

# EDITOR'S PROFILE of this issue

*from a historical perspective ...*

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

October, 1959:

Cover: USA vice-president Richard Nixon and USSR chairman Nikita Khrushchev meet at the American National Exhibition in Moscow to look at a replay of their videotaped meeting, using Ampex equipment (page 10). Both seem delighted as they watch the color playback.

Page 6: Now that the Section has 14 groups (chapters), their monthly AdCom meetings are too long and involved. The decision is to standardize the professional group issues/discussions. A professional group committee will take on that task, and meet once each year (or maybe more) to address issues. Then the ExCom can address non-group matters, such as the budget, relationships, etc.

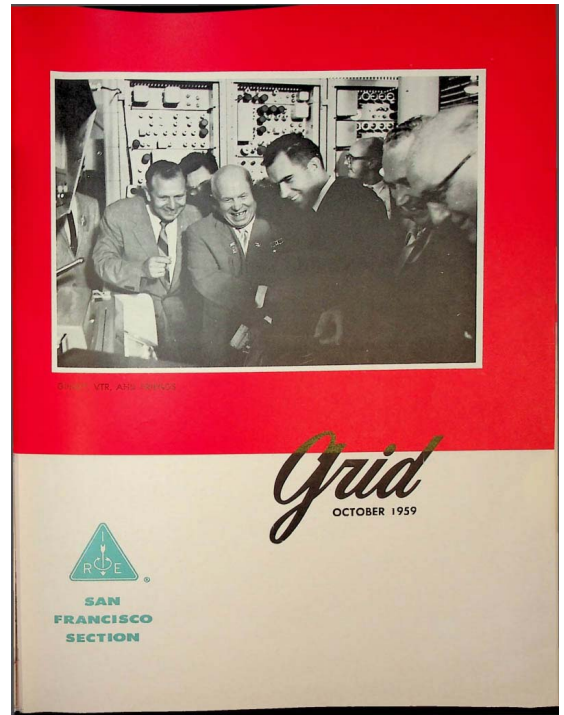
Page 6: There is no Section office in Palo Alto yet; the Section's offices are shared with WEMA's offices in San Mateo.

Page 8: The Electronic Computers group has Jay Last as its speaker. He is one of the "traitorous eight" that left Shockley to form Fairchild. He speaks on the recently invented "Micro-miniature Silicon Circuits" (today known as ICs) and gives a plant tour at Fairchild's main plant.

Page 12: David Steinberg, head of purchasing at Lenkurt Electric, talks on the tasks involved in purchasing of electronics parts. When I worked at Lenkurt (1968-1970), I'd sometimes go to Dave's office for fatherly advice as I was starting my career.

Page 22: Charles (Bud) Eldon, of Hewlett Packard, runs for VP of the Production Techniques group (predecessor to today's EPS chapter); his bio lists two degrees from Stanford. He goes on to be Region 6 Director for IEEE, and IEEE president in 1985. He recorded an oral history for IEEE's History Center.

Page 30: Sylvania discusses plans for new buildings. The groundbreaking ceremony for their Mountain View building includes Fred Terman (page 31).



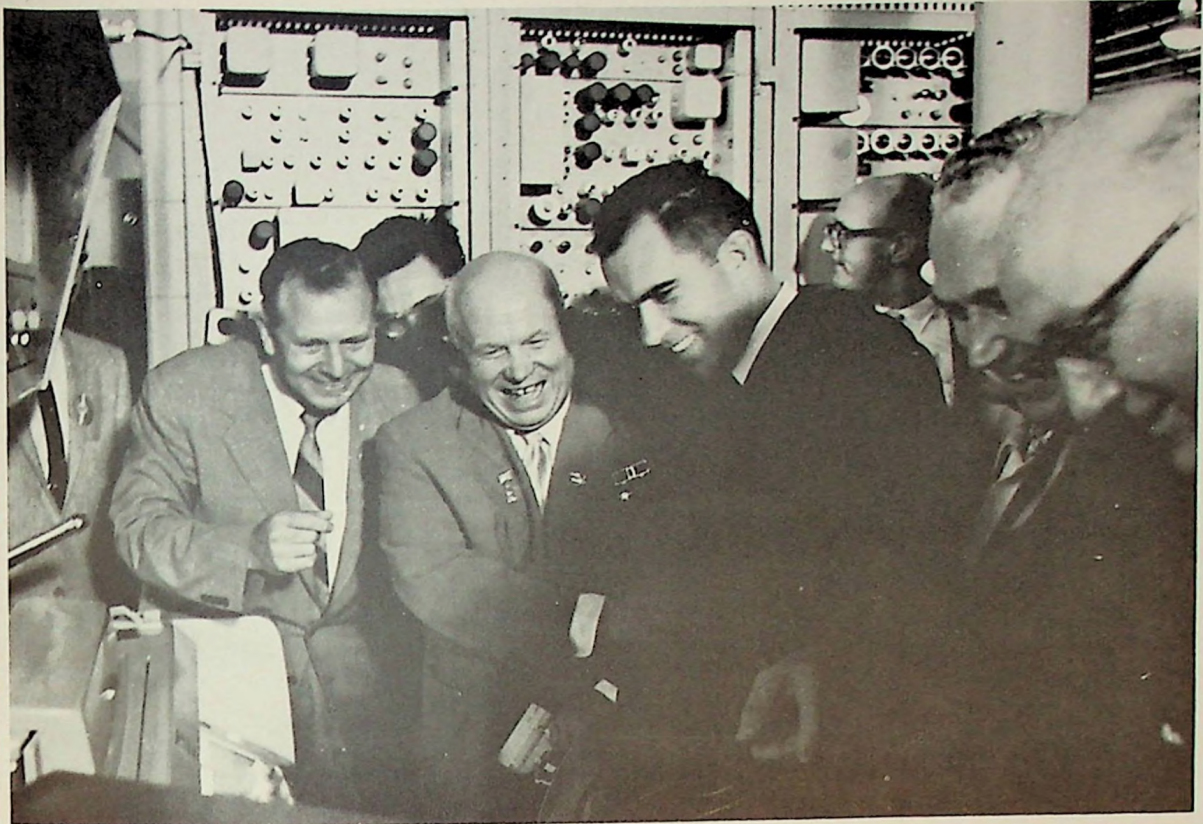
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At time of scanning, the bound volumes are held by Paul Wesling.

