

## EDITOR'S PROFILE of this issue

*from a historical perspective ...*

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

July, 1961:

In July and August, the LA Section (Bulletin) and the SF Section (Grid) jointly publish the GRID-BULLETIN; it promotes the WESCON show and is distributed to members in both Sections. Although it has its own volume number (6), I'm treating it as a continuation of the GRID volume 7.

Cover: The focus is on the new "Dish" radio-telescope behind the Stanford campus.

p. 7: WESCON volunteers include Barney Oliver's wife Priscilla setting up women's activities. Prof. Alan Waterman (my EE advisor at Stanford) is in charge of the Future Engineers Show ("for bright lads – and probably a lass or two"). The winning author gets the Frederick Emmons Terman Award with \$250.

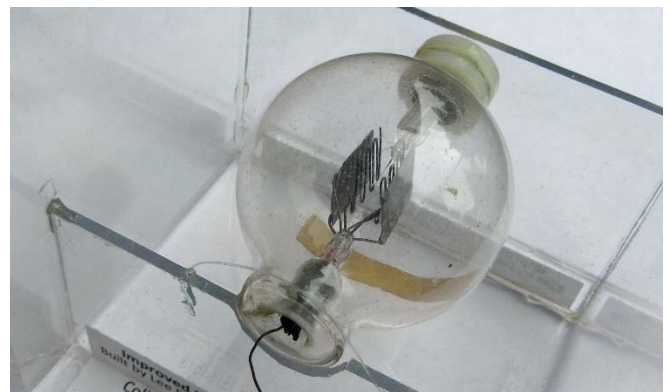
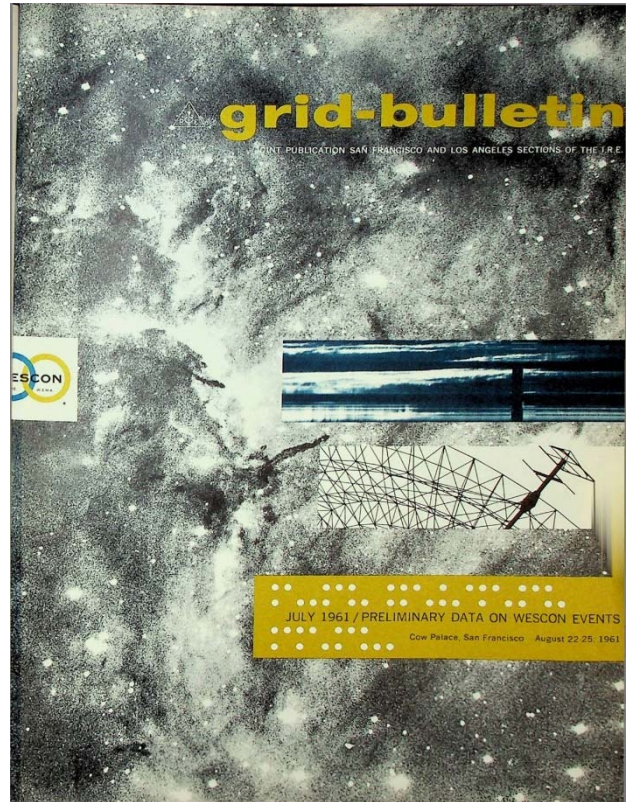
p. 8: With the new quantum device – the laser – a hot topic, WESCON has six papers on them, plus a demonstration. There are three sessions on information theory and 4 sessions on computers. Barney Oliver, head of HP Labs, gives a talk (p. 24) on optical masers.

p. 16: Andrew Viterbi of CalTech/JPL gives a talk on coherent synchronous sampled data telemetry systems; he went on to co-found Qualcomm, and the engineering school at USC is named after him.

p. 19: Hunter Vinton is profiled; he started the first IRE local publication in 1955 which then became the GRID. The name for our magazine comes from the tube element that, with modest voltage changes, modulates large swings in output voltage – an amplifier. Also mentioned on this page is Fred Terman, an IRE Fellow; on p. 32 there's a photo of David Packard, also an IRE Fellow.

p. 34: Prof. John Moll of Stanford gives a talk on P-N junction charge-storage devices; the Ebers-Moll transistor model is named for him; he was awarded the IEEE Edison Medal in 1991.

p. 37: Leonard Fuller, who had been chief engineer at Federal Telegraph and then head of EE at UC-Berkeley, is one of the IRE Fellows. His grandson showed me a box of items left to him by Fuller in 1965; inside were two audion tubes made during Lee De Forest's days at Federal Telegraph in Palo Alto (see figure). Fuller received the first EE PhD granted by Stanford (1919). His gift of an unused arc transmitter's magnetics to Ernest Lawrence in 1932 was used in a 42" cyclotron at UC-Berkeley, and resulted in 6 Nobel prizes for Berkeley physicists by 1960. He received the first IEEE Morris N. Liebmann Memorial Award.



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.

January, 2021

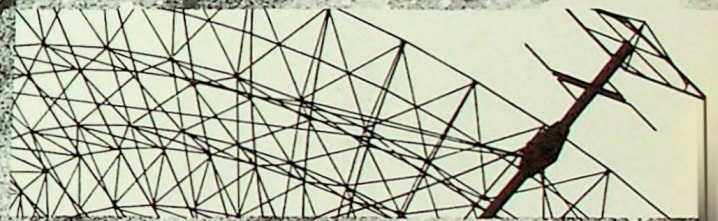
Contact [p.wesling@ieee.org](mailto:p.wesling@ieee.org)





# grid-bulletin

JOINT PUBLICATION SAN FRANCISCO AND LOS ANGELES SECTIONS OF THE I.E.E.



JULY 1961 / PRELIMINARY DATA ON WESCON EVENTS

Cow Palace, San Francisco August 22-25, 1961



Gertsch announces:  
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**Ideal for voltage and phase comparison.  
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**COMPLEX RATIO BRIDGE**—Models CRB-1B and CRB-2B. In these units, quadrature component reading is indicated either as rectangular coordinate,  $\tan \theta$ , or  $\theta$  directly in degrees. Useful for measuring angles as small as  $.001^\circ$ . Six-place resolution, with high accuracy. Cabinet or rack mounting.

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*Complete literature on all units sent on request. Bulletin CRB.*

*Gertsch*

**GERTSCH PRODUCTS, INC.**

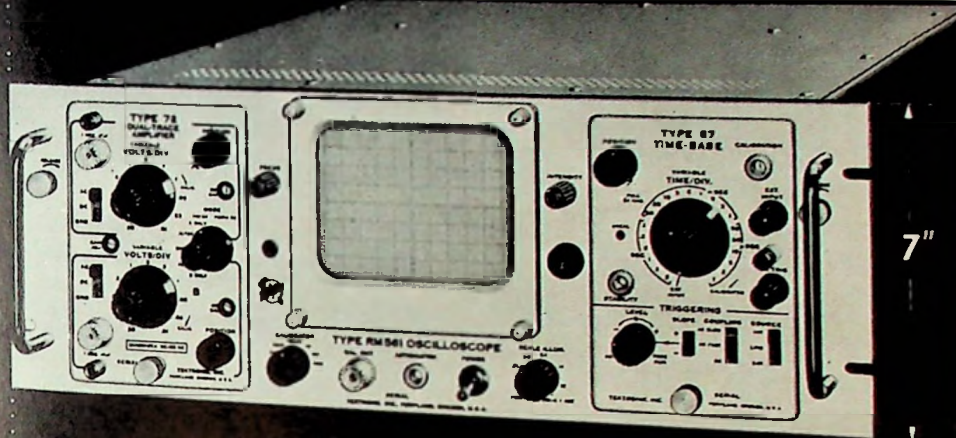
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**Type RM561  
 Oscilloscope**  
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 —basically an Indicator  
 which accepts a wide range  
 of plug-in units in  
 both channels.



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- ... which drive the crt deflection plates directly.
- ... which house approximately 3/4 of the circuitry.
- ... which contain minimum components and controls.

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5-inch rectangular cathode-ray tube • 3.5 kilovolts accelerating potential • 8 by 10 centimeter viewing area • Z-axis input • 6 calibrated square-wave voltages available—ranging from 1 millivolt to 100 volts • Regulated dc heater voltage thru separate regulator circuitry.

Regulated dc supply operates between 105 to 125 volts or 210 to 250 volts, 50 to 60 cycles ... provides 85 watts for powering all present and future plug-in units in this series.

See this Tektronix Oscilloscope at WESCON—Booths 1726-1728, 1823.

### AVAILABLE NOW Plug-in units presently available include:

<b>Type 50 Vertical Amplifier</b> Passband—15 cps to 200 kc. Sensitivity—1 mv/cm.	<b>\$115</b>	<b>Type 87 Time-Base Unit</b> Sweep rates—21 calibrated steps from 1 $\mu$ sec/cm to 5 sec/cm, accurate within 3%. Magnifier—5X.	<b>\$150</b>
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<b>Type 59 Basic Amplifier</b> Passband—dc to 400 kc, at maximum sensitivity. Sensitivity—approximately 1 v/cm, attenuation provided by variable potentiometer at the input. Maximum Input Voltage—600 volts.	<b>\$50</b>	<b>Type 75 Wide-Band Unit</b> Passband—dc to 4 mc. Sensitivity—50 mv/cm to 20 v/cm in 9 calibrated steps, with variable control. Risettime—approximately 85 nanoseconds.	<b>\$175</b>
<b>Type 60 1-MC Amplifier</b> Passband—dc to 1 mc. Sensitivity—50 mv/cm to 50 v/cm, calibrated decade-step attenuator (4 steps), with variable control.	<b>\$99.50</b>	<b>Type 63 Differential Unit</b> Differential input, 50-to-1 rejection ratio at maximum sensitivity. Passband—dc to 300 kc. Sensitivity—1 mv/cm to 20 v/cm in 14 calibrated steps, with variable control.	<b>\$125</b>
<b>Skeleton Plug-In Unit</b> Contains 24-pin connector, latch, front-panel overlay ... for constructing your own circuits. <b>\$15</b>			
<i>Prices F.O.B. Factory</i>			

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In Europe please contact Tektronix International A.G., Terrassenweg 1A, Zug, Switzerland, Phone (042) 4-91-92, for the address of the Tektronix Representative in your country.



*san francisco greetings*



**WELCOME TO WESCON**

On behalf of the San Francisco Section of the IRE, I would like to extend a cordial invitation to attend the 1961

WESCON. This year we are giving a special welcome to members of the International Astronomical Union who are meeting simultaneously with us in Berkeley. With their cooperation a joint technical session on radio astronomy is being held as part of the WESCON technical program. Special emphasis this year at WESCON is also being put on the area of generation and detection of coherent optical radiation using quantum-electronic techniques. An unusually strong technical program has been developed this year in a number of areas.

The general operation of WESCON as a convention and a show has become quite smooth by now, even though the size is continually growing. Those who have contributed so generously of their time and talent to this complex organization have made it a truly satisfactory place to meet your friends and see and discuss the new in electronics. On their behalf, a most hearty welcome to WESCON.

—DONALD A. DUNN  
CHAIRMAN, 1960-61  
SAN FRANCISCO SECTION, IRE

*los angeles greetings*



**WELCOME TO WESCON**

Los Angeles Section welcomes this opportunity to extend our congratulations to the San Francisco Section for its edition of the 1961 WESCON. We extend also a warm welcome to engineers and scientists throughout the nation to travel to San Francisco on August 22

to enjoy four days of our fine technical convention — and to enjoy the fringe benefits of many delights for the epicure and bon vivant offered by the Bay City.

We in Los Angeles, as IRE co-sponsors for the event, as part of the Seventh Region, and as host city in the even-numbered years, will be out in force to enjoy the many WESCON advantages up North this year. We've come to expect something new and worthwhile at each and every WESCON—the 1961 WESCON continues this tradition of technical show evolution. There will be an IRE Banquet, featuring International President, Dr. Lloyd Berkner, a new departmentalized arrangement of exhibits, and excellent papers on coherent light generators and quantum electronics, "breakthrough" subjects.

Nor should the old stand-by features be ignored. Forty significant technical sessions, 1200 exhibits of latest hardware, social events, ladies' program, future engineers show, industrial design awards, and eight field trips keyed to the technical program.

Altogether an appetizing menu, not to be missed. We'll be looking for you there!

—WALTER HAUSZ  
CHAIRMAN, 1960-61  
LOS ANGELES SECTION, IRE





*Albert J. Morris, Radiation at Stanford, chairman of the board; O. H. Brown, Eitel-McCullough, chairman of the executive committee; John V. N. Granger, Granger Associates, convention director; and Calvin K. Townsend, Jennings Radio Mfg., show director, ran the organization for WESCON 1961*

**Organization**

**WORKING TOWARD WESCON**

An impressive array of talent has been organized to lead the main committee functions of the 1961 Western Electronic Show and Convention in the San Francisco Cow Palace Aug. 22-25.

Albert J. Morris, WESCON board chairman, and O. H. Brown, chairman of the executive committee of WESCON's board, have headed up the organization that has been hard at work for several months planning the wide variety of activities associated with the West's largest technical conference and trade exhibition.

Answering to Dr. John V. N. Granger, convention director, are the following:

**Technical Program**—E. W. Herold of Varian Associates, chairman; L. G. Clarke of Stanford Research Institute, vice chairman.

**Facilities**—Robert Craig of Hanson Laboratory, Stanford University, chairman; H. M. Meyer of Stanford Research Institute, vice chairman.

**Field Trips**—Richard J. Reynolds of Hewlett-Packard Co., chairman; Robert Miller of Applied Electronics, Stanford University, vice chairman.

**Women's Activities**—Mrs. Bernard M. Liver of Los Altos Hills, chairman; Mrs. Norman H. Moore of Atherton, vice chairman.

**All-Industry Banquet**—John S. McCullough of Litton Industries, Inc., Electron Tube Division, chairman; Cortlandt Rensselaer of Dymec Division, Hewlett-Packard Co., vice chairman.

**Future Engineers Show**—Jack L. Melchior, chairman; Alan T. Waterman of Applied Electronics, Stanford University, vice chairman.

**Hospitality**—John A. Chartz of Dalmo Victor Co. and Donald B. Harris (SRI), co-chairmen.

Answering to Calvin K. Townsend, show director, are the following:

**Exhibits**—Jack Silhavy of Varian As-

sociates, chairman; Berkley J. Baker of Litton Industries, vice chairman.

**Visitors' Service**—W. A. Melchior of Eichorn & Melchior, Inc., chairman; Norman P. Hiestand of Varian Associates, vice chairman.

**Registration**—Robert E. Johnston of Jennings Radio Manufacturing Corp., chairman; Fred J. MacKenzie of Stanford Research Institute, vice chairman.

**Cocktail Party**—Emmet G. Cameron of Varian Associates, chairman; Glenn A. Walters of Dalmo Victor Co., vice chairman.

**Distributor-Representative Conference**—Elvin Feige of Elmar Electronics, chairman; Charles N. Meyer of Meyer and Ross Co., vice chairman.

**Industrial Design Competition**—Carl J. Clement, Jr. of Hewlett-Packard Co., chairman; J. W. Stringer of IBM, San Jose, vice chairman.

**Heading Public Relations**, which answers to Don Larson, manager of WESCON, are Peter N. Sherrill of Hewlett-Packard Co., chairman, and Charles Elkind of IBM, San Jose, vice chairman.

*astronomical in scope*

**THE TECHNICAL PROGRAM**

The IRE's leading part in WESCON is again being demonstrated in the current shaping of the technical program that will dominate the convention in San Francisco August 22-25. While the main responsibility for the technical program rests with committeemen from the San Francisco Section, a good deal of assistance has come from IRE members across the nation.

Edward W. Herold, chairman of the Technical Program Committee, and Lucian G. Clarke, its vice chairman, recently indicated their satisfaction with many of the excellent papers which have been submitted for consideration. Clarke said, "I have worked with the Program Committee of past WESCON meetings and there is every reason to think the 1961 program will be the most outstanding we have had in the San Francisco area."

Herold said that he felt the preprint

*(Continued on page 8)*



*E. W. Herold*



*L. G. Clarke*





Lloyd V. Berkner, Institute president, and speaker at the newly established WESCON Banquet, chats with Al Morris during the recent 7th Regional Conference in Phoenix

#### MORE PROGRAM

and publication policy, new with this year's WESCON, has paid off in making available the best material. "Our committee has been able to select from outstanding papers which were being reviewed for IRE Proceedings and Transactions, in addition to the many we always receive in response to our regular call for papers."

#### Joint Activity With the I.A.U.

Herold and Clarke explained a special feature of the convention program. There will be a combined session with the International Astronomical Union, which meets in Berkeley at the same time as WESCON. "We will be extremely fortunate in having in the area a large number of the world's most distinguished scientists in radio-astronomy," they said. "The tremendous interest in outer space and the valuable tools which have been provided by large antennas, masers, parametric amplifiers, high-power transmitters, and the like have given great impetus to further space exploration."

This combined session will include several specially prepared papers covering the latest developments in the field.

#### Quantum-Electronic Research

Herold is also enthusiastic about the part of the program which will feature new quantum-electronic research. He commented: "For the past few years we've been hearing a lot about masers. However, we must concede that such devices are chiefly useful as low-noise amplifiers or frequency standards. Now, with the advent of coherent light generators, or lasers, we are entering a completely new era in quantum electronics. Not only do we have the possibility of bridging the radio-to-infrared gap, but for the first time large enough power outputs at a single light frequency are available for communication, intense heating of microscopic

areas, and completely new instrumentation."

When not otherwise involved with WESCON, Herold is vice president of research for Varian Associates and Clarke is assistant general manager of engineering at Stanford Research Institute.

One hundred and twenty-three formal papers are listed in the accompanying program under 41 sessions, representing the latest in a wide range of technological developments by a broad segment of the nation's topflight engineering and technical management talent.

A major new field in the 1961 WESCON program is that of coherent optical emission, with six excellent papers on this highly significant topic. For the first time, the ruby optical maser has been used as an amplifier of light, rather than just as a generator. Papers will treat both developments. Another paper suggests that by using present generating and detecting equipment (a ruby-pulsed laser) under favorable conditions, it would appear that communications across our entire solar system is feasible. In one session a coherent light radar, known as Colidar, will be set up and demonstrated.

