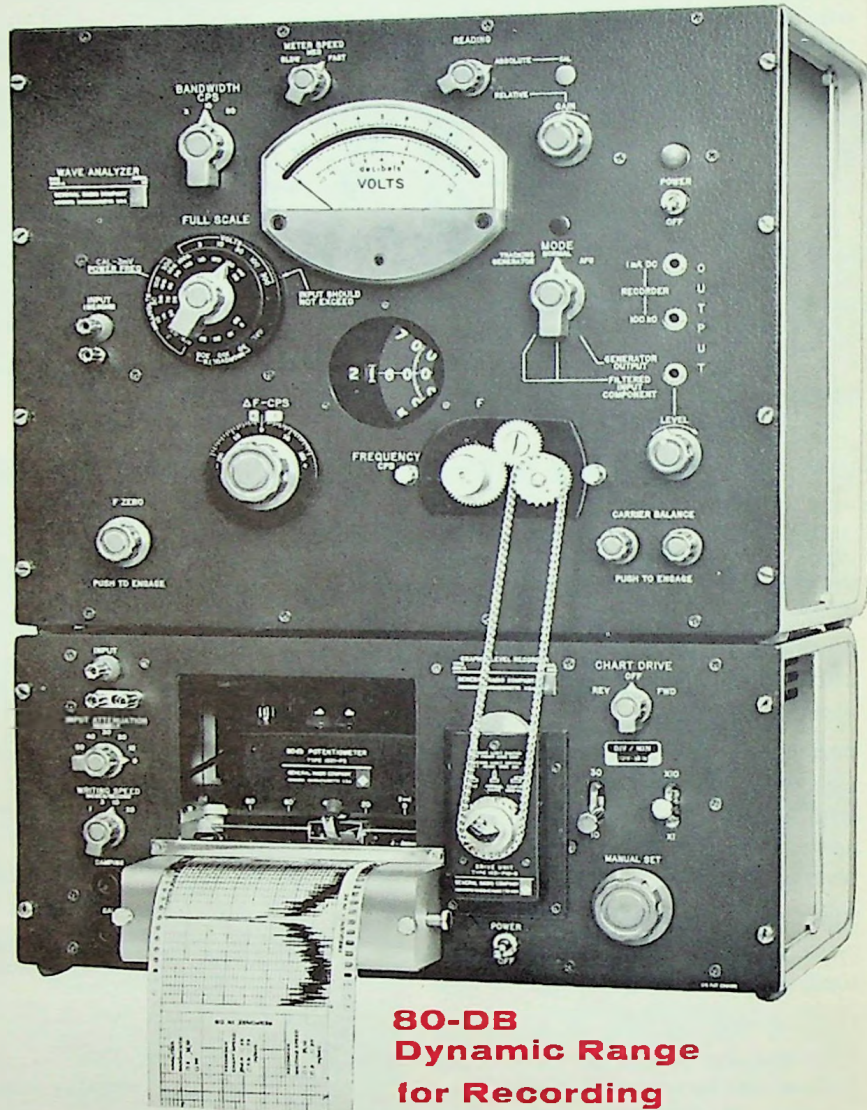


Make Your Own Comparison

The new Type 1900-A Wave Analyzer features:

- ★ **3 Bandwidths**, determined by quartz-crystal filters. Let you choose the best selectivity for each measurement whether your signal is periodic or random noise. 3-cps or 10-cps bandwidth for detailed measurements, 50-cps bandwidth for rapid analysis or for measurement of fluttering or drifting signals. Bandwidth skirts are better than 30-db down at ± 6 cps, ± 20 cps, and ± 100 cps for 3-, 10- and 50-cycle positions, respectively; 80-db down at ± 25 cps, ± 80 cps, and ± 500 cps.
- ★ **Linear 20-cps to 54-kc Range**. Easy-to-read in-line readout is graduated in 10-cycle increments. $\pm 0.5\%$ calibration accuracy. Output is provided for measurement of frequency components with a counter, where extreme accuracy is desired.
- ★ **Precise Frequency Settability** — incremental-frequency dial has twice the resolution of main dial — lets you fine-tune any component. Covers ± 100 -cycle range, independent of Analyzer center frequency.
- ★ **High Input Impedance (1-M Ω)** on all ranges, coupled with low-noise i-f circuits, makes for excellent sensitivity.
- ★ **Voltage Range** is 30 μ v to 300v, Full Scale, in 15 ranges. Accuracy, $\pm(3\%$ of reading +2% of full scale). Either absolute or relative levels of components are measured.
- ★ **AFC** allows Analyzer to "follow" a slowly drifting input signal.
- ★ **Choice of 3 meter speeds** for easier noise measurements — the meter does the averaging for you.
- ★ **Quick Calibration** — calibrating signal is always at power-line frequency so that it can be located quickly.
- ★ As a **"Tracking Generator"**, instrument is both a signal source (delivering 2v across 600 Ω) and a detector, tuned to each other exactly.
- ★ **Excellent Tunable Filter**. For example, the instrument can be used to produce 3-, 10-, and 50-cycle bands of noise over a tunable range from 20c to 54kc when a random-noise generator is connected to the analyzer input.
- ★ **Two outputs for Recording** — 100 kc with 80-db dynamic range, and 1-ma dc.

Type 1900-A Wave Analyzer... \$2150 In U.S.A.



Now, you can make uninterrupted analyses of the frequency spectrum — no attenuator switching in the midst of measurements. 1910-A Recording Wave Analyzer, \$3500 complete, including Analyzer, Recorder with 40-db and 80-db potentiometers, and all accessories.

Make Your Own Evaluation . . . Ask for a Demonstration

GENERAL RADIO COMPANY

WEST CONCORD, MASSACHUSETTS

Sales Engineering Office in SAN FRANCISCO: 1186 Los Altos Avenue, Los Altos, California
James G. Hussey • Donald M. Vogelaar • David M. Lloyd
Tel: 415 948-8233 • TWX: 415 949-7964