July, 2021

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



GUNDS, VTR, AHS FRIENDS

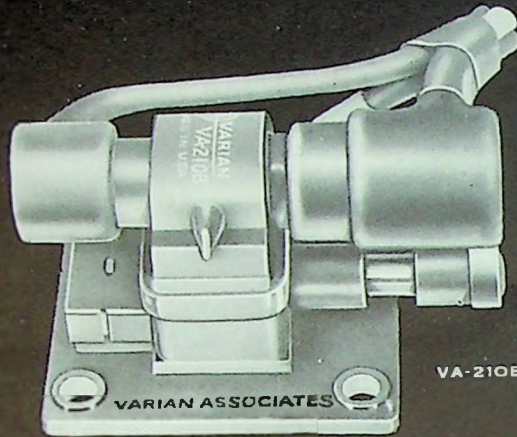
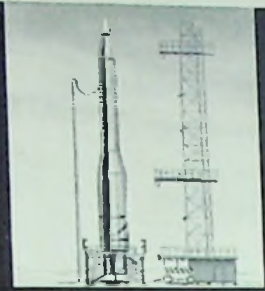
# *Grid*

OCTOBER 1959



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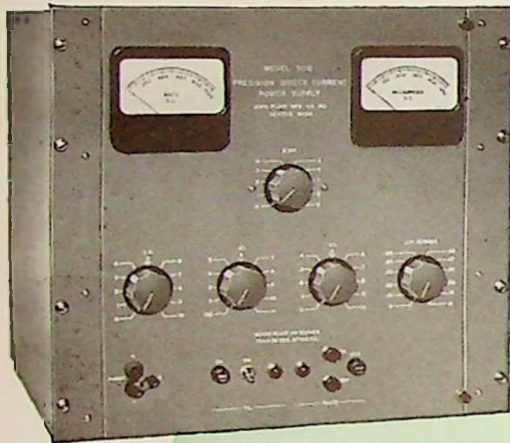


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 RESOLUTION ..... 500 Microvolts  
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*(Continued on page 8)*

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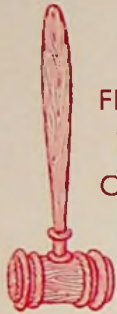
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FROM  
THE  
CHAIR

## Meetings and Professional Groups

One of the principal functions of the San Francisco Section is that of holding meetings adapted to the needs of its members. We have divided the responsibility for organizing these meetings by professional group and there are now 14 professional groups in our Section plus the East Bay Subsection. This set of groups will probably hold about 100 meetings during the coming year. Just because a lot of people don't recognize some of these groups when they see their initials, I have included at the end of this commentary a list of the groups (and their initials) that are active in our section.

We are going to try to get the professional group part of our section operating in a reasonably standardized fashion by the end of the coming year. In future years we hope it will be a little easier for the new officers of each group to know what they are supposed to do in order to comply with the requirements of the national organization, to get money from the Section, and to make use of the services that are available to them from the section. We are going to try to provide a more or less standardized set of services to any group that wishes them through the IRE-WEMA office in San Mateo. During the course of the next few months I will be issuing some memos to the chairmen of these groups to clarify some of these matters.

As Vic Corey stated in his editorial in last month's *Grid*, a professional group committee has been formed within the executive committee of the Sec-



*Don Dunn*

tion to deal with problems of the professional groups. This group will have as its chairman the Section vice chairman and, as a permanent member and secretary, the Section professional group coordinator. This committee normally will have at least one meeting at the beginning of the year to settle a tentative meeting schedule for the year. Our meeting schedule for the coming year was listed in last month's *Grid* following the directory of officers. We will probably have more meetings of this committee during the coming year, but no definite pattern for the future yet exists.

Generally speaking, one of the major jobs we hope to perform at the Section level in the future is a job of communications. Insofar as possible, we would like to avoid having two meetings that one person would like to go to on the same night. Since we try to hold most of our meetings on Tuesday night, we have to be reasonably careful in planning the schedule. There are a lot of other professional societies in the Bay Area that hold meetings on subjects of interest to IRE members and their meetings are brought to your attention, as a Section member, by means of the "San Francisco Engineer." Hopefully, we have meeting-planning coordination both among our professional groups and with those societies that are likely to have meetings we would be interested in, as IRE members. An objective is to end up with joint sponsorship of all meetings that are of special interest to more than one group, in preference to

holding more than one meeting either on the same subject or with the same speaker.

All of this coordination can't occur unless the individual group program chairmen cause it to occur. I believe it will be worthwhile in the long run in causing fewer, better meetings than would otherwise be the case.

—*Don Dunn, vice chairman, SFS*

PGAP—Professional Group on Antennas & Propagation

PGA—Professional Group on Audio

PGB—Professional Group on Broadcasting

PGCS—Professional Group on Communications Systems

PGED—Professional Group on Electron Devices

PGEC—Professional Group on Electronic Computers

PGEM—Professional Group on Engineering Management

PGEWS—Professional Group on Engineering Writing & Speech

PGME—Professional Group on Medical Electronics

PGMTT—Professional Group on Microwave Theory & Techniques

PGMIL—Professional Group on Military Electronics

PGPT—Professional Group on Production Techniques

PGRQC—Professional Group on Reliability & Quality Control

PGSET—Professional Group on Space Electronics & Telemetry





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**CIRCUIT DESIGN**—transistors, cores and other solid state devices in: logic elements, small signal applications, drivers for mechanical or magnetic devices.

**COMPONENT DESIGN**—creative studies of phenomena associated with: magnetic heads, core logic, thin films and surfaces.

**SYSTEM PLANNING**—application and system requirements in: communications, facsimile recording, digital data handling, magnetic and photo memory.

**MECHANICAL ENGINEERS:**

**MECHANISM DESIGN**—high-speed, complex devices used in: memory access, input-output elements, card and tape handling mechanisms, hydraulic servos.

**PHYSICISTS:**

**SOLID STATE**—explore phenomena of: electroluminescent devices, photoconductor devices, special transistor devices.

**OPTICS**—photometric, high-resolution photo techniques in high-performance optical systems.

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# MEETING CALENDAR

## PROFESSIONAL GROUPS

### Antennas & Propagation

8:00 P.M. • Tuesday, October 13

"A VLF Satellite Experiment"

Speaker: Professor R. A. Helliwell, electrical engineering department, Stanford University

Place: Physics Lecture Hall, Stanford University

Meet-the-speaker dinner: 6:30 P.M. (Happy Hour: 6:00 P.M.), Hal's Restaurant, 4085 El Camino Way, Palo Alto

Reservations: Mrs. Lames, DAvenport 1-3300, ext. 365

8:00 P.M. • Tuesday, November 10

(Joint meeting with PGSET)

"The Argus Experiment"

Speaker: N. C. Christofilos, Lawrence Radiation Laboratory, University of California, Livermore

Place: Physics Lecture Hall, Stanford University

Meet-the-speaker dinner: 6:30 P.M. (Happy Hour: 6:00 P.M.), Hal's Restaurant, 4085 El Camino Way, Palo Alto, Calif.

Reservations: Mrs. Lames, DAvenport 1-3300, ext. 365

### Electronic Computers

7:30 P.M. • Tuesday, October 27

"Micro-Miniature Silicon Circuits" and Plant Tour

Speaker: Dr. Jay Last

Place: Fairchild Semiconductor Co.—Main Plant, 545 Whisman Road, Mountain View, Calif.