Throughout the history of electronics, the useful methods of amplifying have always been electrical in character. In a new development to be disclosed at the 1961 WESCON, it has been found possible to build an amplifier which uses no electric currents or electrical effects in its amplifying mechanism. Using non-linear acoustical phenomena in a quartz crystal, of the parametric amplification behavior is entirely different from that in conventional solid-state amplifiers, which also will be discussed.

#### Information Theory and Computers

WESCON will have a preponderance of papers in the fields of information theory (3 sessions) and computers (4 sessions). Among the 21 papers in these fields, one of the new applications of

computers stands out as most revolutionary—a very large computer known as the Iliac is being used at the University of Illinois as a teaching machine. Of even greater interest is the subject this computer is teaching—its own operation and uses. In the coming revolution in education, this new use of computers may develop into an important facet.

Some challenging engineering achievements in recent years have been made in the development of particle accelerators from which has arisen most of our understanding of nuclear physics. There are three giant machines presently being completed in the U. S.—one at Princeton, known as the Princeton-Pennsylvania accelerator, another at Brookhaven National Laboratory and the third at Argonne Laboratories, known as the "zero gradient synchrotron." A complete session of WESCON will cover major electronic aspects of each of these.

Another "first" to be heard at WESCON concerns a new industrial radiographic apparatus which produces such high-energy high-intensity x-rays that large objects can be examined in short exposures. For example, certain solid-fuel missiles are completely photographed in a few minutes, as against hours needed with prior methods. It appears that this new design, in which a linear accelerator was specially developed just for radiographic purposes, will revolutionize a vast part of industrial radiography in which only the betatron has hitherto been available.

#### Broad Appeal in Other Sessions

Herold and Clarke have commented on several sessions with more general appeal and some interesting new information to present: one on radio astronomy, two on satellite and space communications and a session on stereo f-m broadcasting. A special evening session covers "Technical Aspects of Arms Control."

#### PROGRAM

##### SESSION 1

##### BROADBAND ANTENNAS

Tuesday, August 22  
Room A—10:00 A.M.—12:30 P.M.

- 1/1 LOG-PERIODIC RESONANT-V ARRAYS  
P. E. Mayes and R. L. Carrel, University of Illinois, Urbana, Illinois.
- 1/2 DESIGN CRITERIA FOR LOG PERIODIC ANTENNAS  
Claes T. Elfving, Sylvania Electric Products Inc., EDL, Mountain View, California.
- 1/3 PROPERTIES OF A PAIR OF WIRE GRIDS FOR USE IN LENS-TYPE HF ANTENNAS  
M. Andreasen and R. L. Tanner, Stanford Research Institute, Menlo Park, California.
- Sponsored by Professional Group on Antennas and Propagation

Chairman and Organizer: Ray Justice, Granger Associates, Palo Alto, Calif.

##### SESSION 2

##### NEW MICROWAVE ELECTRON DEVICES

Room B—10:00 A.M.—12:30 P.M.

- 2/1 THE COAXIAL MAGNETRON, A SUPERIOR MICROWAVE POWER SOURCE  
H. M. Olson and L. H. Van Ohlsen, Bell Telephone Laboratories, Laureldale, Penna.
- 2/2 ANALYSIS OF A CROSSED-FIELD WAVEGUIDE AMPLIFIER  
W. C. Brown and G. E. Dambrowski, Spenser Laboratory, Raytheon Co., Burlington, Mass.

(Continued on page 10)

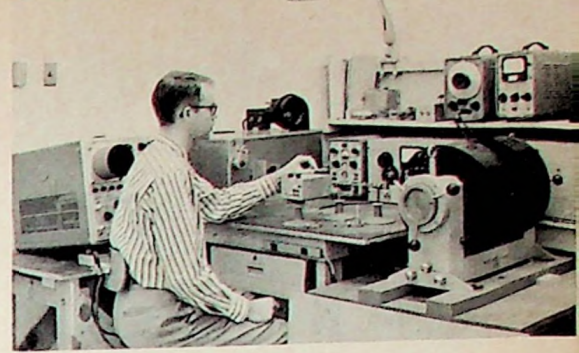




R. J. Reynolds



R. E. Miller



Thursday morning field trip goes to Melabs, Palo Alto, to see this 2-mm wave generation by frequency doubling in ferrite

## Bay area industry

### FIELD TRIPS

The concentration of engineers on the San Francisco Peninsula has produced a constant ferment of professional activity of keen interest to IRE colleagues across the country. WESCON's field trips, tied closely to the main body of the technical program, will concentrate this year on a band of activity running about ten miles north and south of the Stanford University campus.

Richard J. Reynolds of Hewlett-Packard Company and Robert E. Miller of the systems techniques laboratory of Stanford's electronics laboratories are chairman and vice chairman of the IRE group planning the field trips program.

Bus service from the Cow Palace will be offered for the following tours:

Tuesday afternoon, August 22—Litton Industries electron tube division at San Carlos, to inspect high-power and super-power tube facilities; the University of California's Lawrence Radiation Laboratory at Livermore, where emphasis will be placed on basic work in plasma research (tour limited to 50).

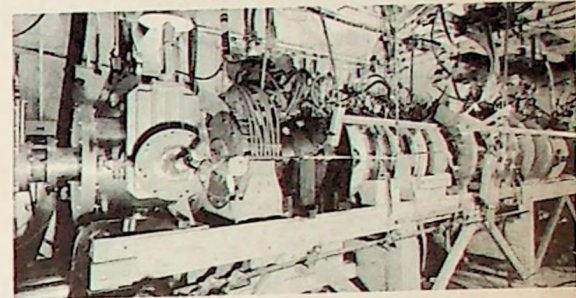
Wednesday afternoon, August 23—Stanford University microwave laboratory will provide an opportunity to

learn about research in two fields; that is (1) ionized cesium plasma and (2) electron guns and ion propulsion engines. Another tour visits the joint radio field site of Stanford University and Stanford Research Institute, with its wide variety of experimental installations used for radio-astronomy projects.

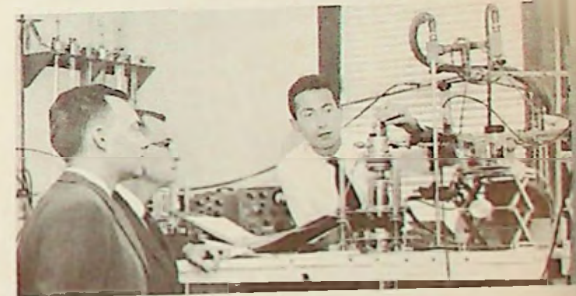
Thursday morning, August 24—Melabs, in Stanford Industrial Park at Palo Alto, for a general tour of new facilities devoted to research, development and production of microwave devices (including cavity masers, S-band traveling-wave masers and L-band parametric amplifiers).

Thursday afternoon, August 24—Hewlett-Packard Co. and its newly expanded center in Stanford Industrial Park, with attention to be concentrated on production areas (prefabrication, wiring and assembly, test and calibration, quality assurance).

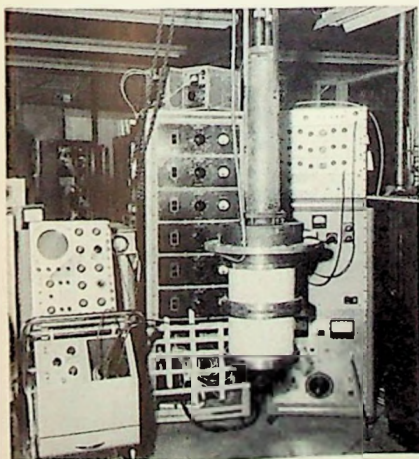
Serving with Reynolds and Miller in planning and carrying out the program are Wright H. Huntley, Jr. of Stanford electronic laboratory, John R. Arnold of Granger Associates, Lester A. Roberts of Watkins-Johnson Co., Wallace F. Burton of R. S. Electronics, John W. Summers of Varian Associates, and Wendel J. Hans of Ampex Corp.



At the University of California Lawrence Radiation Laboratory, covered in a Tuesday afternoon field trip, tourists will view this multistage magnetic mirror machine—part of the controlled thermonuclear research program



Reynolds and Miller preview a Wednesday afternoon jaunt that will include this solid-state maser research instrumentation, being demonstrated here by Dr. Tito Arecchi, research associate at the Stanford electronics laboratories



Testing operation for high-power cathodes will be seen on Tuesday afternoon by those who schedule the field trip to the Litton Industries electron tube division in San Carlos

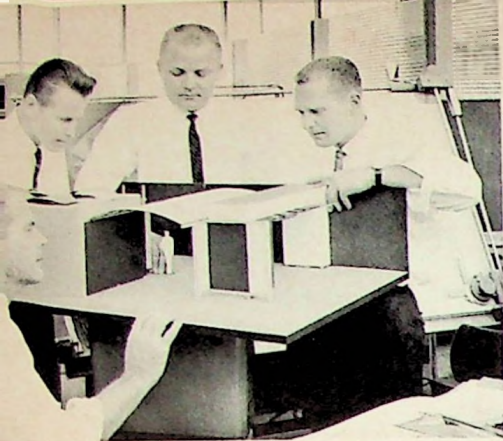


Wednesday afternoon will find field trippers in the pleasant countryside examining this 60-ft dish, first to contact Sputnik I by radar, and other structures at the SRI/Stanford field sites

Aging and testing of crystals and oven assemblies will be carried on at one of the stops for the field-trip group that covers Hewlett-Packard Co. on Thursday afternoon







This is a scale model of the industrial design award exhibit to be seen in the Cow Palace during WESCON as a background for the winning designs. Checking it over are Carl J. Clement, Jr., chairman, and Andi Are, Dale Gruye, and Allen Inhelder

## tomorrow's products

### INDUSTRIAL DESIGN

An innovation at the 1959 WESCON, the unique Industrial Design competition, highlighting the role of the industrial designer in the electronic product team, will have its third annual culmination at the Cow Palace.

Twenty-three merit selections have been made in the 1961 WESCON Industrial Design competition, based on submissions from exhibitors taking part in the Western Electronic Show and Convention in San Francisco August 22 - 25.

Chosen from 172 entries in the third annual competition sponsored by WESCON, the merit-winning selections will be displayed in a special exhibit area.

A later judging will determine up to five "Awards of Excellence" to be announced the opening morning of WESCON. The remaining exhibits will receive the WESCON IDA "Award of Merit."

Carl J. Clement, Jr., of Hewlett-Packard Company and Jack Stringer of IBM-San Jose are chairman and vice chairman of the Industrial design planning group this year. Clement, a member of the WESCON IDA group from the first, has noted the growing fascination of engineers for the "packaging" aspect of their handiwork.

Clement has reported the results of screening and judging by a group of prominent Southern California industrial designers held recently at the school of architecture, University of Southern California, Los Angeles.

He said the judges particularly noted the emergence of several young design-

(Continued on page 12)

## MORE PROGRAM (TUES.)

**2/3 BEAM-PLASMA AMPLIFIERS**  
M. A. Allen and G. S. Kino, Stanford University, Stanford, California.  
Sponsored by Professional Group on Electron Devices

Chairman and Organizer: J. T. Mendel, Hughes Aircraft Co., Culver City, Calif.

### SESSION 3

#### HIGH SPEED LOGIC

Room C—10:00 A.M.-12:30 P.M.

**3/1 RELATIONSHIPS BETWEEN DEVICE AND SYSTEM DESIGN FACTORS IN UHF COMPUTERS**  
E. P. Stabler, General Electric Co., Syracuse, N.Y.

**3/2 ASI — A HIGH SPEED ANTI-SATURATION INVERTER LOGIC CIRCUIT**  
H. Ditzkofsky and A. I. Pressman, RCA Camden, N. J.

**3/3 A TUNNEL DIODE — TUNNEL RECTIFIER, 15 NANOSECOND MEMORY**  
M. M. Kaufmann, RCA Camden, N. J.

Sponsored by Professional Group on Electronic Computers

Chairman and Organizer: James B. Angell, Stanford University, Stanford, Calif.

### SESSION 4

#### TECHNOLOGICAL ADVANCES IN MILITARY ELECTRONIC EQUIPMENT

Room D—10:00 A.M.-12:30 P.M.

**4/1 CONSIDERATIONS FOR THE DESIGN OF MICROMODULE EQUIPMENT**  
B. I. Andrews, RCA, Camden, N. J.

**4/2 ENGINEERING PROBLEMS IN ESTABLISHING A THIN FILM CIRCUIT MANUFACTURING CAPABILITY**  
J. C. Gioia, Light Military Electronics Dept., General Electric Company, Utica, N. Y.

**4/3 DEVELOPMENT OF COMPONENTS FOR TIMM (THERMIONIC INTEGRATED MICRO MODULE) SYSTEMS**  
W. A. Barrows and E. J. Broderick, General Electric Co., Owensboro, Kentucky.

Sponsored by Professional Group on Military Electronics

Chairman and Organizer: K. T. Larkin, Lockheed Missiles and Space Division, Sunnyvale, Calif.

### SESSION 5

#### ELECTRO OPTICAL COMPONENTS

Room E—10:00 A.M.-12:30 P.M.

**5/1 A CONTACTLESS INFINITE RESOLUTION POTENTIOMETER**  
P. H. Wendland, Electro Radiation, Inc., Santa Monica, Calif. and H. H. Houdyshell, Duncan Electronics, Inc., Costa Mesa, Calif.

**5/2 THE PHOTOREED — A NEW VERSATILE FREQUENCY-SENSITIVE CONTROL**  
F. H. Inderweisen, Midwest Research Institute, Kansas City, Mo.

**5/3 A NEW APPROACH TO DIGITAL DISPLAYS USING ELECTROLUMINESCENCE**  
E. O. Stone, Sylvania Electric Products, Seneca Falls, N. Y.

Sponsored by Professional Group on Component Parts

Chairman and Organizer: W. Dale Fuller, Lockheed Missile and Space Division, Sunnyvale, Calif.

### SESSION 6

#### CURRENT AND FUTURE RADIO ASTRONOMY AND TECHNIQUES

Room A—2:00 P.M.-4:00 P.M.

**6/1 LOW NOISE RECEIVERS**  
P. D. Strumm, Applied Technology, Inc., Palo Alto, Calif.

**6/2 DEVELOPMENTS IN ANTENNA TECHNIQUES FOR RADIO ASTRONOMY**  
Emile-Jacques Blum, Observatory of Paris, Meudon, France.

**6/3 RADIO ASTRONOMY IN THE SOLAR SYSTEM**  
E. A. Lilley, Harvard University, Cambridge, Mass.

**6/4 RADIO ASTRONOMY BEYOND THE PLANETARY SYSTEM**  
Gert Westerhout, Leiden, Netherlands.

Sponsored by International Astronomical Union and Professional Groups on Antennas and Propagation and on Space Electronics

Organizer: Professor S. Silver, University of California, Berkeley  
Chairman: Professor H. Weaver, University of California, Berkeley

(Continued on page 12)



Lyons

Linville

7th Region IRE Fellows: Harold Lyons, vice president, Electro-Optical Systems, Inc., Pasadena; John Linville, professor, Stanford University, Stanford; J. A. McCullough, chairman of the board, Eitel-McCullough, Inc., San Carlos; Maynard D. McFarlane, research scientist, Robertshaw-Fulton Controls Co., Anaheim



McCullough

McFarlane



# LITTON ALL-INERTIAL AUTOMATIC NAVIGATOR INSTALLED IN AN OPERATIONAL FIGHTER



NEW PROOF OF LITTON'S CONTINUING CONTRIBUTIONS TO THE DEVELOPMENT OF INERTIAL NAVIGATION IS FURNISHED BY THE LN-3-2B AUTOMATIC NAVIGATOR THAT IS NOW BEING INSTALLED IN CANADA'S CF-104 FIGHTER.

Three-hundred-and-sixty-degree freedom of aircraft maneuver on every axis is made possible by four-gimbal isolation of the Litton stable platform that keeps the system's accelerometers aligned in inertial space. Voltage signals from the accelerometers are transmitted to a computer where they are integrated to compute vehicle position components.

In addition, an adapter unit provides 27 outputs of pitch, roll and heading angles and ground speed to other equipment in the aircraft such as bombing computer and autopilot.

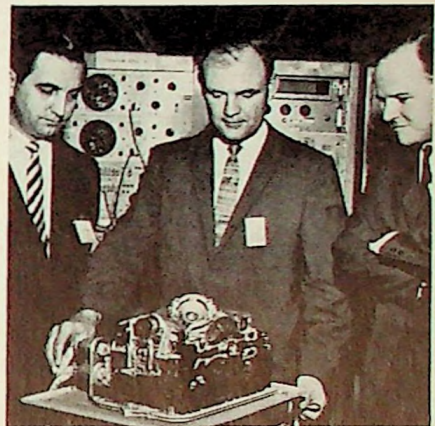
In flight, tight servo loops hold all sensitive elements of the stable platform at null regardless of acceleration.

Any relative motion between the gyro case, which is fixed to the platform, and the floated gyro rotor, which is fixed in space, is sensed and corrected to keep the platform including accelerometers oriented to vertical and north. Any acceleration along an axis produces an accelerometer torquer current which is proportional to the applied acceleration. This torquer current holds the accelerometer at null, and the same signal is transmitted to the navigation computer.

Another indication of the scope and caliber of Litton inertial engineering is the new combined doppler and inertial navigation system being produced by Litton Systems for the

Lockheed P3V-1 anti-submarine patrol aircraft. The inertial system continuously measures accelerations along the two horizontal axes and computes velocity components and aircraft position in latitude and longitude. Velocity information from the AN/APN-122 doppler radar is used in the inertial navigation system to optimize system performance.

A half dozen other Litton inertial navigation systems have been successfully developed to the operational phase. Still others are now in earlier phases of development.

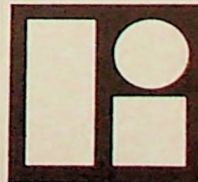
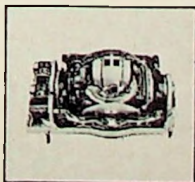
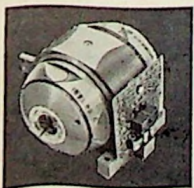


EXAMINING LN-3 STABLE PLATFORM UNDER TEST AT LITTON'S WOODLAND HILLS, CALIF. FACILITY ARE L-R: VIC SYMONDS, LITTON-CANADA; P. LITTON, LITTON-CALIF.; D. BELVEA, COP.