### Engineering Management

8:00 P.M. • Tuesday, October 13

Discussion and tour of Bell System office

Speaker: Lloyd Cornell, general engineering and construction supervisor, Pacific Telephone & Telegraph Co.

Place: Pacific Telephone & Telegraph Co., San Francisco, Calif.

### Medical Electronics

8:00 P.M. • Tuesday, October 27

"The Nervous System and Automatic Control—Similarities and Differences"

Speakers: Gene F. Franklin, PhD, associate professor of electrical engineering, Stanford University; Enoch Callaway, III, M.D., chief of research at Langley Porter Neuropsychiatric Institute, San Francisco; Karl H. Pribram, M.D., associate professor of psychiatry and psychology, Stanford University

Place: Room M 112, Medical Science Building, Palo Alto-Stanford Medical Center, Stanford, Calif.

### Microwave Theory & Techniques

8:00 P.M. • Tuesday, October 20

"The Tunnel Diode"

Speaker: Herbert Krömer, Varian Associates

Place: Physics Lecture Hall, Stanford University

Dinner: 6:00 P.M., Hal's Restaurant, 4085 El Camino Way, Palo Alto

Reservations: Mrs. Val Pakaski, DAvenport 6-4000, ext. 302

### Military Electronics

• Tuesday, November 3

(Details to be announced)

### Production Techniques

8:00 P.M. • Tuesday, October 27

"Painting and Finishing"

Speakers: Gene Dodge, vice president of Tepco company, Sunnyvale; Dr. Sidney Simon, chief chemist of Rhino Tech Company, Santa Clara; and Roy Koren, president of Doidge-Koren Co., South San Francisco

Place: Room 100, Physics Lecture Hall, Stanford University

### Space Electronics & Telemetry

8:00 P.M. • Tuesday, November 10

(Joint meeting with PGAP, see above)

## CHRONOLOGICAL RECAP

October 13—Antennas & Propagation, Engineering Management

October 20—Microwave Theory & Techniques

October 27—Electronic Computers, Medical Electronics, Production Techniques

November 3—Military Electronics

November 10—Antennas & Propagation/Space Electronics & Telemetry





## NATO SELECTS EIMAC KLYSTRONS TO POWER EUROPE'S LARGEST TROPO-SCATTER NETWORK

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Eimac Klystrons will be used in NATO installations. Proved Eimac reliability will aid in safeguarding the security of all free European nations.

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*In Moscow, here is the scene of the making of the historical Videotape recording*

## ABOUT THE COVER

### Moscow Hit: Videotape

This cover is a sequel to the celebrated Videotape debate between the Russian Premier and the American Vice President in the American National Exhibition at Moscow. It shows the reaction of the two men to seeing themselves in immediate color playback on the Ampex equipment. SFS Member Phil Gundy, Ampex vice president, is at left. William Barnhart, at right rear, is one of the Ampex engineers who made the trip. Others were Glen Pew and Joe Roizen.

The **Grid's** reporter in Moscow was Jack Miller, Ampex shows manager, who supplied notes on the exhibit.

*Meanwhile, back in Redwood City, the man who started it all, Alex M. Poniatoff, right, Ampex board chairman, shares flying reminiscences with Air Force Major General S. T. Wray, a recent visitor*



Russians attending the fair (nearly three million) voted the color tv studio (including the Ampex recorder) their favorite exhibit—topping the American automobiles.

The studio was erected in the main exhibition hall and intended primarily to show off the equipment. It was here that Premier Khrushchev and Vice President Nixon held their famous studio encounter. Just as Khrushchev was delighted with the quick playback of the Ampex color tape recording, so were thousands of other Russians subsequently.

Original plans fell apart when it became impossible to get Soviet artists to perform in the studio. Miller and the television men turned to what talent

they could find among the guides and other American exhibition personnel. Numerous sewing-machine demonstrations, cooking exhibitions, and similar bits were televised and played back for the curious Russians.

One guide sang cowboy songs in Russian. He also left a bag full of award ribbons from the Baytown, Texas, Fair. This inspired the studio people to hold a game of musical chairs for the Russian children. Both the youngsters and crowd of onlookers responded enthusiastically. Subsequent repeats of the games before the cameras proved the biggest audience draw of all.

Mustache contests on-camera also were very popular. An applause meter determined the winner among the various contestants. One young fellow said it had taken 21 years to grow his wispy mustache. Seems he had never shaved it in his life. One winner, a grand old-timer with handlebars that would have served him well in the wild west, was asked for his advice to young aspiring mustache growers. "Don't shave," he said. "Oh, yes, and use a little spit."

A program which appealed to the Russian women was the use of eight novelty wigs. The last one was a rainbow-colored hairdo which completely stumped and delighted them.

As Videotape stands now, 142 television stations are equipped, as well as numerous independent producers including Red Skelton. But Red Khrushchev and his colleagues cannot presently qualify to place an order under our export regulations.

## MEETING AHEAD

### Nervous Automation

Besides getting a chance to examine the new medical science building of the Stanford Medical Center at Stanford, those who attend the October 27 meeting of PGME will hear a group of three speakers comparing and contrasting the human nervous system with automatic control. See "Meetings Calendar" for details.

Selected to give broad coverage of the subject, the speakers have the following special interest; Franklin—automatic control systems, Callaway—neuropharmacology and Pribram—neurosurgery and neurophysiology.

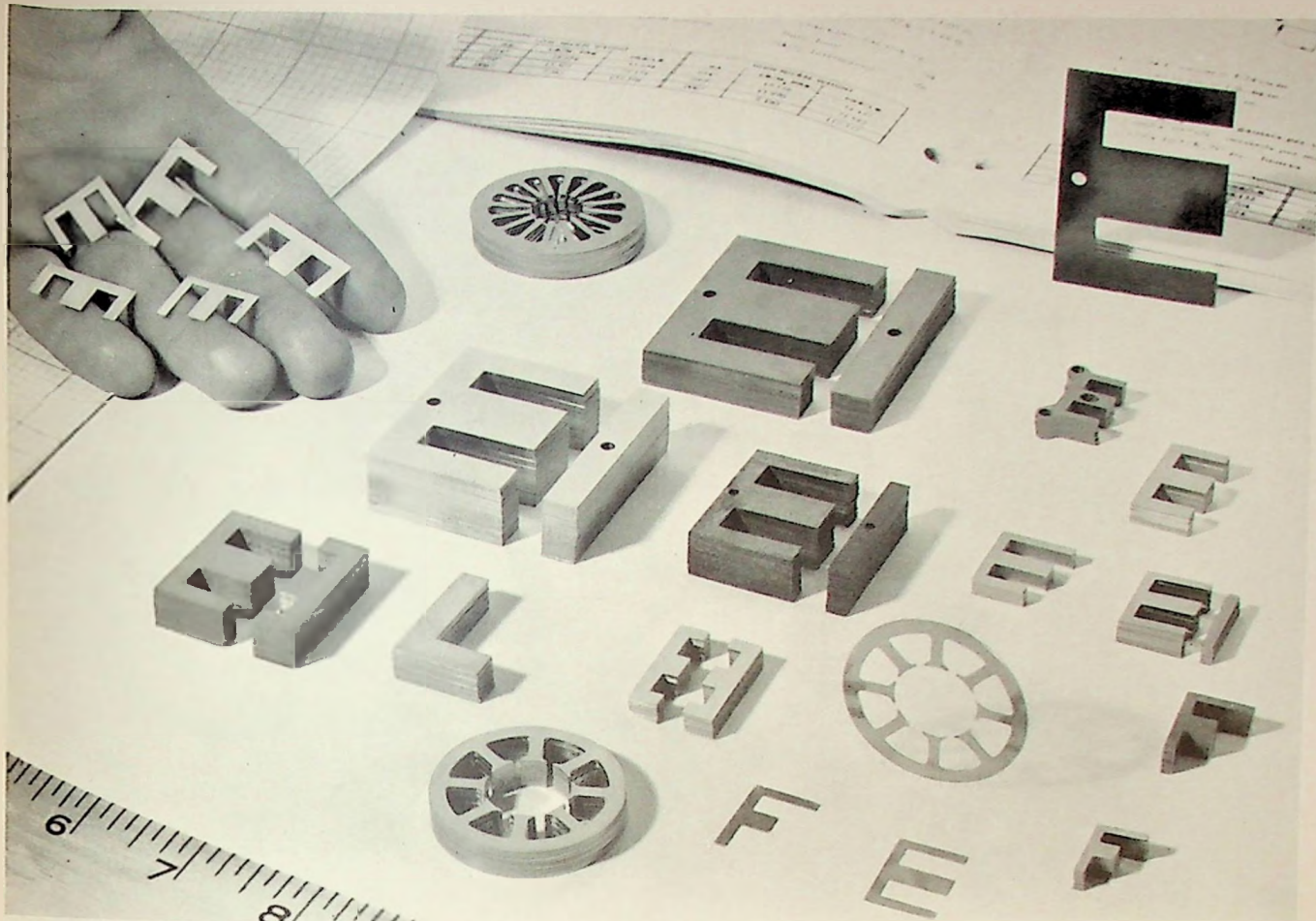
## MEETING AHEAD

### Cosmetic Aspects

Painting and finishing of equipment will be the topic of the night of October 27 when the Professional Group on Production Techniques will meet at a place and time detailed in "Meeting Calendar." Three speakers will appear

*(Continued on page 12)*





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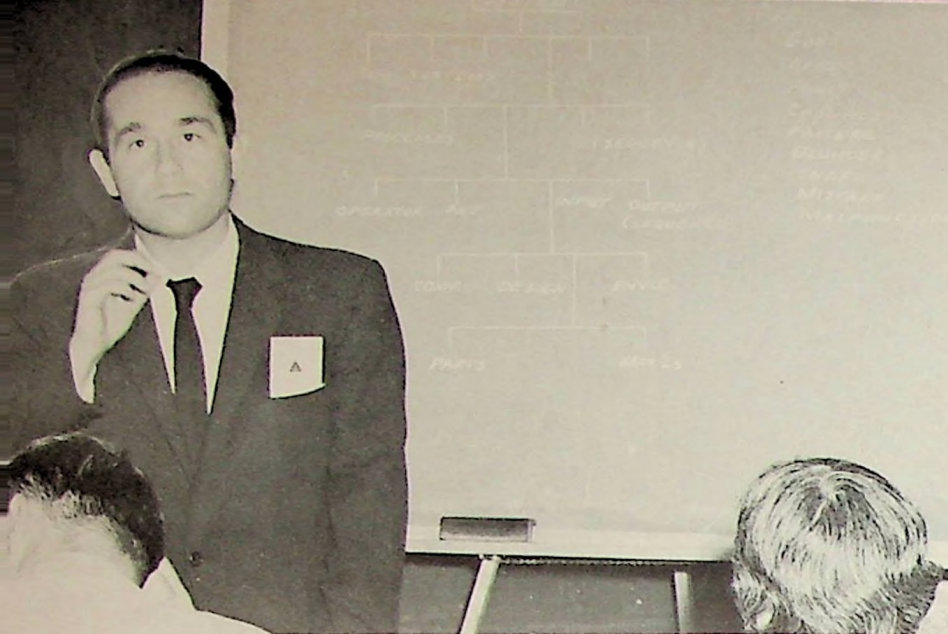
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*Fein at the September PGRQC meeting*

### **MORE COSMETIC**

and each cover his particular area of interest as follows: Dodge on electroplating, Simon on organic finishes, and Koren on water-dispersed coatings.

### **DISTAFF SIDE**

#### **WAEI & Purchasing**

David Steinberg, purchasing manager of Lenkurt Electric Co., will speak on "Purchasing in Electronics" at the October 19 meeting of the Women's Association of the Electronics Industry. The association's dinner meeting at 7:15 P.M. at The Old Plantation, Los Altos, will be preceded by a social hour.

Steinberg, who has been with Lenkurt since 1957, is one of the area's authorities on electronic purchasing. Previously, he was purchasing agent for the electronics division, Fairchild Controls Corp., Syosset, New York, and purchasing agent for the Freed Electronics and Controls Corp., New York.

The purpose of the WAEI is to bring together a group of women with a com-

mon interest in the field of electronics. Included in this group, representing 34 Bay Area firms, are: executive secretaries, engineers, purchasing agents, personnel directors, draftsmen, technicians, assembly workers, etc. All women employed in electronics, in any capacity, are invited to join. Further details may be had by calling Jo Thompson at Davenport 5-4451.

### **MEETING REVIEW**

#### **Work with Words**

In a joint meeting of the PGRQC and PGEWS on Tuesday, September 29, Dr. Louis Fein, a consultant in the fields of computers and reliability, presented a paper on "The Construction of a Glossary of Technical Terms." Fein stated that the number of words in a particular language is a measure of the development of the culture of the society using the language. This notion was compared to primitive peoples and their use of language; to such mature and well-defined fields as physics; and to the newer, less well-defined fields such as computer and reliability technology.

In his well-thought-out and splendidly presented paper, Fein said that the construction of an adequate and coherent glossary requires a prior knowledge of the field just as fundamental knowledge of the English language is a prerequisite to writing an English dictionary.

The point was well established by a model "system" which was broken down functionally into sub systems, processes, operators (both human and machine), components, and parts (and materials). Fein suggested, for example, that cessation of operation in a part might be called a "casualty," that cessation of function in a component might

be called a "failure," that inaccuracy of an operator (whether machine or human) might be called a "mistake," and that other terms which mean "failure" should be applied to other specific levels of the system model.

Another requirement of an adequate glossary was said to be standardization of the format of the "article" of each definition in the glossary much in the same manner in which this is done in dictionaries. An example of such an "ordered article" might include: the name of the element, the part of speech, the etymology, the definition of the word, and synonyms and antonyms appropriately.