*These programs are being carried forward by engineers specializing in inertial navigation and related techniques. By engineers with their own long-range plans, and the ability to make important contributions to inertial engineering. By engineers who prefer engineering to paper work. By engineers willing and able to see a job through from concept to product.*

*Are you specially qualified in inertial equipment, computers, data processing systems, tactical data systems, displays, advanced communication techniques? Write today to Donald Krause, Research & Engineering Staff, Litton Systems, Inc., 336 No. Foothill Road, Beverly Hills, California.*

Qualified applicants will be considered regardless of race, creed, color or national origin.



**LITTON  
SYSTEMS, INC.**  
Beverly Hills, California

DIVISION OF LITTON INDUSTRIES





Carl J. Clement, Jr.

J. W. Stringer



#### MORE INDUSTRIAL DESIGN

ers with a fresh approach to the problems of packaging electronic products in terms of the principal judging criteria—visual clarity of function, ease and safety of operation and appropriateness of appearance.

Instruments, test equipment and some smaller packaged components appeared to dominate this year's submissions, Clement observed.

"Most of the winning entries showed the designer's regard for the operability of the equipment over the usual concerns for balance and 'pure design' factors," Clement said.

#### IDA Judging Panel

Taking part in the judging were: Henry Joe Police, staff industrial designer for Ramo-Wooldridge Corp., Canoga Park; William C. MacPherson, partner in Dunlap & Associates, Santa Monica industrial designers; Robert Mason of Robert Mason & Associates, San Diego industrial design firm; Jim Powell, industrial designer for Hughes Ground Systems, Fullerton; Joseph D. Portanova, industrial designer for Hoffman Electronics Corp., Los Angeles; and Howard Assel, partner in Dunlap & Associates, industrial designers in Santa Monica.

Don Brundage of Brundage Associates, San Francisco, is chairman of the IDA judging activity and arranged the Los Angeles deliberations.

#### Winning Entries to be Shown

Placing in the awards competition were the following companies and products:

Helipot Division of Beckman Instruments, Inc., Fullerton, Calif., for a group of panel meters.

Collins Radio Co., Cedar Rapids, Iowa, for an f-m transmitter for radio broadcasting.

Consolidated Electrodynamics Corp., Pasadena, Calif., two selections—magnetic-tape degausser and mass spectrometer.

Data-Stor Division of Cook Electric Co., Skokie, Ill., for a digital magnetic tape transport.

Ungar Electric Tools, Electronic Division of Eldon Industries, Inc., Hawthorne, Calif., for a soldering iron.

Electronic Associates, Inc., Long Branch, N. J., for a transistorized digital voltmeter.

Fisher Berkeley Corp., Emeryville, Calif., for its intercom for office, industrial or home use.

Light Military Electronics Department of General Electric Co., Utica, N. Y., for a ballistic missile compute depot test set.

Hewlett-Packard Co., Palo Alto, Calif., for an electronic enclosure system.

International Business Machines Corp., White Plains, N. Y., two selections — IBM 1011 data transmission terminal and IBM 1011 paper tape reader.

Kaar Engineering Corp., Palo Alto, Calif., three selections — monitor for radio broadcasting of Conelrad alert and weather warnings, hand phone, and radiotelephone for two-way communication in citizen's radio service.

Lockheed Aircraft Corp., Burbank, Calif., for an infrared gunsight sensitivity checker.

Autonetics Division of North American Aviation, Inc., Downey, Calif., for its high-speed tape reader and precision punch.

Computer Division of Packard-Bell Electronics Corp., Los Angeles, for its module tester.

Precision Instruments Co., San Carlos, Calif., two selections — a recorder-reproducer and a continuous-tape-loop multi-channel simulator.

Sylvania Electric Products, Inc., New York, N. Y., for its large-scale general-purpose digital computer.

Tektronix, Inc., Beaverton, Ore., two selection—transport carriage for oscilloscopes and high-frequency probe.

Says Clement: "In a highly technical industry such as ours, it is especially important to remind ourselves from time to time that our end-products are in reality tools—tools of a very sophisticated and complex nature, but still tools intended for human use. And of course the usefulness of these electronic tools is determined in a large part by the effectiveness of their coupling with the human user. It is with this coupling—physical, mental, and psychological—that the electronics industrial designers are concerned."

MORE PROGRAM (TUES.)

#### SESSION 7

#### SOLID STATE DEVICES I

Room B—2:00 P.M.-4:30 P.M.

7/1 SUPERCONDUCTOR SOLENOIDS  
R. W. Boom and R. S. Livingston, Oak Ridge National Laboratory, Oak Ridge National Laboratory, Oak Ridge, Tenn.

7/2 PARAMETRIC QUARTZ AMPLIFIER  
C. H. Becker, Westinghouse Electric Corp., Baltimore, Md.

7/3 TERRESTRIAL DETERMINATION OF SOLAR CELL SHORT CIRCUIT CURRENT UNDER OUTER SPACE SOLAR ILLUMINATION  
H. K. Gummel and F. M. Smits, Bell Telephone Laboratories, Murray Hill, N. J., and A. R. Froiland, Smithsonian Observatory, Table Mountain, Calif.

Sponsored by Professional Group on Electron Devices

Chairman and Organizer: Professor James F. Gibbons, Stanford University, Stanford

#### SESSION 8

#### COMPUTER APPLICATIONS

Room C—2:00 P.M.-4:30 P.M.

8/1 PLATO: AN AUTOMATED TEACHING DEVICE  
D. Bitzer, P. G. Braunfeld and W. Lichtenberger, University of Illinois, Urbana, Ill.

8/2 THE USER LOOKS AT THE INFORMATION STORAGE AND RETRIEVAL FIELD  
R. R. Segal, Daniel, Mann, Johnson & Mendenhall, Los Angeles, Calif.

8/3 AN ADVANCED DIGITAL DATA SYSTEM FOR USE IN NUCLEAR REACTOR DEVELOPMENT  
W. V. Batts, Jr., Atomics International, Canoga Park, Calif.

Sponsored by Professional Group on Electronic Computers

Chairman and Organizer: John Reid Anderson, Stanford Research Institute, Menlo Park

#### SESSION 9

#### SIGNAL SELECTION

Room D—2:00 P.M.-4:30 P.M.

9/1 THE APPLICATION OF TIME/FREQUENCY CORRELATION FUNCTIONS TO THE CONTINUOUS WAVEFORM ENCODING OF MESSAGE SYMBOLS  
C. A. Stutt, General Electric Co., Schenectady, N. Y.

9/2 A CRITERION FOR SIGNAL SELECTION BASED UPON COMPARISON OF EXPERIMENTS  
T. L. Grettenberg, Stanford University, Stanford, Calif.

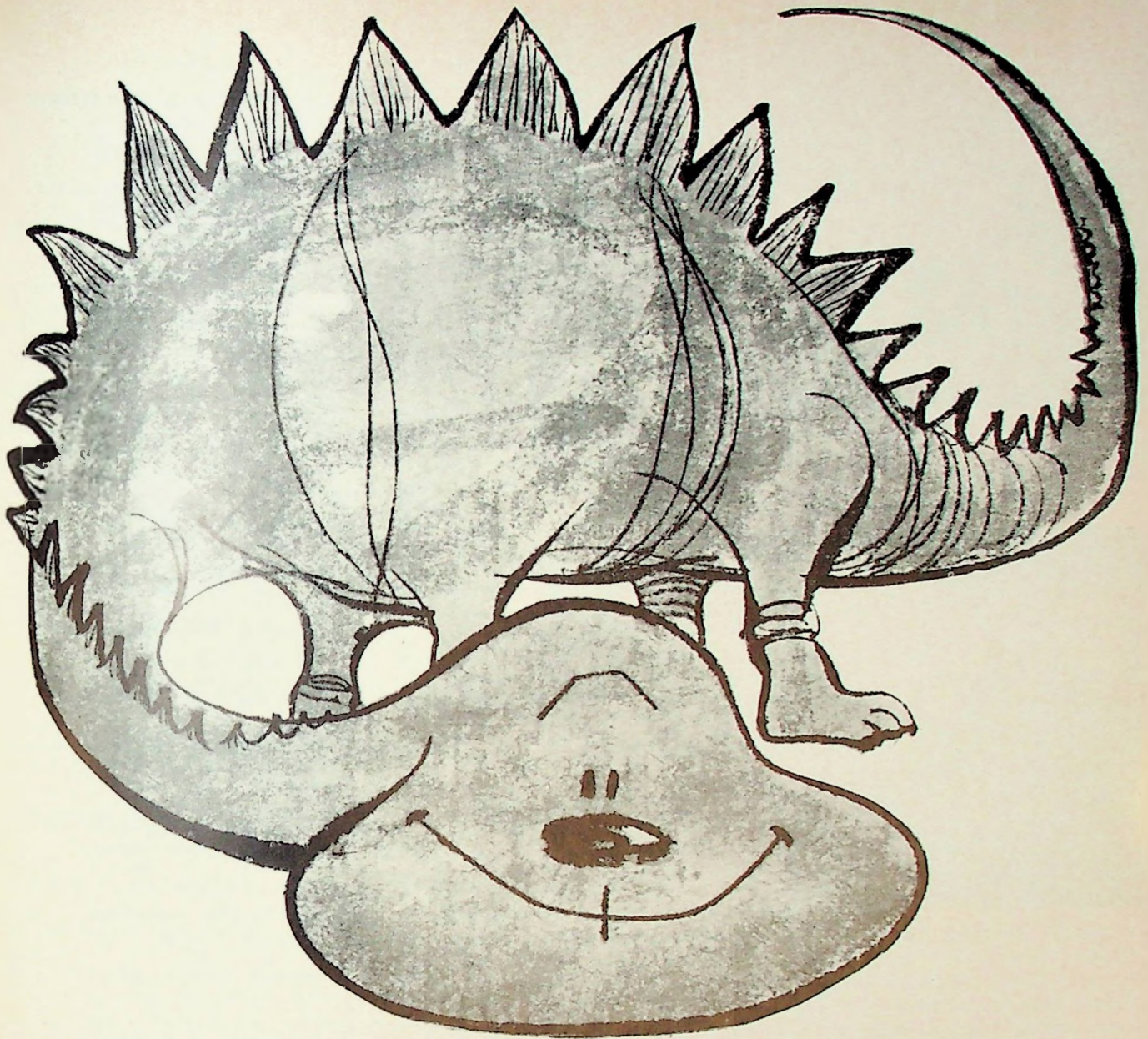
9/3 SIGNAL HAVING GOOD CORRELATION FUNCTIONS  
R. Lerner, Lincoln Laboratory, MIT, Lexington, Mass.

Sponsored by Professional Group on Information Theory

Chairman and Organizer: Professor Norman Abramson, Stanford University, Stanford

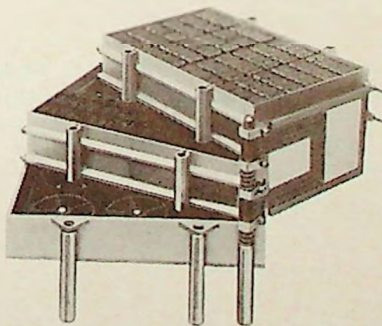
(Continued on page 14)





That it is, friend Dyna-Soar, for your orbital research flights, or for any number of other space applications. This "cordwood" system is an example of EECO's welded matrix packaging technique for digital systems. It's called MiniWeld... a total system concept which utilizes *standard components* but packs them like cordwood into the greatest possible density. MiniWeld systems meet or exceed MIL-E-5400C, Class I or II specifications...withstand extreme temperatures...endure shock of 50g and vibration of 30g (50 cps to 3000 cps). MiniWeld is established hardware with 152 compatible

## FOR ME?



*Cordwood technique used in MiniWeld construction selected by Miniaturization Award Committee as a packaging breakthrough in high-density electronic systems.*

digital circuits catalogued... up to 200 circuits may be cordwood-stacked in a single frame. Mini-Circuits are interconnected with welded ribbon matrix... wire-wrap techniques tie the Mini-Circuit and cable modules together into a system that could go to the moon — and work.

Digital equipment has been an EECO specialty since 1947. So have time code generators, tape search and control systems and timing system complexes with full auxiliary equipment. Is your project mired in the tarpits because of a spaceborne timing and equipment problem? Let EECO help you out. Write for MW-1 data.



**Electronic Engineering Company of California** 1601 East Chestnut Avenue, Santa Ana, California

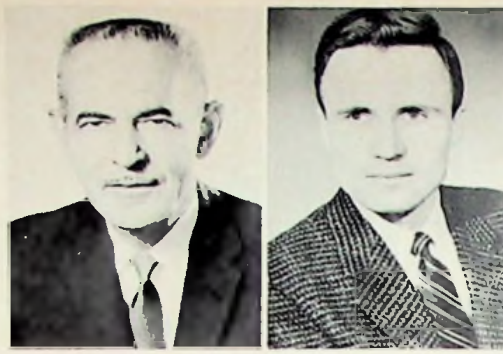
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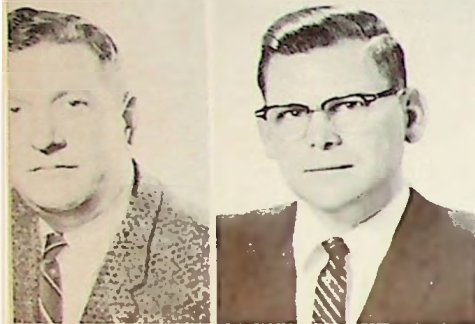




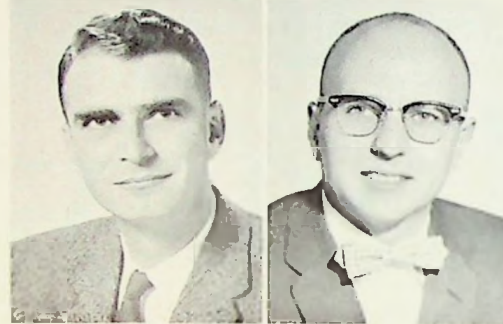
Jack L. Melchor, Melabs, chairman; and Alan T. Waterman, Jr., Stanford, vice chairman, future engineers show



Jack Silbavy, Varian Associates, chairman; and Berkley J. Baker, Litton Industries, vice chairman of the exhibits committee



John S. McCullough, Litton Industries, chairman; and Cortland Van Rensselaer, vice chairman of the banquet committee



Robert Craig, Stanford University, chairman; and Hank M. Meyer, SRI, vice chairman of the facilities committee



Robert E. Johnston, Jennings Radio Mfg., chairman; and Fred J. McKenzie, SRI, vice chairman of the registration committee



Elvin Feige, Elmar Electronics, chairman; and Charles N. Meyer, Meyer and Ross Co., vice chairman of the distributor-representative conference committee



Emmet Cameron, Varian Associates, chairman; and Glenn A. Walters, Dalmo Victor Co., vice chairman of party committee



Mrs. Bernard Oliver, Los Altos Hills, chairman; and Mrs. Norman Moore, Atherton, vice chairman of the women's activities committee

MORE PROGRAM (WED.)

SESSION 13

HIGH DENSITY TAPE RECORDING

Room C—10:00 A.M.-12:30 P.M.

13/1 REPRODUCTION AND EQUALIZATION OF PULSES FROM A MAGNETIC TAPE SYSTEM  
G. J. Fan, IBM, Yorktown Heights, N. Y.

13/2 HIGH DENSITY DIGITAL MAGNETIC TAPE RECORDING  
C. N. Batsel and W. L. Ross, RCA, Los Angeles, Calif.

13/3 PULSE RESOLUTIONS FROM MAGNETIC AND HALL REPRODUCE HEADS  
Irving Stein, Ampex Corporation, Redwood City, Calif.

Sponsored by Professional Group on Electronic Computers

Chairman and Organizer: Erwin Tomash, Ampex Computer Products, Culver City

SESSION 14

DETECTION AND SIGNAL PROCESSING

Room D—10:00 A.M.-12:30 P.M.

14/1 CROSSCORRELATION WITH BINARY SIGNALS  
G. R. Cooper, Purdue University, Lafayette, Ind.

14/2 THRESHOLD COMPARISON OF PHASE-LOCK, FREQUENCY-LOCK AND MAXIMUM LIKELIHOOD TYPES OF F-M DISCRIMINATORS  
J. J. Spilker, Jr., Lockheed Missiles and Space Division, Palo Alto, Calif.

14/3 CLASSIFICATION AND EVALUATION OF COHERENT SYNCHRONOUS SAMPLED DATA TELEMETRY SYSTEMS  
A. J. Viterbi, JPL, California Institute of Technology, Pasadena, Calif.  
Sponsored by Professional Group on Space Electronics and Telemetry

Chairman and Organizer: R. G. Davis, Lockheed Missiles and Space Division, Sunnyvale, Calif.

SESSION 15

MICROWAVE COMPONENTS AND TECHNIQUES

Room E—10:00 A.M.-12:30 P.M.

15/1 MICROWAVE VARIABLE ATTENUATORS AND MODULATORS USING P-I-N DIODES  
J. K. Hunton and A. G. Ryals, Hewlett-Packard Company, Palo Alto, Calif.

15/2 THE ISOMODULATOR  
Howard Scharfman, Raytheon Company, Waltham, Mass.

15/3 A PRACTICAL APPROACH TO THE DESIGN OF PARAMETRIC FREQUENCY MULTIPLIERS  
G. Luettgenau, J. Williams and H. Miyahira, Pacific Semiconductors, Inc., Lawndale, Calif.  
Sponsored by Professional Group on Microwave Theory and Techniques

Chairman and Organizer: Edward M. T. Jones, Stanford Research Institute, Menlo Park, Calif.

(Continued on page 18)



# GUARD AGAINST SIGNAL DROPOUTS WITH RELIABLE TAPES OF MYLAR®

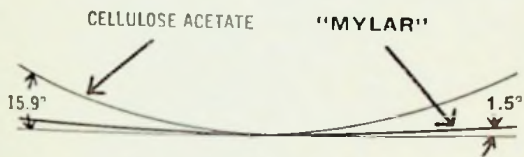
## CUPPING

Test per MIL-T-21029 (Ships) Section 4.4.6.