A four-man panel which discussed Dr. Fein's paper in some detail consisted of Dr. Harry Romig, director of Hoffman Laboratories; Dr. Ben Epstein, professor of mathematics at Stanford University; Bill Wahrhaftig of Philco Corporation; and Hyman Olken of the Lawrence Radiation Laboratory at Livermore.

It was concluded that much work is yet to be done in the establishment of an adequate glossary of terms in the field of reliability. This reporter, who was moderator for the evening, stated that people are needed to serve on a joint IRE, ASQC, AIA, EIA, and DOD committee on definitions in the San Francisco Bay area. Those interested in contributing to this work should contact him at the Dalmo Victor Company, phone LYtell 1-1414.

—John Hall



*Astrahan at the Sept. PGEC meeting*

### **MEETING REVIEW**

#### **Russia: Square vs Round**

The first meeting of the PGEC for 1959-1960 was held at SRI September 22. Members and guests were invited to bring their wives to hear Mort Astrahan report on his trip to the USSR last spring.

Dr. Astrahan, who was the first chairman of PGEC, 1951 to 1953, is manager of systems development of the advanced systems development division laboratories at IBM, San Jose. He has

*(Continued on page 14)*



*David Steinberg*



# FROM LAGRANGIAN TO LIFT-OFF

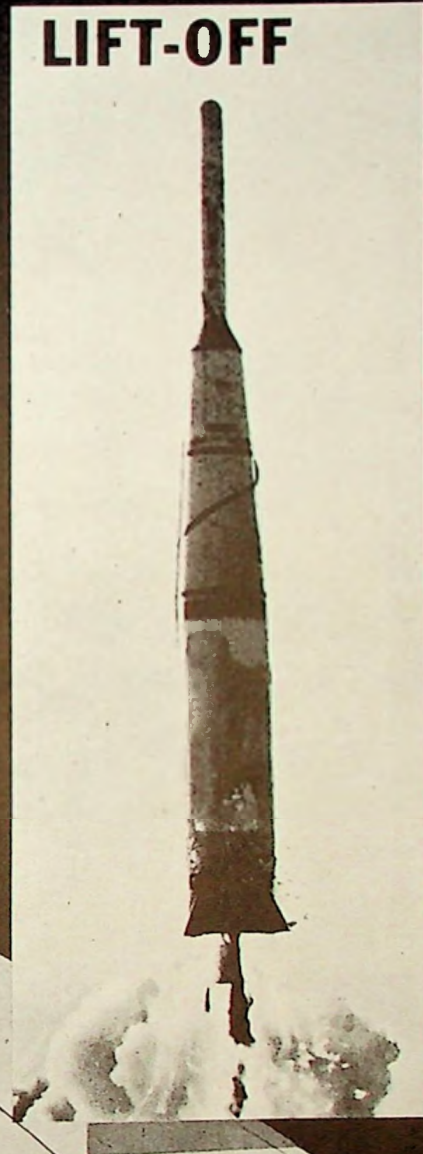
Sometimes forgotten during the thundering ascent of a space probe rocket are months of meticulous analysis, engineering and planning. The staff of Space Technology Laboratories is now engaged in a broad program of space research for the Air Force, the National Aeronautics and Space Administration and the Advanced Research Projects Agency under the direction of the Air Force Ballistic Missile Division. For space probe projects STL provides the total concept approach, including preliminary analysis, sub-system development, design, fabrication, testing, launch operations and data evaluation. The total task requires subtle original analysis in many fields as well as sound technical management.

The STL technical staff brings to this space research the talents which have provided system engineering and technical direction since 1954 to the Air Force Ballistic Missile Program. Major missile systems currently in this program are Atlas, Titan, Thor and Minuteman.

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$$L = \frac{m}{2} (\dot{r}^2 + r^2 \dot{\theta}^2 + r^2 \sin^2 \theta \dot{\phi}^2) + \frac{GMm}{r}$$





Exhibit area in the San Francisco Civic Auditorium during NSSET

## MORE PGEC

been with IBM since 1949 and was sent by them to investigate Soviet computer technology and also to visit the computer conference in Paris.

Since there was such a good turnout of wives, including his own, Astrahan directed the talk toward his general impression of Russia. He showed many excellent 35-mm color slides he photographed in Moscow, Leningrad, Kiev, and a smaller city, Pensa. Astrahan's wife, Joanne, also made the trip and she very good-naturedly did not let her husband deliver any misinformation. They also showed movies and during one reel that had been double-exposed by mistake both of them talked at once to explain the two superimposed pictures.

The city of Pensa (population: about 250,000) is not open to tourists but since their party was promised a visit to a computer factory, they were allowed in. The color slides taken there, where all facilities are much less elaborate, were particularly interesting.

Astrahan reported that the Russians up to now have concentrated exclusively on scientific computers at the expense of business data processing. Their computers are lagging ours in speed, and particularly in input-output equipment such as magnetic tape. Apparently they have no transistorized computer in production yet.

They are working on language translation and information retrieval programs but do not seem to have advanced as far as some Americans had been led to believe. There are many groups in Russia working quite independently on computers and each group tries hard to justify its budget. They have the same old computer-language standardization problems; some punch round holes in cards, some square, etc.

—Henry L. Herold

## NSSET

### End of Orbit

At its apogee, the recent National Symposium on Space Electronics & Telemetry had an attendance of 904 and 39 exhibitors utilizing 57 booth spaces. The affair wound up September 30 after having presented nine sessions of 41 papers, a luncheon, a banquet, and a reception and cocktail party. Social items were held in the Whitcomb Hotel, exhibits in the San Francisco Civic Auditorium across Market Street.

Speaking at the banquet on September 29, Dr. Robert Jastrow of NASA sketched out the scientific problems which exist in the areas of vehicle development, space technology, and space science. As a review he provided the recapitulation of major vehicle capabilities which accompanies this report.

After discussing the nature of the space around us and listing the types of experiments with appropriate instrumentation which are planned for the future, he described the activity which will possibly occur just before the time

than man first sets foot on the moon:

"The ultimate in unmanned exploration may be the remote-controlled roving vehicle. The use of this roving vehicle will enable us to get away from the perturbed conditions in the vicinity of the landing site produced by the blast from the retro-rockets. We will also avoid misleading impressions resulting from the analysis of data acquired at a limited number of sites whose conditions may not be representative of larger areas of the lunar surface. The roving vehicle will be capable of exploration over an extended area around the landing site for indefinite periods of time. It will be powered by solar cells, and during each fortnight-long lunar day it will crawl slowly over the lunar surface, collecting data samples and analyzing local conditions as it proceeds; it will hibernate during the lunar night, and come to life again at each lunar dawn.