Average degree of cupping:

1.5 mil Cellulose Acetate—15.9° (Range: 12.0° to 33.5°)

1.5 mil "Mylar"—1.5°

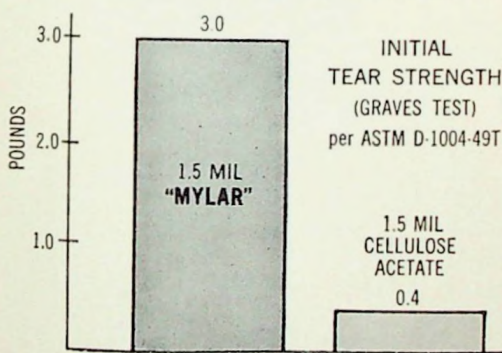


Signal dropouts can make the data from critical tests completely useless. That's why the reliability of your magnetic tape base is so important. Tapes of Mylar\*, because they're dimensionally stable, resist cupping which may cause signal dropouts from loss of contact with the recording or playback heads. They also resist swelling and shrinking which can cause track displacement.

Tapes of "Mylar" also resist stretching and breaking from sudden stops and starts, edge nicks, and are unaffected by humid storage and aging. They have 7 times the initial tear strength of ordinary plastic tapes!

The tremendous cost of gathering data demands reliability. Get it with tapes of "Mylar". Send coupon for free booklet of comparative test data and judge for yourself. Du Pont Company, Film Department, Wilmington 98, Del.

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



Better Things for Better Living . . . through Chemistry

DU PONT  
**MYLAR**®  
POLYESTER FILM

E. I. du Pont de Nemours & Co. (Inc.)  
Film Department, Room #13, Wilmington 98, Delaware

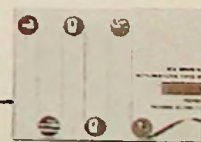
Please send free, 12-page booklet of comparative test data to help me evaluate magnetic-tape reliability.

Name \_\_\_\_\_ Position \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_







A rose by any other name . . . etc., etc., etc. Shakespeare, we finally realized, was right. In the depths of the night quite recently, we recalled, with not a modicum of horror, those first disastrous days when we were trying to put a name to the corporation now known as Rantec. "It's gotta have 'micro' in it," an officer high on the echelon (there were three of us at the time) claimed, "without 'micro' we just ain't in the electronics business." "Well, we're not, really," some wretched iconoclast put forth, "has anybody seen a contract around here yet?"

Having gotten rid of him, we settled down to facts, or some semblance thereof. R for radomes, ANT for antennas, EC for electronic components. RANTEC. Fabulous. Meaningful. Easy to say with your mouth full. And it was truly valid for about three and a half days. Although we still make antennas (and quite a number, if the truth be known), Rantec is now involved up to its neck in ferrite devices, multiplexers, waveguide components and microwave sub-systems. See what we mean.

The upshot of this entire thing has been a little game called "Pin the Tail on the Electronic Firm" which has succeeded in pulling our senior research engineers away from the ping pong table and our technicians away from the chessboard. The amazing thing is that the game has no prizes and nobody wins. Of course, nobody loses either which might or might not mean something. The rules are simple: name a fictional electronic firm. Although, as we said, there are no prizes, no one can deny us the right of picking our favorites. Try these on for size. (1) HydroPeptic, manufacturers of irrigation equipment; (2) Macroneurotic and its wholly-owned subsidiary, Frustronics, which provide problems instead of solutions; and (3) Myoptics, Inc. which designs and develops complete systems with equally complete obsolescence.

If first prize there were to be, it must be awarded to one of our brilliant electronic engineers who thought it might be wise to open up a second-hand hardware company in Culver City, California, and call it the Used Tool Company.

Any engineer on the outside who might have a smattering of knowledge about microwave theory or antennas or electronics of various orders and who might or might not want a job can join in the fun. Send your answer to Rantec Corporation, Calabasas, California. Rantec. That's pretty funny, right there.

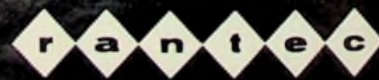
Speaking of filters, Rantec is way up front. Men who know filters best in such projects as Mercury, Titan, Polaris and Discoverer—choose Rantec two to one. Why? Strictly the result of Rantec's superb miracle blend of research and development.

Broadband Harmonic Filters from C through K, bands rejecting the second and third harmonics of any frequency in the pass-band region . . . Waveguide Band-Pass Filters employing from one to fifteen cavities with precise equal-ripple, maximally flat insertion loss or maximally flat time-delay response . . . Coupled Coaxial Resonator and Coaxial Low-Pass, High-Pass and Band-Pass Filters in frequency ranges from 100mc to 10,000mc . . . Stripline Diplexing Filters to meet specific customer specifications for packaging, frequency band, response, isolation and power rating.

Below . . . the FS-203 Band-Pass Filter—pass-band 2,000-4,000mc; stop-bands 0-1,800mc, 4,400-12,000mc; VSWR in pass-band 1.5 max.; insertion loss 1db max. in pass-band, 50db min. in stop-bands; impedance 50 ohms.

Reach for a Rantec . . . available in crush proof and soft pack! Also from Rantec . . . antennas, ferrite devices, waveguide components, electric components and microwave sub-systems.

*it's  
what's  
up front  
that  
counts*



Rantec Corporation • Calabasas, California



Hunter H. Vinton of 16 Crescent Drive, Palo Alto, died Tuesday, June 13, at the Palo Alto-Stanford Hospital Center after a four-month illness.

Hunter was an established fixture in the publication representative field on the Peninsula back in 1955 when the groundwork was being done to establish the publication which became the **Grid**. Of all the representatives, he seemed to comprise the qualities of dignity, proficiency, and cooperative spirit needed in the launching of this kind of enterprise under the sponsorship of the Institute.

Those of us on the original study committee and the initial task force shared this reaction unanimously, and an arrangement was made for him to serve the Section as advertising manager of the **Grid**. This was an arrangement which no one has since ever had occasion to regret.

Hunter retained his equanimity and quietly effective drive throughout the trying periods of the establishment of both the **Grid** and the **Grid-Bulletin**, and the professional character of the publications—certainly from the advertiser's point of view—was imparted in large measure by his steady and efficient hand.



In late January of this year he suffered a mild stroke, followed some weeks later by another, more severe. Last month, death came in the Palo Alto-Stanford Hospital.

To those of us accustomed to working intimately with him from month to month, it is difficult to realize that he is gone. His like will not soon be seen again.

—F.H.

### wescon gentlemen

#### NO SPREE

WESCON again this year has asked the electronics industry for a "gentlemen's agreement" to restrict personnel recruiting activities.

The "gentlemen's agreement," which resulted in a major de-emphasis on recruiting during the 1960 show in Los Angeles, was renewed in a letter signed by Albert J. Morris, WESCON board chairman, and sent to presidents of exhibiting companies.

Accompanying the letter was a four-page printed folder, which sets forth WESCON's position on recruiting and suggests some "guidelines" for insuring the success of company social events at the show.

In the booklet, the WESCON board reviews the almost-unanimous cooperation of exhibitors in eliminating overt recruiting at the 1960 show, and concludes that "it remains apparent that aggressive recruiting of technical personnel has no place in a forum of scientific professionals . . . we again ask participants to join in a 'gentlemen's agreement' to eliminate this practice . . ."

In discussing exhibitor social events at WESCON, the booklet recognizes that "entertainment is a natural convention

function" and offers some suggestions for insuring success of parties and receptions. Included are notes on methods of invitation, space requirements, timing, and general planning of WESCON parties.

In his letter to electronics executives, Morris congratulated them on individual policies under which "no responsible organization takes advantage of the WESCON 'population' to launch personnel recruiting efforts."

### channels of commerce

#### DISTRIBUTOR-REP-MANUFACTURERS CONFERENCE

Enlarged space and increased activity figures in planning for the Distributor-Representative-Manufacturers Conference in association with the 1961 Western Electronic Show and Convention in San Francisco this August.

Elvin Feige, chairman, has announced location of the conference at the Jack Tar Hotel for Monday, August 21, and an all-day program starting with breakfast and concluding with a dinner.

Morning and afternoon sessions will provide twenty 15-minute periods of table conferences for distributors to meet with manufacturers and their purchasing and sales agents.

MORE PROGRAM (WED.)

#### SESSION 16

##### METHODS OF RELIABILITY IMPROVEMENT

Room A—2:00 P.M.-4:30 P.M.

##### 16/1 REDUNDANCY AND THE DETECTION OF FIRST FAILURES

D. C. James and A. H. Kent, The Martin Company, Denver Colo.

##### 16/2 USE OF THE WEIBULL DISTRIBUTION FUNCTION IN THE ANALYSIS OF MULTIVARIATE LIFE TEST RESULTS

A. A. Proccassini and A. Romano, Motorola, Inc., Phoenix, Ariz.

##### 16/3 KEWB — A RADIATION BURST TEST FACILITY

W. M. Haussler, Atomic International, Canoga Park, Calif.

Sponsored by Professional Group on Reliability and Quality Control

Chairman and Organizer: R. A. Davis, Palo Alto, Calif.

#### SESSION 17

##### INDUSTRIAL ELECTRONICS

Room B—2:00 P.M.-4:30 P.M.

##### 17/1 A DIGITAL CONTROL SYSTEM FOR REFINED OIL BLENDING

C. A. Hill, Packard Bell Computer Corp., Los Angeles, Calif.

##### 17/2 RADIOGRAPHY OF LARGE MISSILES WITH A LINEAR ELECTRON ACCELERATOR

J. Haimson, Varian Associates, Palo Alto, Calif.

(Continued on page 20)



Wooldridge



Terman

7th Region IRE Fellows: Dean E. Wooldridge, president, Thompson Ramo Wooldridge, Inc., Canoga Park; F. E. Terman, vice president, Stanford University, Stanford; Dean A. Watkins, president, Watkins-Johnson Co., Palo Alto; Oswald G. Villard, Jr., professor of electrical engineering, Stanford University, Stanford



Watkins



Villard





John Chartz, Dalmo Victor, co-chairman; and Donald B. Harris, SRI, co-chairman; hospitality committee



Bill Melchior, Eichorn & Melchior, chairman; and Norman Hiestand, Varian, vice chairman; visitors services



Peter N. Sherrill, H-P, chairman; and Charles Elkind, IBM, vice chairman; public relations committee

*literature automation*  
**LEAVE THAT WHEELBARROW  
AT HOME**

WESCON's anticipated 35,000 visitors will use special "credit cards" to request product literature. As a further step in streamlining the world's second largest technical gathering, an agreement has been worked out with Addressograph-Multigraph Corp. for supplying thousands of embossed plastic "inquiry cards," to be issued to WESCON registrants at three stations within the Cow Palace August 22-25.

The cards, similar to hotel and restaurant charge cards, will be embossed with the name, title, company affiliation, and address of the visitor.

In contrast with the traditional "paper-gathering" forays of past major technical expositions, WESCON engineers and executives can simply present the Inquiry Card to the booth representative of any company or product line in which they are interested.

Exhibitor companies, all of which will be supplied with imprinting machines by WESCON, will quickly record all the name-and-address information on index cards also provided by the management of the show. Companies will then use the index cards for prompt mail service of product and company literature directly to the inquirer.

The service presents several major advantages to exhibitors and visitors alike, WESCON Manager Don Larson pointed out. In the first place, briefcase "tonnage" will be reduced sharply for registrants interested in getting the latest line on developments of 1180 exhibiting companies.

Chances of loss or misplacement of important materials during the busy four-day show are also eliminated, and exhibitor companies are free of the pressures of supplying their booths with thousands of pieces of printed information daily. Instead, corporate brochures and other materials can be sent directly to interested persons. Waste and duplications should be eliminated, Larson said, along with the time required to register thousands of requests by hand.

**MORE PROGRAM (WED.-THURS.)**

**SPECIAL SESSION**

**ARMS CONTROL**

California Masonic Memorial Temple  
1111 California Ave., San Francisco  
8:00 P.M.-10:00 P.M.

Recognizing the wide-spread interest and concern with the problem, WESCON plans an evening session at which a group of specially-qualified individuals from government and the scientific community will discuss the background, current status and future implications of the arms control effort, with particular emphasis on the implications for research and development.

*Chairman: L. C. Van Atta, Special Assistant for Arms Control, Office of the Director of Defense, Research and Engineering, Washington 25, D. C.*

**SESSION 21**

**POINT-TO-POINT COMMUNICATIONS  
VIA SATELLITE RELAYS**

Thursday, August 24  
Room A—10:00 A.M.-12:30 P.M.

21/1 **TWELVE ADVANTAGES OF STATIONARY SATELLITE SYSTEMS FOR POINT-TO-POINT COMMUNICATIONS**

S. G. Lutz, Hughes Research Laboratories, Malibu, Calif.

21/2 **TECHNIQUES FOR INCOHERENT SCATTER COMMUNICATION**

D. P. Harris, Lockheed Missiles and Space Division, Palo Alto, Calif.

21/3 **THE OPERATIONAL ANALYSIS OF A NEW YORK-LONDON COMMUNICATIONS SATELLITE LINK BY MACHINE CALCULATION**

W. Williams, Jr., and L. K. Arquette, Bendix Systems Division, Ann Arbor, Mich.

Sponsored by Professional Group on Communications Systems

*Chairman and Organizer: General J. D. O'Connell, General Telephone & Electronics Laboratories, Inc., Menlo Park, Calif.*

**SESSION 22**

**CIRCUIT DESIGN FOR EXTENDING PERFORMANCE**

Room B—10:00 A.M.-12:30 P.M.

22/1 **AN ANALYSIS OF THE MODES OF OPERATION OF A SIMPLE TRANSISTOR OSCILLATOR**

J. F. Gibbons, Stanford University, Stanford, Calif.

22/2 **THEORY AND DESIGN OF WIDE BAND PARAMETRIC CONVERTERS**

E. S. Kuh, University of California, Berkeley, Calif.

22/3 **STABLE LOW-NOISE TUNNEL DIODE FREQUENCY CONVERTERS**

F. Sterzer and A. Presser, RCA, Princeton, N.J.

Sponsored by Professional Group on Circuit Theory

*Chairman and Organizer: Victor H. Grinich, Fairchild Semiconductor Co., Palo Alto*

**SESSION 23**

**NANOSECOND TECHNIQUES**

Room C—10:00 A.M.-12:30 P.M.

23/1 **NANOSECOND PULSE MEASUREMENTS**

C. N. Winningstad, Tektronix Co., Beaverton, Ore.

23/2 **A TRIGGERED NANOSECOND PULSED LIGHT SOURCE**

T. G. Innes and Q. A. Kerns, University of California Radiation Laboratory, Berkeley, Calif.

23/3 **ANALYSIS AND MEASUREMENT OF PHASE CHARACTERISTICS IN MICROWAVE SYSTEMS**

P. Lacy, Wiltron Co., Palo Alto, Calif.

Sponsored by Professional Group on Instrumentation

*Chairman and Organizer: Nicholas Pappas, Iconix, Inc., Palo Alto, Calif.*

**SESSION 24**

**SYSTEM DESIGN CONSIDERATIONS IN MILITARY ELECTRONICS**

Room D—10:00 A.M.-12:30 P.M.

24/1 **THE ROLE OF ELECTRONICS IN THE SPECTRUM CONCEPT OF MILITARY OPERATIONS**

E. Deimel, Light Military Electronics Dept., General Electric Co., Utica, N. Y.

24/2 **SYSTEM DESIGN CONSIDERATIONS FOR EFFICIENT USE OF AUTOMATIC TEST EQUIPMENT**

J. Rescoe, Hughes Aircraft Co., Culver City, Calif.

*(Continued on page 24)*



# ENGINEERS and SCIENTISTS attending WESCON

VISIT  
or  
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for appointment EXbrook 7-7036  
**AERONUTRONIC SUITE**  
at the St. Francis Hotel

This rapidly growing Division of Ford Motor Company provides excellent professional opportunities for qualified personnel.

Aeronutronic's Engineering & Research Center is ideally located at Newport Beach, overlooking the Pacific, 40 miles southeast of Los Angeles. This imposing facility contains all plant and support

equipment necessary for military and commercial programs which involve advanced research, development, design and production.

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Power Supply  
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Microwave  
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Downrange Instrumentation  
Airborne Instrumentation  
Circuit Design  
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Launch Instrumentation

## PHYSICS

Weapons Effects Parameters  
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Aerodynamic Behavior  
Re-entry Phenomena  
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Hypersonic Wakes  
Radar Scattering  
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**AERONUTRONIC**  
DIVISION

*Ford Motor Company*

FORD ROAD, NEWPORT BEACH, CALIFORNIA



**MORE PROGRAM (THURS.)**

**24/3 ON THE MEANING OF QUANTIFIED MAINTAINABILITY**

N. J. Maroulis, Light Military Electronics Dept., General Electric Co., Utica, N. Y. Utica, N. Y.

Sponsored by Professional Group on Military Electronics

*Chairman and Organizer: John Day, Granger Associates, Palo Alto, Calif.*

**SESSION 25**

**COHERENT OPTICAL EMISSION**

Room E—10:00 A.M.-12:30 P.M.

**25/1 FUNDAMENTAL ASPECTS OF OPTICAL MASERS**

J. R. Singer, University of California, Berkeley, Calif.

**25/2 SOME POTENTIALITIES OF OPTICAL MASERS**

B. M. Oliver, Hewlett Packard Co., Palo Alto, Calif.

**25/3 THE RUBY-MASER AS A LIGHT AMPLIFIER**

P. P. Kisliuk and W. S. Boyle, Bell Telephone Laboratories, Murray Hill, N. J.

**25/4 ALKALI VAPOR OPTICAL MASERS**

H. Cummins, Columbia University, New York, N. Y.

**25/5 OPTICAL MASER STUDIES AT LINCOLN LABORATORY**

H. A. Bastick, Lincoln Laboratories, Lexington, Mass.

**25/6 REPETITIVE HAIR-TRIGGER MODE OF OPTICAL MASER OPERATION**

M. L. Stinch, E. J. Woodbury, J. H. Morse, Hughes Aircraft Co., Culver City, Calif.



Rambo



Reinartz

*7th Region IRE Fellows: William Rambo, director of Stanford electronic laboratories, Stanford; John L. Reinartz, retired; Rolf W. Peter, manager of electron devices division, Watkins-Johnson Co., Palo Alto; Ernst H. Schreiber, engineering education activities, Pacific Telephone and Telegraph, Los Angeles*



Peter



Schreiber



Malter



Chodorow

*7th Region IRE Fellows: Louis Malter, director of vacuum-tube products, Varian Associates, Palo Alto; Marvin Chodorow, director of microwave laboratory, Stanford University; Bernard M. Oliver, director of research and development, Hewlett-Packard Co., Palo Alto; A. M. Zarem, president, Electro-Optical Systems, Inc.*



Oliver



Zarem

Sponsored by Professional Groups on Electron Devices and Microwave Theory and Techniques

*Chairman and Organizer: Professor J. R. Singer, University of California, Berkeley*

**SPECIAL SESSION**

**FUTURE ENGINEERS SYMPOSIUM**

Room F—10:00 A.M.-12:30 P.M.

This special session will consist of a competition among the five top technical papers submitted by student exhibitors at the Future Engineers Show. The author of the paper judged best by a panel of judges will receive the Frederick Emmons Terman Award of \$250.00.

*Chairman: Alan B. Simpkins, Delcon Corporation, Palo Alto, Calif.*

**SESSION 26**

**SPECTRUM CONGESTION IN VEHICULAR COMMUNICATIONS**

Room A—2:00 P.M.-4:30 P.M.

**26/1 MULTI TRANSMITTER/RECEIVER INSTALLATION PROBLEMS AND CURES**

S. Meyer, Hammarlund Mfg. Co., New York, N. Y.

**26/2 ALLOCATION OF FREQUENCIES FOR THE MOBILE RADIO SERVICE — SHOULD CHANGES BE MADE?**

G. Olive, RCA, Camden, N. J.

*(Continued on page 30)*

**NEW AT  
WESCON**  
from  
**AUTOMATION  
DEVELOPMENT  
CORPORATION**

the only  
complete line of

**STEP-  
SERVO**

digital  
components

**PLUS**  
these 'firsts'

**AUTOMATED  
ARC-WELDING  
CONTROLLER**

**AUTOMATED  
PRESSURE  
CONTROLLER**

**AUTOMATED  
PUNCHED-TAPE  
PROGRAMMER  
AND READER**



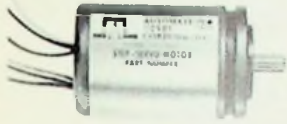
SEE THEM  
IN BOOTH 1805

july 1961



# Step-Servo digital components for reliable, accurate, low-cost automated control systems

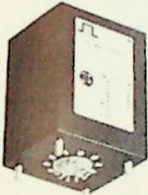
## STEP-SERVO MOTORS



Pulse operated digital actuators operate bi-directionally in precise increments of 45°, 90°, 180° or 360° per pulse. Provide accurate shaft rotation without feedback or coarse position pick off to actuate counters, x-y plotters, potentiometers, transducers, switching mechanisms and other digital-to-analog and analog to digital conversions. Shock free magnetic detenting provides smooth stepping up to 250 pps and allows speeds up to 800 pps. Available from stock in BuWeps frame sizes 5, 8, 11, 15 and 23 with a wide variety of torque, inertia, pinion size and impedance specifications, designed to meet all applicable paragraphs of MIL E-5272B and MIL E-5400. Bearings are ABEC Class 5 or better, stainless steel construction, class H insulation standard. All units rated at 28v dc. Custom units available to specification.

PART NUMBER	Bu. Weps. Size	Max. Stall Torque @ 25°C (inch oz.)	Oper. Temp. Range (°C)	Max. Rate Inertia (GM CM <sup>2</sup> )	Pinion Size	Terms or Leads	Stator Poles (ØDms Per Phase)	DIMENSIONS (inches)				* SUGGESTED FOR USE WITH CONTROLLER NO.			
								Diam.	Length	Regular Diam.	Spdt Extension	90° B: D need not		180° B: Directional	
												55° to -70°C	55° to +125°C	55° to -70°C	55° to +125°C
700 5 120 100	5	0.5	-55° to +100°C	0.3	1250 Dia. 5/16" Ø	L	120	.500	1.196	.375	1/2	010	020	012	021
701 5 120 100	5	0.5	-55° to +100°C	0.3	10796P	L	120	.500	1.196	.375	1/2	010	020	012	021
707 8 200 125	8	0.5	-55° to +125°C	0.15	137120P	L	200	.750	1.225	.500	1/2 ± 015	010	020	012	021
710 8 170 125	8	1.0	-55° to +125°C	0.15	10796P	L	120	.750	1.225	.500	1/2 ± 015	010	020	012	021
711 8 900 125	8	0.8	-55° to +125°C	1.5	137120P	L	900	.750	1.135	.500	1/2 ± 015	014	030	012	021
712 8 170 70	8	0.8	-55° to +70°C	1.5	10796P	L	120	.750	1.135	.500	1/2	010	020	012	021
713 8 325 125	8	0.2	-55° to +125°C	0.15	10796P	L	325	.750	1.225	.500	1/2	014	030	012	021
714 8 160 70	8	0.5	-55° to +70°C	0.65	10796P	L	160	.750	1.135	.500	1/2	010	020	012	021
717 11 210 125	11	1.0	-55° to +125°C	0.75	10796P	L	210	1.062	1.360	.625	3/8 ± 010	010	020	012	021
719 11 300 125	11	1.0	-55° to +125°C	0.75	10796P	L	300	1.062	1.360	.625	3/8 ± 010	014	030	012	021
721 11 300 125	11	1.2	-55° to +125°C	2.5	10796P	L	300	1.062	1.310	.625	3/8 ± 010	014	030	012	021
722 11 120 125	11	1.4	-55° to +125°C	0.65	10796P	T	120	1.062	1.820	.625	3/8 ± 010	010	020	012	021
723 11 120 125	11	1.4	-55° to +125°C	2.5	10796P	T	120	1.062	1.825	.625	3/8 ± 010	010	020	012	021
725 11 300 125	11	1.2	-55° to +125°C	2.5	10796P	T	300	1.062	1.765	.625	3/8	014	030	012	021
726 11 300 125	11	1.2	-55° to +125°C	2.5	10796P	T	300	1.062	1.650	.625	3/8 ± 010	014	030	012	021
729 11 120 125	11	2.0	-55° to +125°C	1.2	10796P	L	120	1.062	1.750	.625	3/8 ± 015	010	020	012	021
731 11 120 70	11	2.0	-55° to +70°C	1.2	10796P	L	120	1.062	1.750	.625	3/8 ± 015	010	020	012	021
732 11 120 70	11	1.4	-55° to +70°C	0.65	10796P	T	120	1.062	1.820	.625	3/8 ± 010	010	020	012	021
733 15 120 125	15	1.8	-55° to +125°C	1.5	10796P	L	120	1.437	1.400	.875	3/8 ± 010	010	020	012	021
714 15 120 70	15	1.8	-55° to +70°C	1.5	10796P	L	120	1.437	1.400	.875	3/8 ± 010	010	020	012	021
735 15 100 125	15	1.5	-55° to +125°C	1.5	10796P	L	100	1.437	1.400	.875	3/8 ± 010	014	010	012	021
736 15 120 125	15	3.6	-55° to +125°C	3	10796P	L	120	1.437	2.4	.875	3/8 ± 010	010	020	012	021
737 23 120 125	23	3.0	-55° to +125°C	5	15796P	L	120	2.250	2.250	2.000	3/4 ± 010	010	020	012	021
740 23 30 125	23	6	-55° to +125°C	10	15796P	L	30	2.250	3.250	2.000	3/4 ± 010	009	008	007	006

## STEP-SERVO CONTROLLERS



\*Patent 2809335; others pending

Contains reliable solid-state circuitry to accept pulse input from computer, tape, or other programmer to sequence the pulses and energize the stator of the motor, and cause magnetic detenting between pulses. Available from stock or to custom specification to meet wide variety of applications. Designed to meet applicable MIL E-5272B and MIL E-5400 specs. Pulse input requirements for 90° bi-directional stepping are: positive 28v — 8v dc to cw lead and ccw lead at rated current; pulse length 15 µsec. min, 75 µsec. max; rise time under 10 µsec. Unless otherwise specified, units are for use with step-servo motor with 2 pole PM rotor and 2 phase center tapped stator.

PART NUMBER	1 Min. Motor Stator Resistance (Ohms per Phase)	B: d: ccw: cw: Rotation per Pulse	Operating Temp. Range	DIMENSIONS (inches)			Max. Pulse Current (amp)	Max. Pulse Input (v)	Max. No. Current Req. to Motor & Controller (amps)
				W	D	H			
009 90 30 70	30	90°	-55° to +70°C	-	-	-	-	-	4.0
008 90 30 125	30	90°	-55° to +125°C	-	-	-	-	-	4.0
007 180 30 70	30	180°	-55° to +70°C	-	-	-	-	-	3.0
006 180 30 125	30	180°	-55° to +125°C	-	-	-	-	-	3.0
010 90 120 70	120	90°	-55° to +70°C	2 1/2	2 1/2	3 1/2	14	65	1.0
020 90 120 125	120	90°	-55° to +125°C	2 1/2	2 1/2	3 1/2	15	65	1.0
012 180 120 70	120	180°	-55° to +70°C	-	-	-	-	-	25
021 180 120 125	120	180°	-55° to +125°C	-	-	-	-	-	25
014 90 300 70	100	90°	-55° to +70°C	2 1/2	2 1/2	3 1/2	15	25	0.4
010 90 300 125	100	90°	-55° to +125°C	2 1/2	2 1/2	3 1/2	7	25	0.4

\*data available from factory

## STEP-SERVO EQUIPMENT

In addition to units listed, special components and equipment can be supplied to your requirements, including gear trains, programmers, counters and other read out devices, step-servo driven potentiometers and switches, power supplies, and complete automation systems.



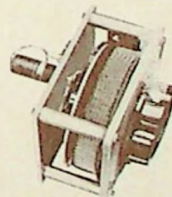
### 502A PULSE GENERATOR MODULES

An adjustable pulse train source available in five ranges: 4-16, 7-30, 25-70, 45-150 and 65-300 pps. Pulse amplitude 26v ± 5v; pulse width 15-100 µsec; rise and fall time under 10 µsec; frequency stability ± 10%. Weighs two ounces in MIL T 27A-AH can. Two 1/2" x 3/8" stud mounts. Specify pulse rate range and required operating temperature range (from -55°C to 70°C or from -55°C to 125°C).



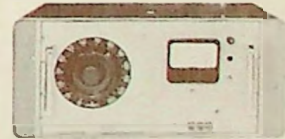
### 101A PULSE GENERATOR

An inexpensive lab or field instrument for step-servo testing or general digital application. Pulse rate adjustable from 4 pps to 108 x 10<sup>3</sup> pps; pulse amplitude from 0 to 40v (no load); pulse width from 5 µsec. to 8 ms. Rise or fall time 1.0 µsec. with negligible overshoot. Output imp. 200 ohms. Size 9"H, 10 1/2"W, 9"D. Wt. 8 1/2 lbs. 115v ac. 60 cps. 50w.



### 604A AUTO TRANSFORMER DRIVE

Used with step-servo controller and pulse source to control variable auto transformer independent of line frequency. Operates open loop without overshoot, eliminating need for compensation by conventional servo mechanisms. Positions autotransformer accurately within 0.2 Control rate up to 110 increments per sec. Power: 28v dc, 1 amp max. Designed for use with Gen. Radio Co. W20 or M20 Variac®. Other drives available to specification.



### 402A AUTOMATED VOLTAGE CONTROLLER

Produces an adjustable and externally programmable regulated output from 0.5v to 135v ac over entire input range from 50 to 135v ac (single phase 60 cps). Incorporates step-servo driven variable auto transformer. Regulation adjustable to 2% over output range; response time adjustable to 14v per sec. 20 amp output. External program input 2000 ohms per volt. Cabinet model: 11 1/2"H, 24"W, 15"D, 74 lbs. Rack model: 10 1/2"H, 19"W, 13"D, 48 lbs. Also available: 25, 60 and 400 cps single and poly phase controllers built to spec.

**AL AUTOMATION DEVELOPMENT CORPORATION**

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## LABORATORY LAUNCH PAD

"In-house" missile flights are a daily occurrence at Lockheed Missiles and Space Division. The advantages of "flying" the POLARIS FBM inside the laboratory, on an amazing internally-developed simulator, are obvious.

The simulator performs many developmental and test functions. When the missile is first conceived, performance characteristics are cranked in; basic overall requirements are read out. Later, the simulator details the functional requirements of each subsystem and calculates specifications for hydraulic, electronic and pneumatic hardware. As each component is built, it replaces its computer counterpart.

Finally, the whole guidance and flight control package is put through simulated flights for final checkout. But that isn't all. The simulator also performs the role of post-flight evaluation detective when it is fed tapes of actual flights, and the effects are observed on earth-bound hardware.

It is with such elaborate equipment, guided by engineers and scientists of outstanding calibre, that Lockheed Missiles and Space Division has attained its place in the forefront of missile and space technology. And such progress is constantly creating key positions for other engineers and scientists of proved ability, so they may take up the exciting challenges offered by Lockheed and share in its rewards.

This unusual organization is located in Sunnyvale and Palo Alto, on the San Francisco Peninsula in California. For an informative brochure, "Your Place in Space," write to: Research and Development Staff, Department M-31B, 962 West El Camino Real, Sunnyvale, California. U.S. citizenship or existing Department of Defense industrial security clearance required. All qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

**Lockheed** / MISSILES AND SPACE DIVISION

*Systems Manager for the Navy POLARIS FBM and the Air Force AGENA  
Satellite in the DISCOVERER and MIDAS Programs*

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## regional roundup

### THE REGIONAL CONFERENCES

One of the activities sponsored by the 7th Region that is specifically designed as a service to members of the smaller sections is the 7th Region Conference, held annually in the spring. This conference, which usually is combined with a trade show, is designed to counterbalance WESCON which logistically is confined at present to the Los Angeles and San Francisco areas because of its size. The Regional Conference is on a scale compatible with the

*Deplaning at Phoenix for the Seventh Region Conference was one contingent of the WESCON Board of Directors, which made a special presentation on WESCON's 1961 plans to the Seventh Region directors during the course of the meeting. Shown in ascending order are Mr. and Mrs. Albert J. Morris, Dr. John V. N. Granger, and Calvin K. Townsend of the San Francisco Bay Area, and Donald C. Duncan, a director from the Los Angeles area*

capabilities of the medium sized sections and rotates among them on a somewhat flexible schedule. This allows a larger number of engineers and especially the younger ones from the smaller population centers, the opportunity of attending and participating in a large conference without the expenditure of time and money that is involved for them to go to WESCON. In addition they are afforded a time-saving opportunity of seeing at the trade show demonstrations of operating electronic equipments that might be useful to them in their work.

The 1961 7th Region Conference was held in sunny, pleasant Phoenix, April 26 to 28. The emphasis of the papers was on the subject of Spectrum Management (interference problems) and Electronic Control (computer and otherwise), both subjects of great interest in the Phoenix area. Since there were never more than two simultaneous sessions, the atmosphere was much more relaxed than at the larger conferences and there could be much more intimate discussion, both in sessions and out. A special evening session presented a group of well prepared and well presented, informative student papers, previously selected by contests in the various sections. The quality of the papers was very gratifying and deserves much greater participation by the adult IRE members at the conferences.

The 7th Region Conference of 1962 will return after a two-year absence to

sunny (?), pleasant Seattle. This is by special dispensation of the 7th Region Committee and through the courtesy of the Salt Lake Section where it was originally scheduled. The purpose of this rescheduling is to permit participation in the "Century 21" Exposition being held there during the summer to celebrate the growth of the West. Since electronics has been such a factor in that growth, it is only fitting that the IRE should participate in the celebration. In keeping with the occasion the Board of Directors of the IRE will convene there for their only meeting outside of the New York headquarters. A Student Papers Contest will again be featured.

The added attraction of the first international exposition in the West since 1939 should make for an even more interesting and informative 7th Region Conference in Seattle. Remember the dates—May 23-25, 1962.

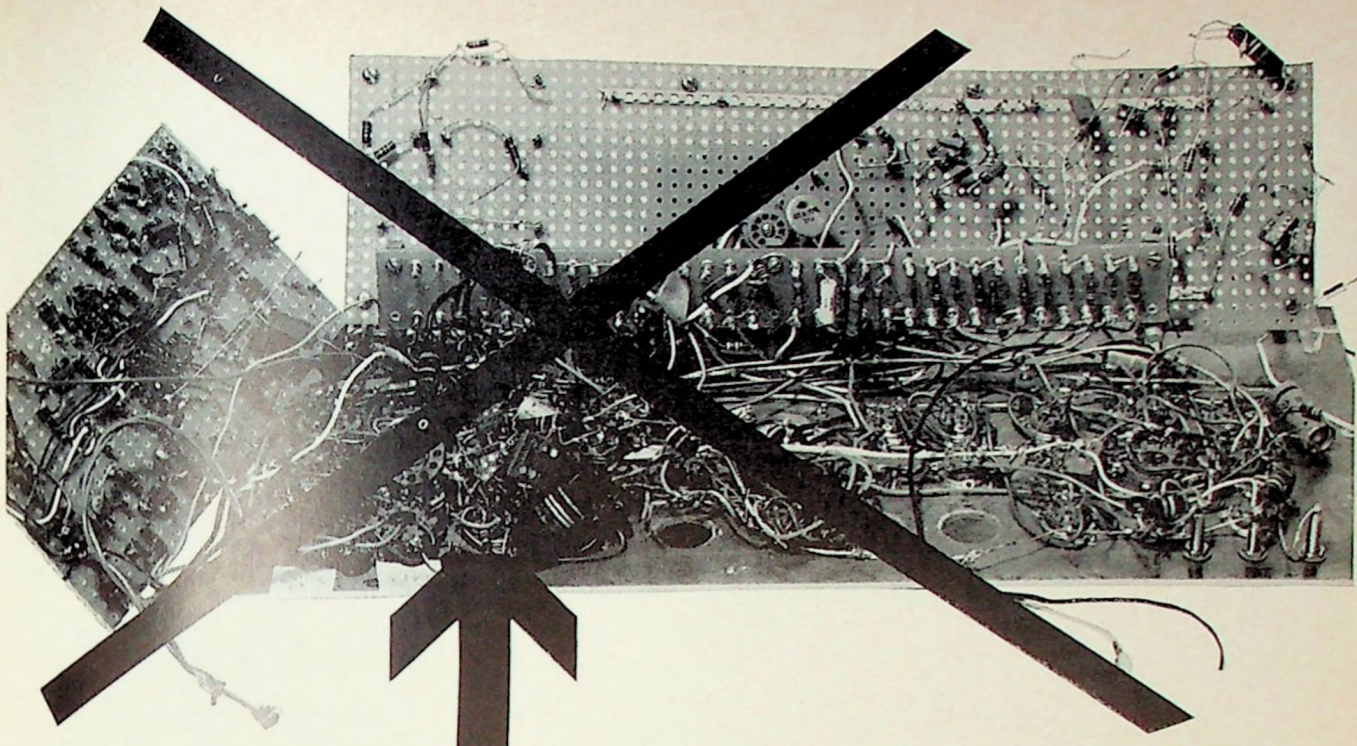


—W. G. ABRAHAM,  
SECRETARY,  
SEVENTH REGION,  
IRE



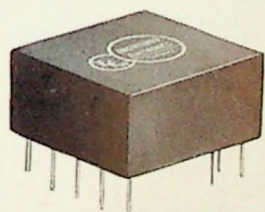
—Walt Miller in the Grid-Bulletin





$$X\bar{Y}\bar{C} + \bar{X}Y\bar{C} + \bar{X}\bar{Y}C + XYC = SUM$$

$$XY\bar{C} + X\bar{Y}C + \bar{X}YC + XYC = CARRY$$



ACTUAL SIZE

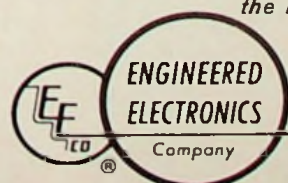
### FROM LOGIC EQUATION TO SYSTEM PROTOTYPE IN ONE STEP

That's how simple it can be when EECO's new U-Series Digital NOR-Circuit modules are used. Engineering time can be spent designing systems, because EECO has taken care of circuit details. The first units of this new family of compatible germanium transistor circuit modules operate over the frequency range of 0 to 25 kcs. These units are designed to meet the requirements of MIL-STD-202B, as modified by temperature specifications of individual units.