"Although we talk in a matter-of-fact fashion about these projects, it is actually an extremely formidable problem to construct a reliable vehicle for

(Continued on page 16)

## MAJOR SPACE-VEHICLE CAPABILITIES

### Existing Vehicles.

- JUPITER C:** Redstone booster with Sergeant clusters in the upper stages; used for the first Explorer satellites with a payload of about 15 pounds.
- JUNO II:** Jupiter booster and Sergeant clusters in the upper stages; used for the pioneer space probes, the heavy IGY satellite, and for coming satellites in the upper atmosphere program; having a capability of 80 pounds in a 1000-mile-satellite orbit.
- THOR-ABLE:** Thor booster with modified Vanguard second stage and solid propellant 3rd stage; used for the first Pioneer space probe, and the STL space probe; having a payload of approximately 300 pounds in a 300-mile satellite orbit.

### Advanced Stages of Development (available soon)

- SCOUT:** All solid, 200 pounds in a 300-mile orbit; relatively inexpensive, the workhorse vehicle for upper atmosphere studies.
- THOR-DELTA:** Improved version of the Thor-Able with superior guidance; 300 pounds in a 300-mile orbit; or 65 pounds gross payload to the moon.
- ATLAS-ABLE:** Similar to the Thor-Able, with Atlas boosters in place of Thor; 300 pounds to the moon.

Nuclear rockets offer larger payloads, perhaps 3 times those mentioned above, but on a longer time scale. Note that the clustered rockets give reliability and safety; the SATURN will maintain close to full thrust with

### Vehicles in an Intermediate Stage of Development (2 to 3 years from now)

- VEGA:** Atlas booster, modified Vanguard first stage for the second stage, new JPL third stage; will place 4000 pounds in a 300-mile orbit or bring 700 pounds to the moon.
- CENTAUR:** Similar to the Vega but with high energy (lox-hydrogen) second stage roughly doubling payload; will bring 1500 pounds gross weight to the moon, or 300 pounds net weight available in soft landing.

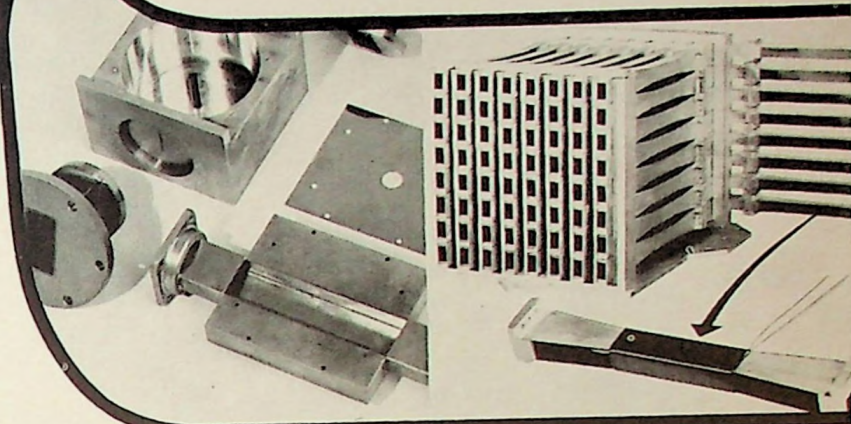
### Advanced Vehicles in Preliminary Stage of Development (4 to 8 years from now)

- SATURN (ABMA):** A cluster of 8 improved Rocketdyne engines to give 1.5 million pounds of thrust; will bring 4 tons to the Moon, and 1 ton net weight for instrumentation in a soft lunar landing; also manned circumnavigation of the Moon.
- NOVA:** Cluster of million pound engines to give 6 to 8 million pounds of thrust; will bring 10 tons to the Moon, sufficient for manned flight, a lunar landing and return; also 75 tons in a 300-mile orbit, sufficient for manned space laboratories.

failure of 1 or 2 engines, and will maintain control if 3 or perhaps 4 engines are out.



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**MATERIALS RESEARCH**—In the field of Solid State Chemistry and Physics, studies are directed toward the synthesis and characteriza-

tion of organic and inorganic compounds; new polymer systems; structural and electronic ceramics; and ferroelectric, ferrimagnetic and paramagnetic materials for electronic applications.

**MICROWAVE ENGINEERING**—the products of research are converted into advanced components, processes, and techniques for ultimate system application. Novel antennas, radomes, filters, and ferrite devices are being developed for the entire microwave and UHF spectra. New materials and processes are exploited for the production of ferrites and garnets, silicone plastics, ablative materials, high-temperature insulating and encapsulating materials, and electroluminescent panels. Research and engineering ideas are rapidly embodied in concrete forms through the facilities provided by a versatile design staff and a well-equipped shop.

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*Symposium Chairman Rawlins addresses the luncheon group at NSSET*



*Obviously there were subjects funnier than man's exploration of outer space to engage the attention of NSSET committeemen. Here one of these subjects is shared by Mrs. Robert DeLiban; Robert Grimm, exhibits and arrangements chairman; Robert DeLiban, publicity chairman; Robert Rawlins, national chairman; and George Larse, technical program chairman*

#### MORE NSSET

roving over the surface of the moon under conditions which cannot be known too well beforehand, performing physical and chemical tests as it proceeds under remote control by a terrestrial operator a quarter of a million miles away. The engineering problems involved in the development of such a vehicle cannot be overestimated. A great deal of study and testing will be necessary before we can feel confident in our ability to carry out such projects, but the program is a very important one and we are going to move ahead as fast as hard work will enable us to."

#### NEIGHBOR SECTIONS

##### Hawaii

For its September meeting, the Hawaii Section scheduled a paper titled "Problems in Reception of Signals from Space Satellite Vehicles" by Elmer Harger, Jr., assistant in physics at the University of Hawaii.

#### ELECTION NEWS

##### Professional Group on Electron Devices

**Robert A. Craig, Stanford Microwave Laboratory, chairman.** Craig attended Montana State College and received his BS degree in EE in 1949. For his graduate study he came to Stanford University as a teaching and research assistant in the electronics and microwave laboratories. Here he was awarded MS and Engineer degrees in EE, and in 1951 became a research associate in the microwave laboratory where he was concerned with research on high-power traveling-wave tubes. In 1955 he received his PhD in EE.

In 1954 Craig joined the General Electric Microwave Laboratory in Palo Alto, and was subsequently engaged in the development of high-power traveling-wave tubes. He returned to Stanford as research associate in the Microwave Laboratory in September, 1958. He is a member of Tau Beta Pi, Phi Kappa Phi, and Sigma Xi.



*Robert A. Craig, chairman, PGED*

**Joseph F. Hull, Litton Industries, vice chairman.** Hull attended the University of Wisconsin, receiving there the BS in electrical engineering in 1943. During the war he carried on research at the General Electric Research Laboratory under the sponsorship of OSRD.

In 1945 he was assigned to the thermionics branch of the Signal Corps engineering laboratories at Fort Monmouth, New Jersey, and between 1946 and 1955, was employed in the same laboratory as a civilian engineer in charge of microwave-tube research and development. In 1951, he received an MS in electrical engineering from Rutgers, and in 1958 a Doctor of electrical engineering from the Polytechnic Institute of Brooklyn.