#### PACKAGING

Two packaging styles are available. Both use all-welded electrical connections and both are encapsulated. Rectangular units with wire leads (to simplify dip-soldering) are available for installation on circuit cards. Cylindrical units with pins are available for installation in tube-type sockets. This latter package is admirably suited for system breadboarding. System wiring can be accomplished at the sockets; modifications in system design can be performed easily and rapidly. The cylindrical packages measure 7/8" diameter by 1.0" seated height. The rectangular packages measure 0.95" long by 0.95" wide by 0.5" seated height.

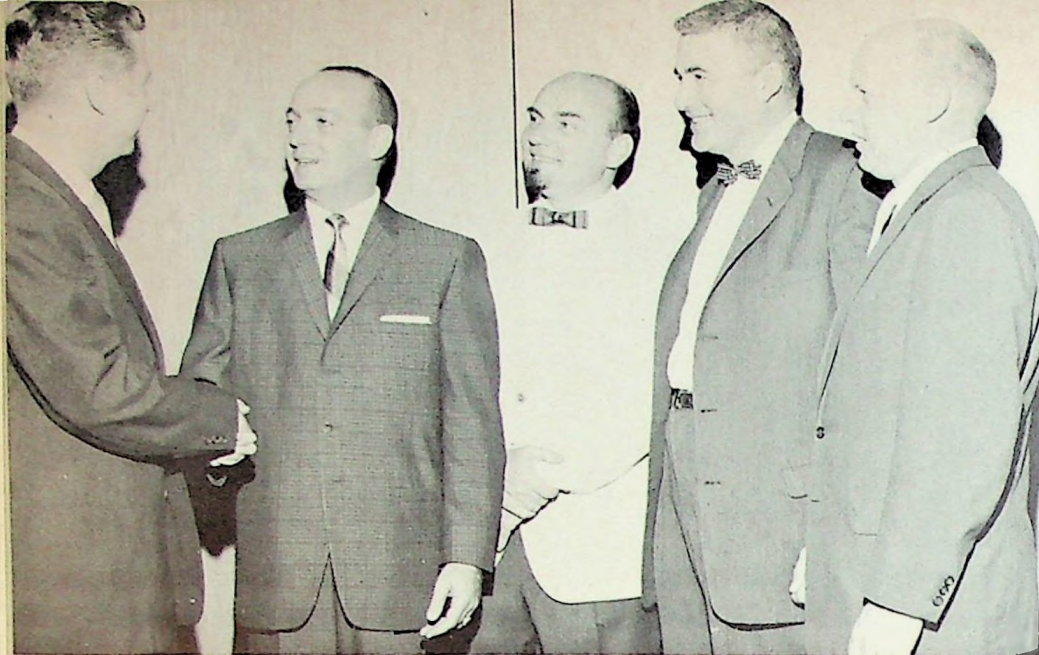
*Write, wire, or phone today for detailed information on the EECO U-Series of NOR units or for information on any of our other families of digital circuit modules.*



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*Putting the pilot ashore, new San Francisco Section Chairman Kaisel, second from left, gets the bon voyage from private citizen Dunn while, of Secretary Sitskind, Vice Chairman Lacy, and Treasurer Waterman, only the latter looked appropriately apprehensive*

### *regional roundup*

#### **THE SAN FRANCISCO YEARLY BLAST**

By six o'clock on June 15, members attending the annual dinner were on their way to the Section's biggest social get-together. Certainly the nicest food in the memory of veteran members was served to a variety of distinguished Section hands (see illustration) from downy-cheeked student-award winners to Arnold Van Mill, according to Toastmaster John R. Whinnery, the only member present who had actually worked on a radio.

The Section's three new Fellows: R. N. (Continued on page 32)



*Student award winners honored at the San Francisco Section meeting: Paul Abern, Santa Clara; F. H. Taylor, Stanford; and Ahsani Ali Reza, Healds; get a personal greeting from Don Dunn*

*Although the annual San Francisco Section meeting was a spirited affair, some of the animation evident in this general view was actually introduced by a special photographic process under development by the staff*



### **MORE PROGRAM (THURS.)**

#### **26/3 THE USE OF THE 15 KC TERTIARY CHANNELS IN THE 150 MC BUSINESS RADIO SERVICE**

M. Peckhart, Motorola, Chicago, Ill.

Sponsored by Professional Group on Vehicular Communications

*Chairman and Organizer: Dwight E. Teall, Lenkurt Electric Co., Inc., San Carlos, Calif.*

### **SESSION 27**

#### **MICROWAVE TUBES AND PARAMETER MEASUREMENTS**

Room B—2:00 P.M.-4:30 P.M.

#### **27/1 A BROAD-BANDING THEORY OF THE KLYSTRON AMPLIFIER OUTPUT CIRCUIT**

C. Romiguiere, Compagnie Francaise Thomson-Houston, Paris, France.

#### **27/2 MEASUREMENT OF IMPEDANCE OFFERED TO THE BEAM BY KLYSTRON BROAD-BAND OUTPUT CIRCUIT**

M. Lakits, Compagnie Francaise Thomson-Houston, Paris, France.

#### **27/3 THE USE OF QUASI-STATIC MODE APPROXIMATIONS IN THE DESIGN OF BROADBAND, SLOW-WAVE STRUCTURE IMPEDANCE MATCHES**

W. Raub, Microwave Electronics Corp., Palo Alto, Calif.

#### **27/4 A 50-MICROWATT BWO AND 0.5 WATT TWT FOR CW OPERATION AT 50-60 KMC**

D. O. Melroy, Bell Telephone Laboratories, Murray Hill, N. J.

Sponsored by Professional Group on Electron Devices

*Chairman and Organizer: Willis H. Yocom, Varian Associates, Palo Alto, Calif.*

### **SESSION 28**

#### **NONLINEAR CONTROL SYSTEM THEORY**

Room C—2:00 P.M.-4:30 P.M.

#### **28/1 ON THE APPLICATION OF LYAPUNOV'S SECOND METHOD TO THE SYNTHESIS OF NONLINEAR CONTROL SYSTEMS**

A. Stubberud, C. T. Leondes and M. Margolis, University of California, Los Angeles, Calif.

#### **28/2 MATHEMATICAL ANALYSIS OF AUTOMATIC GAIN CONTROL CIRCUITS**

R. C. Davis, 3817 Finecraft Drive, Claremont, Calif

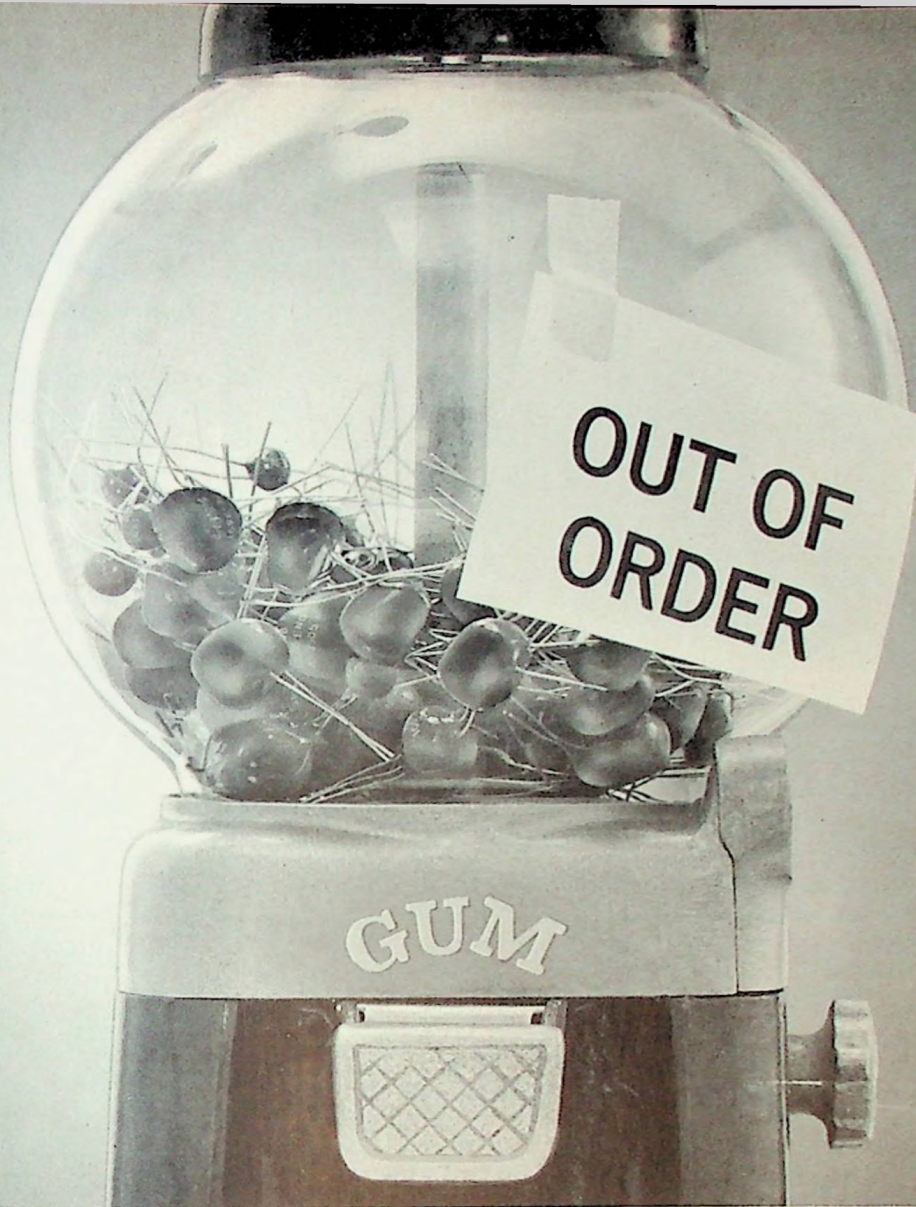
#### **28/3 DUAL MODE FILTERING OF POLYNOMIAL SIGNALS IN NOISE**

L. G. Shaw, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.

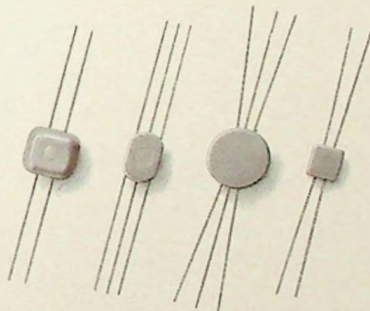
Sponsored by Professional Group on Automatic Controls

*Chairman and Organizer: Professor E. I. Jury, University of California, Berkeley (Continued on page 32)*



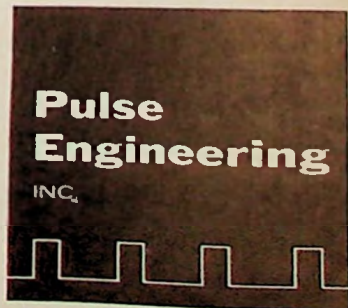


These pulse transformers sent the old "gum ball" back to the candy shop



Shapes that are precise to within ten mils—and the beauty of these new miniature pulse transformers is much more than skin deep. They are more uniform electrically and the higher density completely eliminates porosity and voids. Epoxy bonding to metal leads provides positive sealing and avoids interior contamination. An independent testing laboratory report (if you want a copy, just holler) proves that these units withstand abusive environmental conditions. Just how abusive? Well, you'd have to buy metal encased transformers with glass-to-metal end seals—at 30% more cost—to match their reliable performance.

Cost, as a matter of fact, is an important part of this pulse transformer face lifting story... important because it stays the same. These precision shape units (in the four case styles illustrated or to custom dimensions in quantity orders) are available at the same price as their haphazardly shaped predecessors. The secret: an exclusive transfer molding process that bonds the epoxy under 1000 psi at 300 degrees F without disturbing the delicate works of the units. Available with weldable leads if required, and in either flame retardant or self extinguishing epoxy. The four shapes shown are in production.



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International IRE president chats with Los Angeles Section officers Gerry Goldenstern, treasurer; Einar Ingebretsen, secretary; (Dr. Berkner); and John Guarrera, chairman. Not present, Donald R. Proctor, vice chairman

### regional roundup

#### LOS ANGELES PASSES 9K

A successful 1960-61 term was climaxed by the installation of the 1961-62 officers at the June 13 Section meeting. The new officers are: John Guarrera, Guide Manufacturing Co., chairman; Donald R. Proctor, Electronic Engineering Co. of California, vice chairman; Einar E. Ingebretsen, Guidance Technology, Inc., secretary; and Gerry Goldenstern, Business Development Associates, treasurer. Henry L. Richter, Electro-Optical Systems, and Robert Hansen, Aerospace Corporation, will serve as members-at-large.

Dr. Lloyd V. Berkner, national IRE president, made a special trip to the

west coast to speak before the Section, at the annual installation meeting. His topic was "Electronics in the Space Age." Greeted at the airport by Section officials, he attended a press conference which was followed by a luncheon where he talked with professional group officers. Prior to the evening Section meeting, Dr. Berkner met the Section's executive committee at a cocktail reception party at the Biltmore Hotel.

With an approximate growth of 1000 members since June 1960, the Section starts a new term with 9300 members in the Los Angeles Section, which includes 22 professional groups and seven subsections, the newest addition being the Crescent Bay Subsection, established June 22, 1961.

Only two of the five individuals selected by the Los Angeles Section for its annual awards were able to attend the June 13 meeting where certificates were given. They are: Jack Wills, San Fernando IRE chairman, second from left, and Norbert Lorentz, Section historian, center. Matthew Brady, represented by Henry Richter, extreme left, was in Washington, D. C., aiding U. S. defense, Burgess Dempster, represented by Don Proctor, fourth from left, was in Europe studying the international market, and A. N. Curtiss, represented by Jim Bartell, had been promoted to head the RCA science center, Princeton, New Jersey. All of which points up the scope and intensity of the very active electronics industry in Los Angeles



### MORE PROGRAM (THURS.-FRI.)

- 30/2 A SOLID STATE SPIN ECHO MEMORY SYSTEM FOR A MICROWAVE COMPUTER  
L. K. Wanless and J. R. Singer, University of California, Berkeley, Calif.
- 30/3 THE AMMONIA BEAM MASER AS A STANDARD OF FREQUENCY  
J. A. Barnes, D. W. Allan, and A. E. Weinwright, National Bureau of Standards, Boulder, Colo.
- Sponsored by Professional Group on Microwave Theory and Techniques
- Chairman and Organizer: Professor A. E. Siegman, Stanford University, Stanford

### SESSION 31

#### PROPAGATION STUDIES FOR NEW COMMUNICATIONS TECHNIQUES

Friday, August 25

Room A—10:00 A.M.-12:30 P.M.

- 31/1 LABORATORY SIMULATION OF VLF PROPAGATION AND UNDERGROUND ANTENNA PERFORMANCE  
T. C. Larter, M. E. Louapre and A. Stogryn, Space Electronics Corp., Glendale, Calif.
- 31/2 SYNCHRONIZED-OBLIQUE IONOSPHERE SOUNDING FOR H-F OMF DETERMINATION  
R. D. Baker, R. D. Egan and L. D. Seader, Granger Associates, Palo Alto, Calif.
- 31/3 FREE ELECTRON SCATTER AS A COMMUNICATION MODE  
A. M. Peterson, Stanford University, and Stanford Research Institute, Menlo Park, Calif.
- Sponsored by Professional Group on Antennas and Propagation

Chairman and Organizer: Professor Von R. Eshleman, Stanford University, Stanford

### SESSION 32

#### SOLID STATE DEVICES II

Room B—10:00 A.M.-12:30 P.M.

- 32/1 P-N JUNCTION CHARGE STORAGE DIODES  
J. L. Moll and S. Krakauer, Stanford University, Stanford, Calif., and R. Shen, Harvard University.
- 32/2 A NEW SEMICONDUCTOR TETRODE, THE SURFACE-POTENTIAL CONTROLLED TRANSISTOR  
C. T. Sah, Fairchild Semiconductor Corp., Palo Alto, Calif.
- 32/3 P-N-P DOUBLE DIFFUSED GERMANIUM SWITCH  
J. Brixey and W. Jaeger, Texas Instruments, Inc., Dallas, Tex.
- Sponsored by Professional Group on Electron Devices

Chairman and Organizer: Gordon Moore, Fairchild Semiconductor Corp., Palo Alto

(Continued on page 36)



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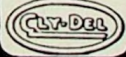
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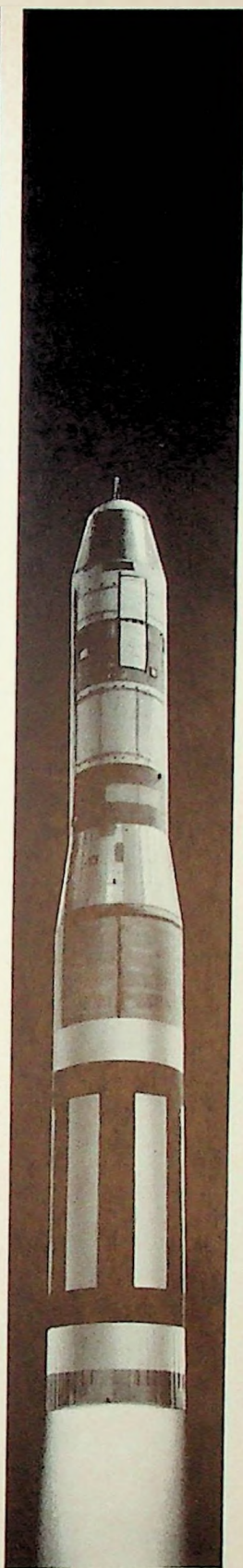
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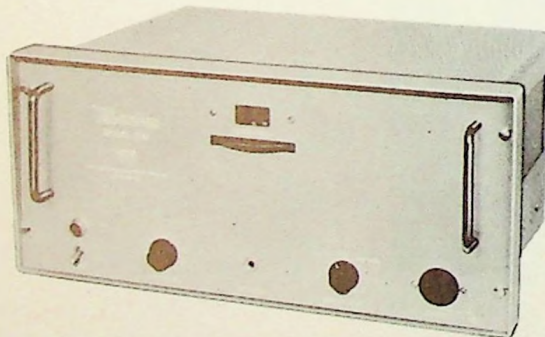
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MORE PROGRAM (FRI.)

#### SESSION 33

##### MODERN PARTICLE ACCELERATORS

Room C—10:00 A.M.-12:30 P.M.

##### 33/1 THE R-F SYSTEMS FOR THE PRINCETON PENNSYLVANIA ACCELERATOR

D. A. Barge, J. Kirschgessner, G. K. O'Neill, G. Rees, and J. Riedel, Princeton University, Princeton, N. J.

##### 33/2 BEAM CAPTURE AND ACCELERATION IN THE BROOKHAVEN ALTERNATING GRADIENT SYNCHROTRON

Martin Plotkin, E. C. Raka, H. Hahn, and H. Halama, Brookhaven National Laboratory, Upton, N. Y.

##### 33/3 THE ZERO GRADIENT HIGH INTENSITY PROTON SYNCHROTRON

A. V. Crewe, Argonne National Laboratory, Argonne, Ill.

Sponsored by Professional Group on Nuclear Science

*Chairman and Organizer: Harry G. Heard, Radiation at Stanford, Palo Alto, Calif.*

#### SESSION 34

##### CODING FOR RELIABILITY

Room D—10:00 A.M.-12:30 P.M.

##### 34/1 ON TIME-VARYING CODING NETWORKS

A. Marcovitz, Columbia University, New York, N. Y.

##### 34/2 SEQUENTIAL DECODING FOR DISCRETE INFUT MEMORYLESS CHANNELS

B. Reiffen, Lincoln Laboratory, MIT, Lexington, Mass.

##### 34/3 THE RELIABILITY OF CODED AND UNCODED BINARY MESSAGES AS A FUNCTION OF THE RATE OF SYMBOL TRANSMISSION

R. D. Klein, Northeastern University, Boston, Mass.

Sponsored by Professional Group on Information Theory

*Chairman and Organizer: Bernard Elspas, Stanford Research Institute, Menlo Park*

#### SESSION 35

##### NEW TECHNIQUES TO EVALUATE PRODUCT DESIGN

Room E—10:00 A.M.-12:30 P.M.

##### 35/1 RANK CORRELATION TESTING APPLIED TO PRODUCT DESIGN

I. R. Whiteman, C-E-I-R Inc., Los Angeles, Calif.

##### 35/2 A SURVEY OF APPLICATIONS OF RADIO-ACTIVITY TO ELECTRONICS

A. J. Moses, Hazleton Nuclear Science Corp., Palo Alto, Calif.

##### 35/3 OPTIMIZED USE OF INDUSTRIAL DESIGN TECHNIQUE

Donald J. McFarland, Latham-Tyler-Jensen, Inc., Long Beach, Calif.

Sponsored by Professional Group on Product Engineering and Production

*Chairman and Organizer: Hugh D. Kennedy, Granger Associates, Palo Alto, Calif.*

(Continued on page 38)





Granger

Silver

7th Region IRE Fellows: John V. N. Granger, president, Granger Associates, Palo Alto; Samuel Silver, professor of engineering science, University of California, Berkeley; Meyer Leifer, chief engineer, instrumentation products, Ampex Corp., Redwood City; Leonard F. Fuller, retired, Palo Alto



Leifer

Fuller



Carnahan

Samuelson

7th Region IRE Fellows: C. Wesley Carnahan, director of central research planning, Varian Associates, Palo Alto; R. E. Samuelson, assistant general manager for research and development Motorola, Inc., military electronics division, Scottsdale; Paul W. Crapuchettes, technical director of electron tube division, Litton Industries, San Carlos; Samuel Sensiper, senior staff consultant, Hughes Aircraft Co., Culver City



Crapuchettes

Sensiper

# CRITICAL MOMENTS! LONG before the SCRAMBLE

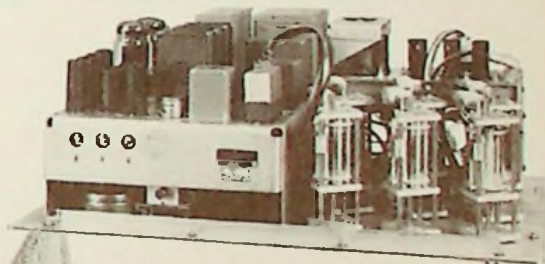
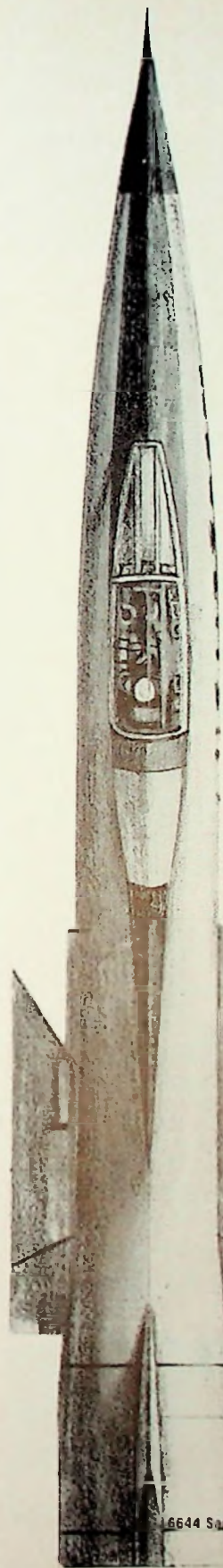
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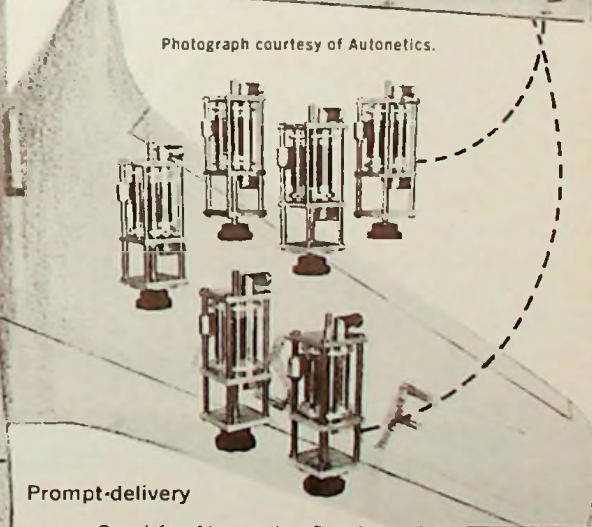
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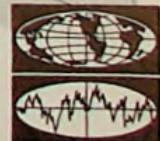


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MORE PROGRAM (FRI.)

**SESSION 36**

**NEW DEVELOPMENTS IN  
COMMUNICATIONS SYSTEMS**

Room A—2:00 P.M.-4:30 P.M.

- 36/1 **THE HC-270 — A FOUR PHASE DIGITAL DATA TRANSCEIVER**  
J. E. Toffler and J. N. Buterbaugh, Hughes Communications Division, Los Angeles, Calif.
- 36/2 **HIGH SPEED SERIAL DATA OVER PARALLEL, LOW SPEED H-F RADIO LINKS VIA SEPATH**  
C. S. Krakauer, Rixon Electronics, Inc., Silver Spring, Md.
- 36/3 **DEPENDANCY OF CROSSTALK ON UPPER AND LOWER CUTOFF FREQUENCIES IN PAM TIME-MULTIPLIED TRANSMISSION PATHS**  
H. M. Straube, RCA, New York, N. Y.

Sponsored by Professional Group on Communications Systems

*Chairman and Organizer: Alan F. Culbertson, Lenkurt Electric Co., Inc., San Carlos*

**SESSION 37**

**ULTRASONIC AIDS TO THE  
MILITARY & INDUSTRY**

Room B—2:00 P.M.-4:30 P.M.

- 37/1 **A METHOD FOR NON-DESTRUCTIVE EVALUATION OF PHYSICAL PROPERTIES IN RUBBER-SOLID COMPOUNDS**  
J. G. Martner, Stanford Research Institute, Menlo Park, Calif.
- 37/2 **EVALUATING SONIC ENERGY CLEANING**  
Dr. Thomas Bulat, Bendix Corporation, Davenport, Iowa.
- 37/3 **THE EFFECTS OF BONDING AND BACKING MATERIALS ON THE CHARACTERISTICS OF ULTRASONIC DELAY LINES**  
W. Konig, L. Lambert and D. Schilling, Stanford Research Institute, Menlo Park, Calif.

Sponsored by Professional Group on Ultrasonic Engineering

*Chairman and Organizer: Gilbert G. Brown, Amsco Electronics Co., Palo Alto, Calif.*

**SESSION 38**

**COMPUTER THEORY**

Room C—2:00 P.M.-4:30 P.M.

- 38/1 **A DECISION THEORETIC APPROACH TO MACHINE LEARNING AND PATTERN RECOGNITION**  
David Braverman, Stanford University, Stanford, Calif.
- 38/2 **DIODE AND TRANSISTOR LOGIC IN SYNTHESIS OF SYMMETRIC BOOLEAN MATRICES**  
H. K. Cooper, Pacific Semiconductors, Inc., Lawndale, Calif.
- 38/3 **LOGICAL SYNTHESIS OF UNIT-TIME ARITHMETIC CIRCUITRY**

Burton Singer, Case Institute of Technology, Cleveland, Ohio.

Sponsored by Professional Group on Electronic Computers

*Chairman and Organizer: Richard I. Teska, Lockheed missiles and space division, Sunnyvale, Calif.*

(Continued on page 40)



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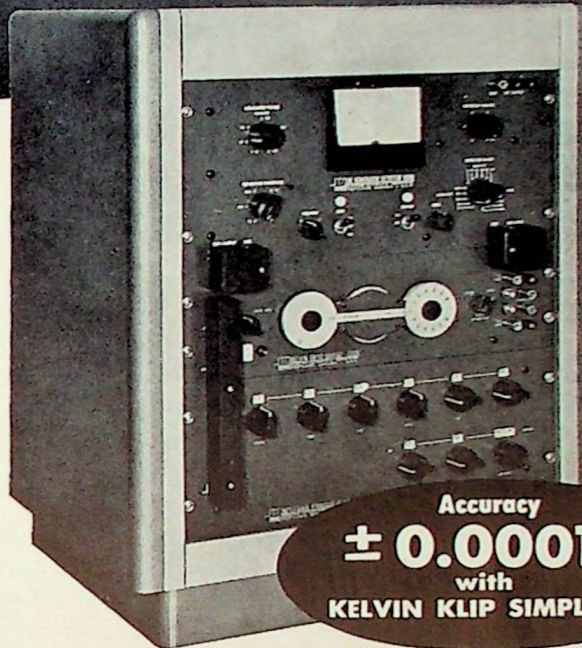
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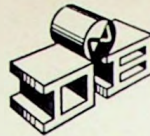
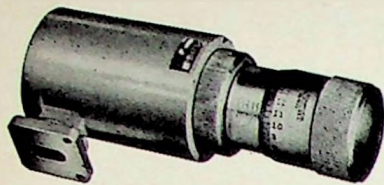


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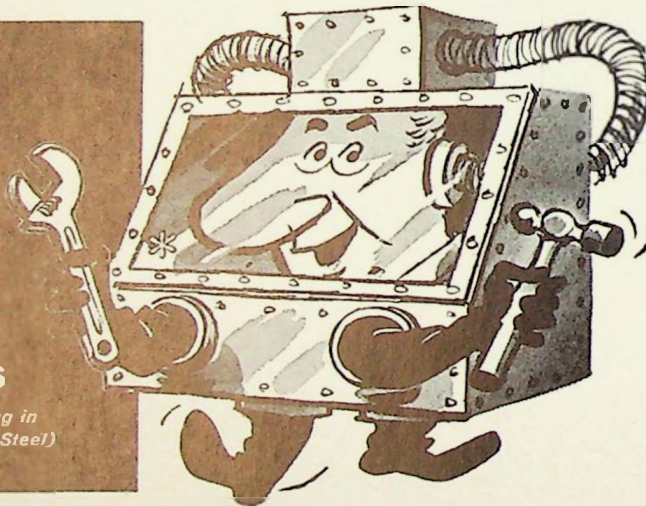


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### SESSION 39

#### IDENTITY AND USE OF OPERATOR CHARACTERISTICS IN ELECTRONIC SYSTEMS

Room D—2:00 P.M.-4:30 P.M.

39/1 THE CONCEPT OF "EQUALIZING ABILITY"  
IN OPERATOR SELECTION AND TRAINING

H. P. Birmingham and R. Chernikoff, U. S. Naval  
Research Laboratory, Washington, D. C.

39/2 ISOLATION OF HUMAN PERFORMANCE  
VARIABLES IN AN OPERATIONAL MAN-  
COMPUTER SYSTEM

M. M. Okanes, System Development Corp.,  
Santa Monica, Calif.

39/3 DECISION-MAKING IN PROBLEMS  
UTILIZING INDUCTIVE AND DEDUCTIVE  
INFERENCE

H. C. Ratz and G. H. M. Thomas, University of  
Saskatchewan, Saskatoon, Canada.

Sponsored by Professional Group on Human  
Factors in Electronics

Chairman and Organizer: Richard S. Hirsch,  
I.B.M. Advanced Systems Dev. Division,  
San Jose, Calif.

### SESSION 40

#### MICROWAVE SOLID STATE DEVICES

Room: E—2:00 P.M.-4:30 P.M.

40/1 AN ELECTRONICALLY TUNABLE BAND-  
REJECT FILTER

K. L. Kotzebue, Watkins-Johnson Company, Palo  
Alto, Calif.

40/2 A NON-DEGENERATE TRAVELING WAVE  
PARAMETRIC AMPLIFIER

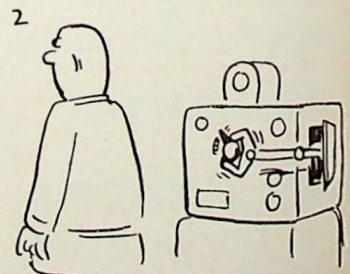
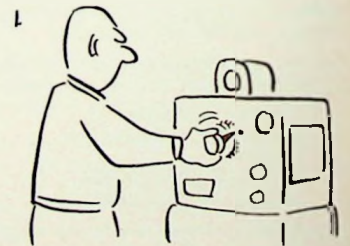
K. P. Grabowski, Hughes Aircraft Co., Fullerton,  
Calif.

40/3 MAGNETICALLY TUNABLE NON-  
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Cumar Patel, Stanford University, Stanford,  
Calif.

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Chairman and Organizer: Philip S. Carter,  
Stanford Research Institute, Menlo Park



—Alvin Hale in Grid-Bulletin





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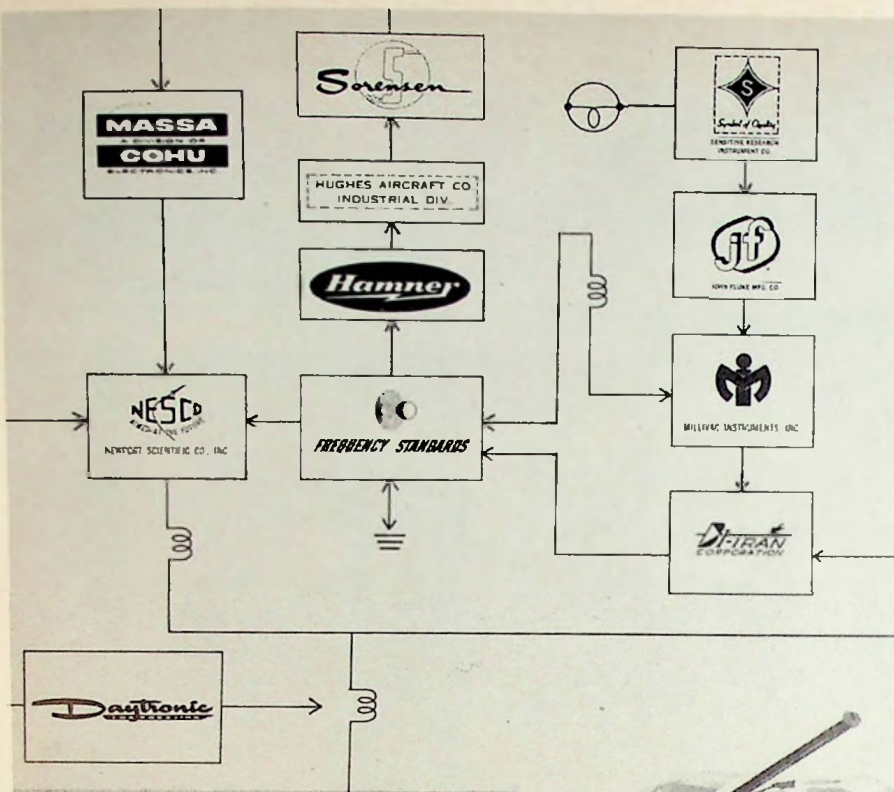
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**INDUSTRY NOTES**

Six Seventh Region firms have recently been approved for membership in the **Western Electronic Manufacturers Association (WEMA)**: Argonaut Associates, Inc., Beaverton, Oregon; California General, Inc., Mektron Division, Chula Vista, California; Controls & Communications Co., Eugene, Oregon; Exact Electronics, Inc., Hillsboro, Oregon; Ratelco, Inc., Seattle, Washington; Smith-Corona Marchant, Inc., data processing systems division, Oakland, Calif.