Hull joined Litton Industries in San Carlos in 1955, and his present posi-



*Joseph F. Hull, vice chairman, PGED*

tion is that of Director of Research. He is a member of Tau Beta Pi, Eta Kappa Nu, and Sigma Xi; and has been the recipient of a B. J. Thompson papers award from the IRE.

**H. John Shaw, Stanford University, secretary.** Shaw is a senior research associate in the microwave laboratory at Stanford University and a research associate in the physics department. A native of Seattle, Washington, he obtained his BS degree in electrical engineering from the University of Washington in 1941 and his MA and PhD degrees in electrical engineering from Stanford University in 1942 and 1948, respectively.

**Dr. Jules Needle, Sylvania, treasurer.** Dr. Needle did his undergraduate and graduate work at the University of Michigan and received the PhD degree in electrical engineering in 1951. From 1942 to 1955 he was successively instructor and assistant professor in the  
*(Continued on page 18)*

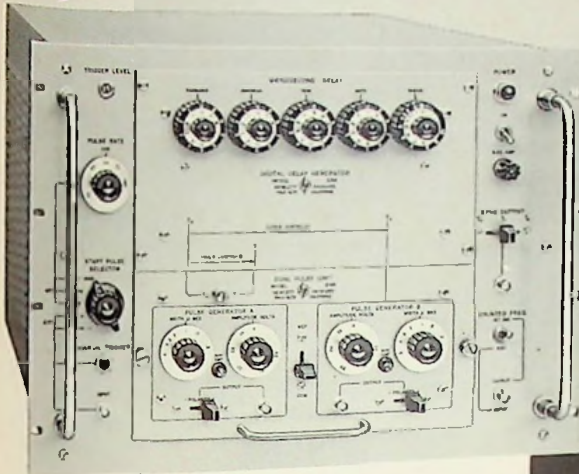


*H. John Shaw, secretary, PGED*

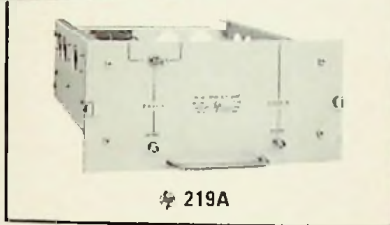




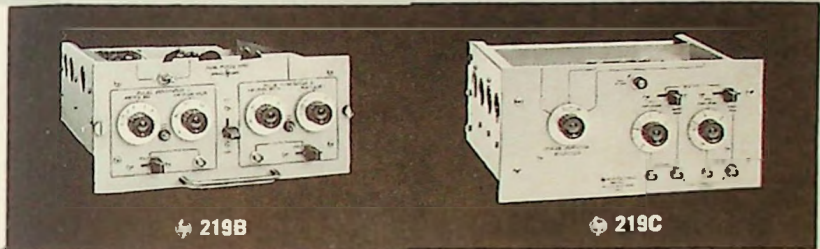
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*Jules Needle, treasurer, PGED*

department of electrical engineering at the University of Michigan. He was later associate professor in electrical engineering and head of the electron tube laboratory at Northwestern University.

During the summers of 1953 and 1954 he was employed as a consultant by Sylvania Electric Products Inc. in both Massachusetts and Mountain View. He joined Sylvania on a full-time basis in 1958 as an engineering specialist at the company's special tube operations in Mountain View. He was later promoted to head of the tube research and development branch of the research and engineering department, the position he now holds.

Needle is a Senior Member of the IRE and past consultant to the IRE sub-committee on operating measurements of microwave oscillator tubes. He is also a member of PGMAT. He holds membership in Sigma Xi, Phi Kappa Phi, and Eta Kappa Nu.

**Professional Group on Engineering Management**



*Allen S. Dunbar, chairman, PGEM*



*Oscar T. Simpson, vice chairman, PGEM*

**Allen S. Dunbar, Lockheed Missiles and Space Division, chairman.** Dunbar is assistant manager of the electromagnetics department at Sunnyvale. Previously he was manager of advanced technical planning at Dalmo Victor Company. He has also been with Stanford Research Institute, the Naval Research Laboratory in Washington, and the Radiation Laboratory at MIT.

His AB in physics from Clark University, Worcester, Mass., has been followed by graduate studies in physics at the University of Maryland. He is a member of the American Physical Society.

**Oscar T. Simpson, Philco Corporation, vice chairman.** As general manager of the Western Development Laboratories, Simpson directs all activities—technical and administrative.

Previously he has been executive engineer in Philco's research division, directing work on radar, microwaves, missiles, infrared, weapons systems, and fuzing and display devices.

Born in Akron, Ohio, in 1918, he ob-



*Wilbur S. Chaskin, sec.-treas., PGEM*

tained both his BS and MS in physics from the University of Akron.

**Wilbur S. Chaskin, ITT Laboratories, secretary-treasurer.** Chaskin, a native of Boston, attended Polytechnic High School in San Francisco and received his technical education by various extension courses, including the University of California.

Of his 20 years of experience in the development and production of radio and communication equipment, 10 have been with Lenkurt Electric Co. in various phases of carrier development.

Since 1956, he has been director of the Palo Alto research and development facility of ITT Laboratories, a division of International Telephone and Telegraph Corp. He is a member of AIEE.

**Professional Group on Medical Electronics**

**George K. Turner, G. K. Turner Associates, chairman.** Turner is president of the scientific-instrument manufacturing concern bearing his name. Formerly chief electronics engineer in the Spinco Division of Beckman Instruments, he obtained both his BS and EE from Massachusetts Institute of Technology.

He has also been a senior engineer in the military electronics division of Hycon Manufacturing Co., Pasadena; works manager of the Alabama Engineering and Tool Co., Huntsville, Alabama; supervisor of the systems engineering unit of North American Aviation at Downey; project engineer at Consolidated Electrodynamics Corp., Pasadena; and a radar maintenance officer in the U. S. Navy.

He holds membership in Sigma Xi and the Naval Research Reserve.

**Mark S. Blumberg, M.D., Stanford Research Institute, vice chairman.** Blumberg  
*(Continued on page 20)*



*George K. Turner, chairman, PGME*





## THE HUMAN FACTOR in today's technology

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**MORE ELECTION**



*Mark S. Blumberg, M.D., vice chairman, PGME*

berg is a senior health economist at SRI. A major interest has been the application of operations research to hospitals and related problems, with recent increased attention to the feasibility of hospital automation.

In the past he has been identified with the Public Health Service, Washington, D. C., and the operations research office of Johns Hopkins University.

A 1950 graduate of Harvard Medical School, he served his internship at Bellevue Hospital, New York. He is a member of the Research Society of America, the American Statistical Association, the Operations Research Society of America, and a diplomate of the National Board of Medical Examiners.

**Noel P. Thompson, M.D., Palo Alto Medical Research Foundation, secretary-treasurer.** Thompson is both an internist in the Palo Alto medical clinic and a research associate and head of the medical electronics section of the Palo Alto Medical Research Foundation.