Shell Development Company has announced a reorganization of its Emeryville research center and the appointment of two scientists to senior management positions: Dr. **D. P. Stevenson** has been appointed director of basic and general science. He was formerly director of fundamental research. Dr. **T. Baron** has been appointed director of basic and general engineering. Until this time he had been head of the chemical engineering department.

The appointment of **Robert R. Goldsborough, Jr.**, as manager of the engineering operations department at the reconnaissance systems laboratory of **Sylvania Electric Products Inc.**, has been announced. Goldsborough succeeds **Gerald C. Rich** who has resigned. With Sylvania since 1953, Goldsborough joined the company as a senior engineer at the electronic defense laboratories. He was later promoted to head of the systems test and integration section, and, in 1958 was transferred to the Waltham laboratories of Sylvania to assume new responsibilities. He returned to Mountain View the following year when that program office was transferred to the West Coast.



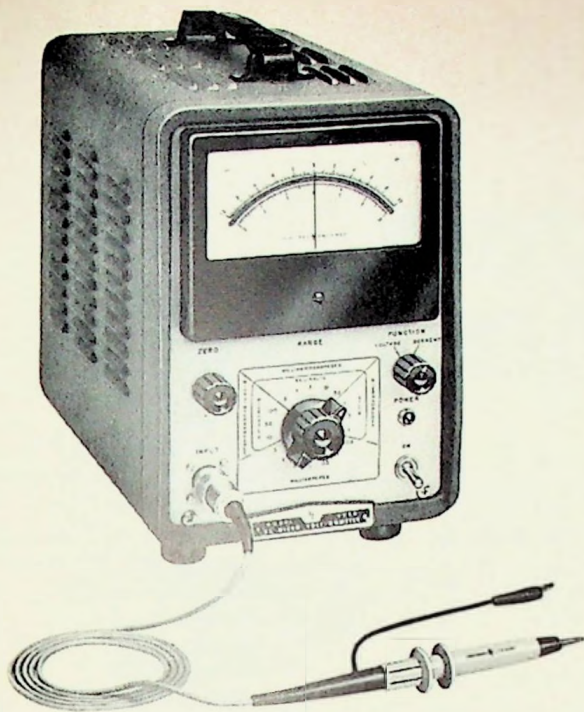
*Goldsborough*

*Kipp*

Melabs recently appointed **Stewart G. Kipp** as manager in charge of western regional sales. Kipp was formerly manager of the San Diego Branch of O'Halloran Associates, and was on the technical staff of the Motorola research laboratory in Riverside, Calif.

*(Continued on page 46)*





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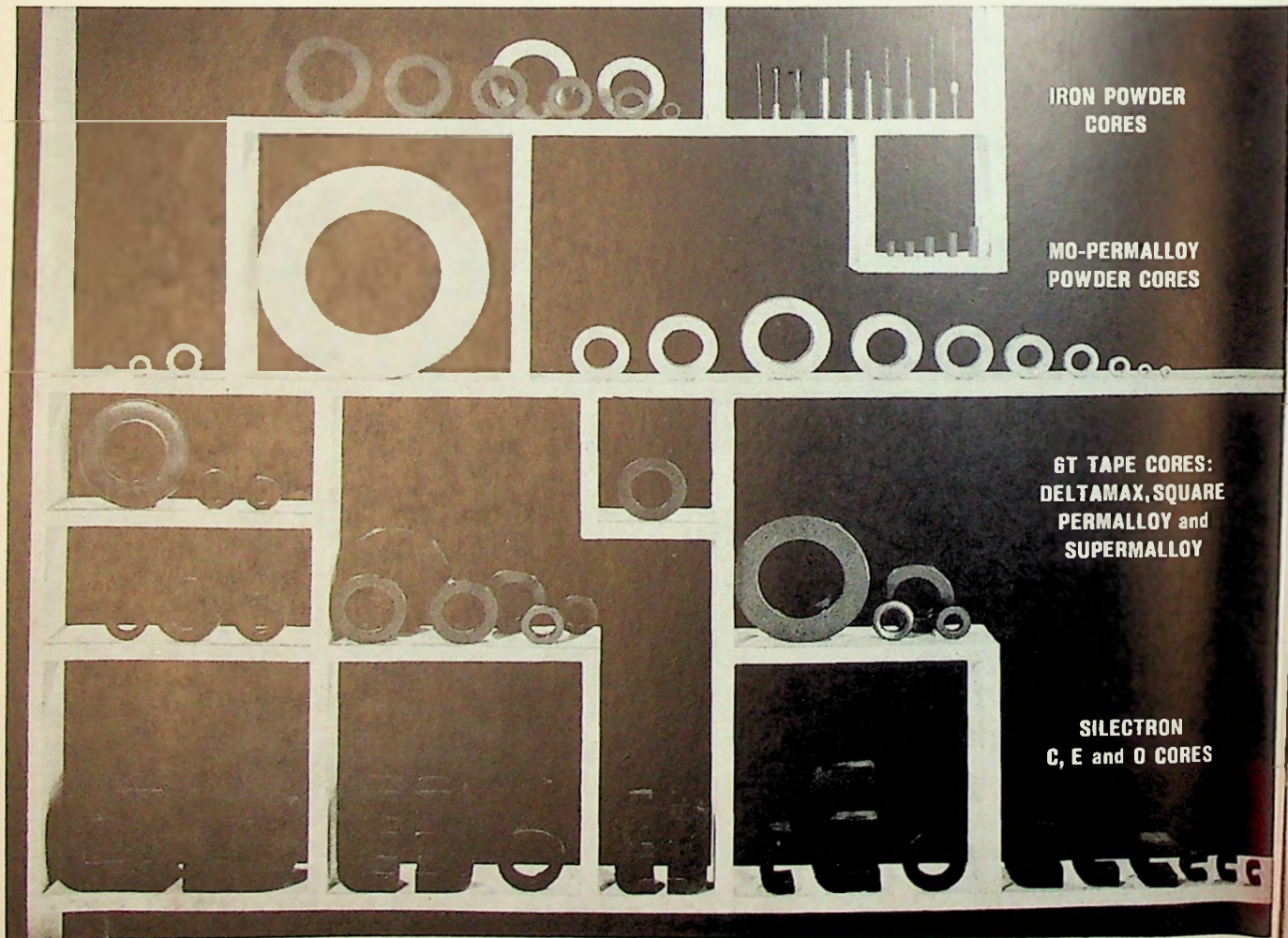
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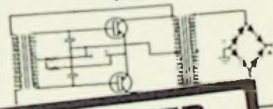
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**MORE NOTES**

The **J. T. Hill Company**, electronic manufacturers' representative organization, announces the following management changes: **Warren R. Huth** has been elected president while **A. Wallace Russell** reforms the Company as vice-president. **J. T. (Jerry) Hill**, who founded the original J. T. Hill Sales Company in 1926, will continue as chairman of the board.

Huth, who will continue to function as sales manager, joined the Company as a field engineer in 1952 and was appointed sales manager in 1957. Russell first came to the J. T. Hill Company as application engineer in 1955 and was appointed engineering manager in 1957. He will serve as general manager of J. T. Hill Company.

Four promotions in the data processing systems division of **Smith-Corona Marchant Inc.**, Oakland, have been announced. **Harry R. Kattelmann** and **Stanley R. Olson** have been named senior project engineers. Both were formerly project engineers. **Herbert P. Stickel** has been moved up from senior engineer to project engineer and **Ronald N. Borrelli** has been promoted to senior engineer. All four were with the SCM data processing systems division prior to its formation in October 1959, when it was the research unit of Marchant Calculators, Inc., which itself is now a division of Smith-Corona Marchant Inc.

Appointment of **Ralph G. Lindstrom** as manager of the engineering services department for the western development laboratories of **Philco Corporation** has been announced. Lindstrom has been associated with Farnsworth Electronics Co. and Associated Missile Products Corp. Prior to joining Philco he was supervisor of engineering services for Lockheed Aircraft Service, Ontario, Calif.

Dr. **Warren A. Christopherson** has been promoted to the rank of senior engineer in **International Business Machines Corp.**'s engineering center in San Jose. A member of the general products division development laboratory, he is engaged in developing non-mechanical memory devices. Christopherson joined IBM's San Jose staff after receiving the PhD degree from Stanford University in 1952. He initially worked on an analog-to-digital converter assignment. He subsequently was manager of a data-transmission group and during 1955 was assistant to the director of advanced development at corporate headquarters.

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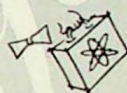
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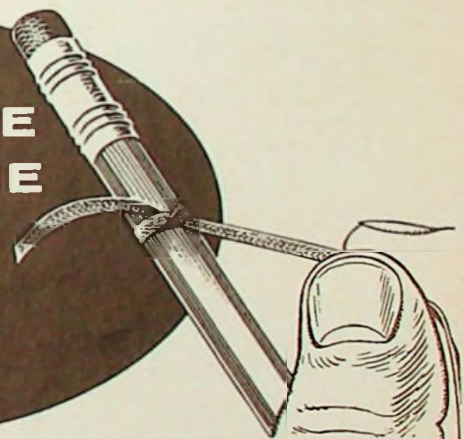
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September 5-8—**16th National Conference of the Association for Computing Machinery and First International Data Processing Exhibit.** Statler-Hilton Hotel, Los Angeles, California. Benjamin F. Handy, Jr., Litton Systems, 5500 Canoga Ave., Woodland Hills, California.

September 6-8—**Space Electronics & Telemetry 1961 National Symposium.** University of New Mexico, Albuquerque, New Mexico. General chairman for the Symposium is Allen B. Church, Sandia Corporation. For information regarding program, contact: Dr. B. L. Basore, 2405 Parsifal, N.E., Albuquerque, New Mexico.

September 12—**Eighth Annual San Francisco Bay Area Quality Control Con-**

**ference.** Cubberley Hall, Stanford University, Palo Alto, California. Chairman of the conference is Grant Ireson, executive head of the Stanford University Industrial Engineering Department.

### PAPERS CALLS

**July 1**—500-word abstracts for International Symposium on Aero-Space Nuclear Propulsion and 8th Annual Meeting of the IRE Professional Group on Nuclear Science (Las Vegas, Nevada; October 24-26). Send to P. M. Uthe, Lawrence Radiation Lab, University of California, P.O. Box 808, Livermore, California.

**August 1**—Papers for 1961 Special Technical Conference on Non-Linear Magnetics (Los Angeles, November 6-8). Contact Dr. Ted Bernstein, Space Technology, Laboratories, P.O. Box 95001, Los Angeles 45, California.

**August 18**—200- to 500-word abstracts in duplicate (original on white bond paper, typed double spaced) for Conference on Magnetism and Magnetic Materials (Phoenix, Arizona, November 13-16). Send to: F. E. Luborsky, General Electric Co., Research Laboratory, P.O. Box 1088, Schenectady, N. Y.

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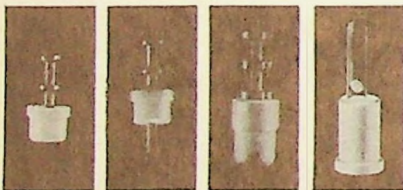
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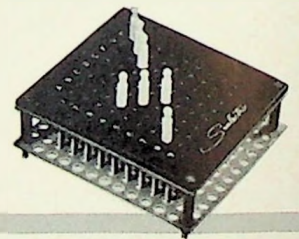


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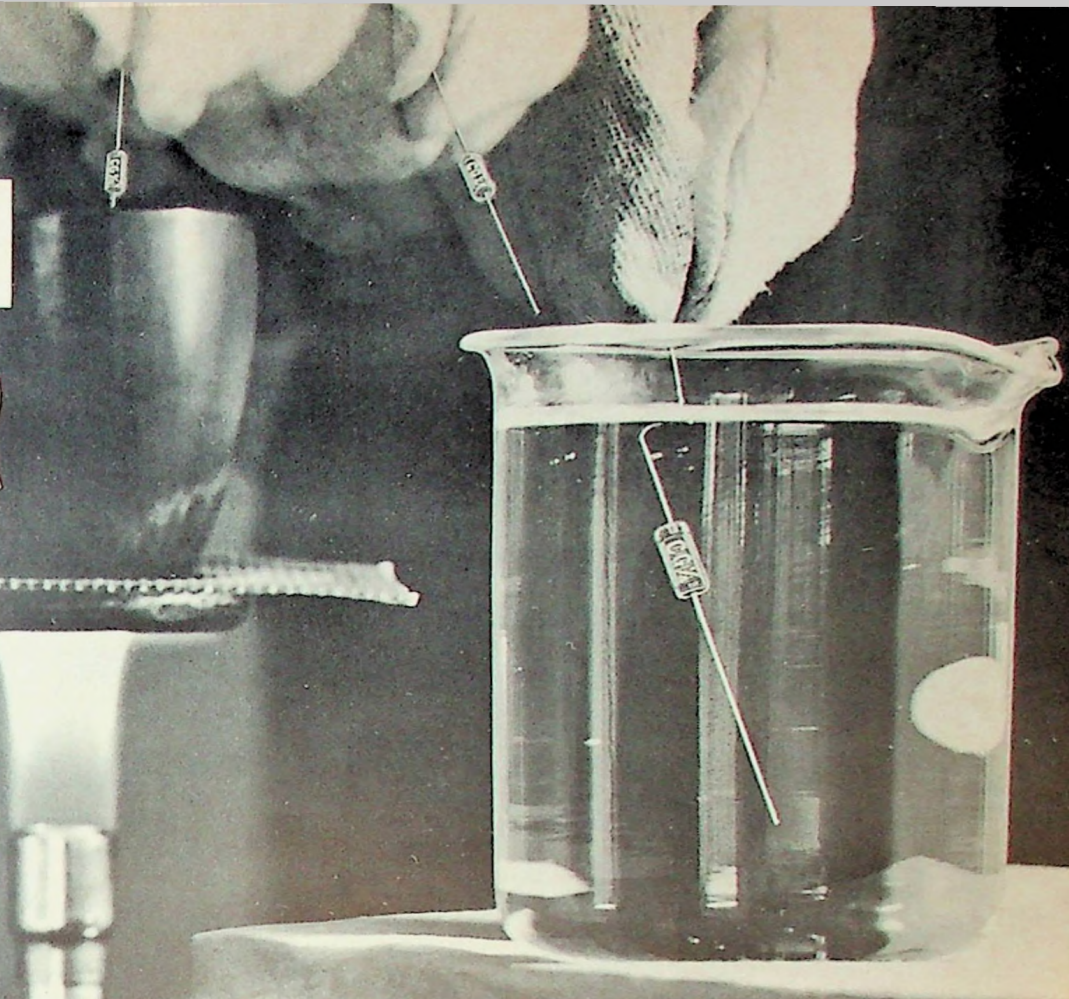
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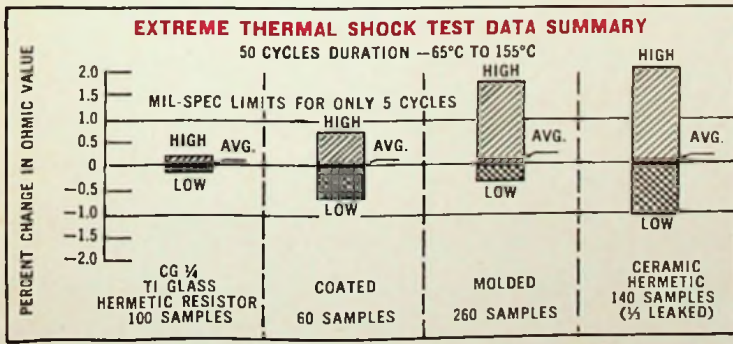


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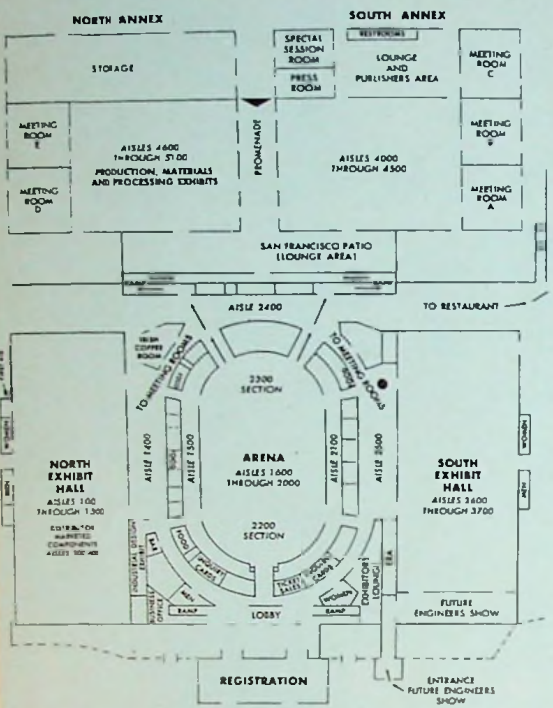
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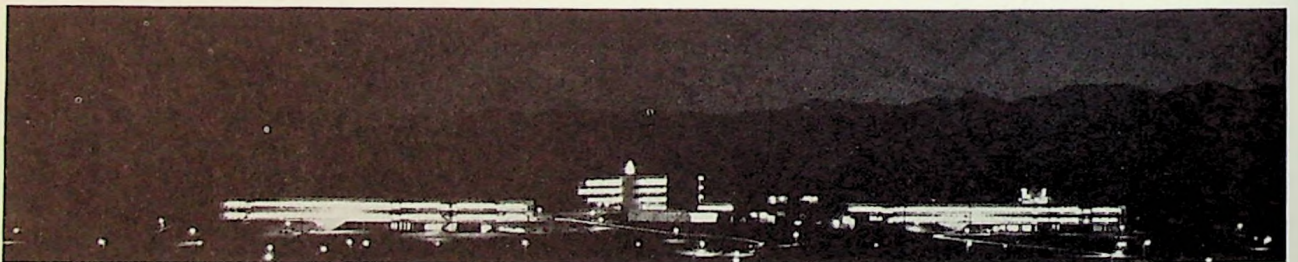
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