*Noel P. Thompson, secretary-treasurer, PGME*

Holding an AB from Stanford University and an MD from the UCLA School of Medicine, he served a rotating internship in hospitals of the University of Wisconsin.

His postgraduate training includes work at Ohio State College and the USAF both in electrical engineering. He has served on the faculties of the College of San Mateo and UCLA and is currently an instructor in electrical engineering at Stanford.

Memberships include the American Medical Association and the Santa Clara Medical Society, besides IRE.

**Professional Group on Microwave Theory & Techniques**

**Theodore Moreno, Varian Associates, chairman.** Joining Varian in 1951, Moreno is now manager of research-and-development engineering and a member of the board of directors. He was formerly a research physicist in guided missiles with Hughes Aircraft Company, a research associate at MIT, and a project engineer with Sperry Gyroscope Company in microwave-component and measuring-equipment research and development.

His education has included an AB and MA from Stanford University and an ScD in 1949 in electrical engineering from MIT.

Moreno is a member of Sigma Xi, Tau Beta Pi, and Phi Beta Kappa.



*Theodore Moreno, chairman, PGMTT*

**Hubert Heffner, Stanford University, vice chairman.** Heffner was born in Lincolnton, N. C. He received the BS degree in physics in 1947 and the MS and PhD degrees in electrical engineering from Stanford University. From 1949 to 1951 he was a pre-doctoral fellow of the



*Hubert Heffner, vice chairman, PGMTT*

Atomic Energy Commission.

During the war he served in the Army Signal Corps where for a time he was in charge of several microwave relay stations in Germany. Between 1952 and 1954, Heffner was a member of the technical staff of the Bell Telephone Laboratories where he was engaged in vacuum-tube research.

Since 1954 he has been on the faculty of Stanford University where he is now associate professor of electrical engineering. Heffner is a member of Phi Beta Kappa, Sigma Xi, and the American Physical Society.

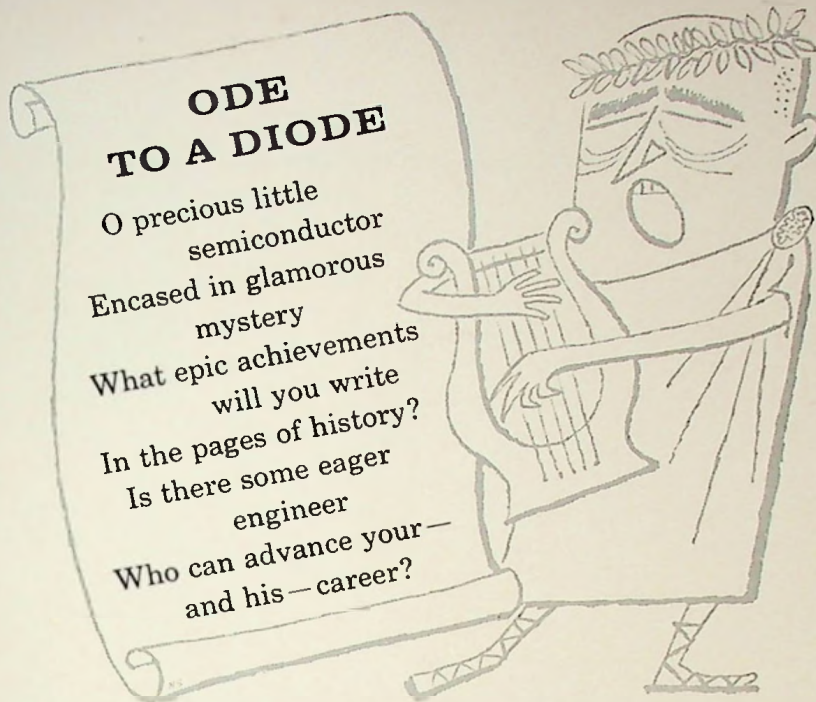
**Edward M. T. Jones, Stanford Research Institute, secretary-treasurer.** Jones, head of the microwave group in the electromagnetics laboratory, received his BS in electrical engineering from Swarthmore College and his MS and PhD, also in electrical engineering, from Stanford University. He was a radar

*(Continued on page 22)*



*Edward M. T. Jones, secretary-treasurer, PGMTT*





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*Estrada Fanjul, chairman, PGPT*

manager of Plant 1 at -hp-. He was born in Tacoma, Washington, lived in Hawaii, obtained degrees of BS in physics and MBA in business, both from Stanford.

His PGPT activities have included that of finance chairman for the Third National Conference, that of WESCON technical-session chairman, and that of Grid reporter. He is a member of the American Institute of Industrial Engineers.

**George F. Reyling, Varian Associates, secretary-treasurer.** A native of New York City, Reyling graduated from Minneola High School and obtained a Bachelor of chemical engineering from the Polytechnic Institute of Brooklyn.

His business connections have included Foster D. Snell Inc.; RCA Manufacturing Co., Harrison, N. J.; and Sperry Gyroscope Co., Lake Success.

At Varian he is currently manager of quality assurance and engineering services.

**Olof Landeck, Electro Engineering Works, program chairman.** Landeck is production manager, having been with



*Charles A. Eldon, vice chairman, PGPT*

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### MORE ELECTION

maintenance officer in the U. S. Navy from 1944 to 1946 and, from 1948 to 1950, was a research associate at Stanford.

Jones joined the staff of Stanford Research Institute in 1950. In 1957 he became head of the microwave group of the electromagnetics laboratory. His fields of specialty include microwave filters and antennas, strip-line components, and parametric amplifiers.

Jones is a senior member of the Institute and a member of PGAP; a member of the Scientific Research Society of America; Sigma Tau; and Sigma Xi.

### Professional Group on Production Techniques

**Estrada Fanjul, Stanford Research Institute, chairman.** A senior designer at SRI, Fanjul is a graduate of Mercersburg Academy. He has attended Cornell University and recently received a certificate in business administration from the University of Santa Clara where he is working toward a BS in commerce.

He had been connected with Electronics Associates, Inc., and North American Aviation before joining SRI in 1951.

**Charles A. Eldon, Hewlett-Packard Co., vice chairman.** Eldon is production





George F. Reyling, secretary-treasurer, PGPT

Electro Engineering Works once before from 1952 to 1954 as plant supervisor. Meanwhile he was with the Berkeley Division of Beckman Instruments.

A native of Sweden, he received his BS in electrical engineering from the State Electrotechnical Institute at Vasteras. He came to the United States in 1949, having worked for ASEA Electric, Inc., as a research and production engineer.

He holds memberships in AIEE and American Society for Quality Control.

### Professional Group on Space Electronics & Telemetry

Gerald O. Moore, Philco Corporation, chairman. Moore was born in Cass County, Indiana, and attended Purdue University where he obtained his BSEE in 1936. He began his uninterrupted professional career with Philco that year as a junior design engineer in the radio and television department.

During World War II he served as project engineer on the proximity fuse and was a member of the all-industry

(Continued on page 24)

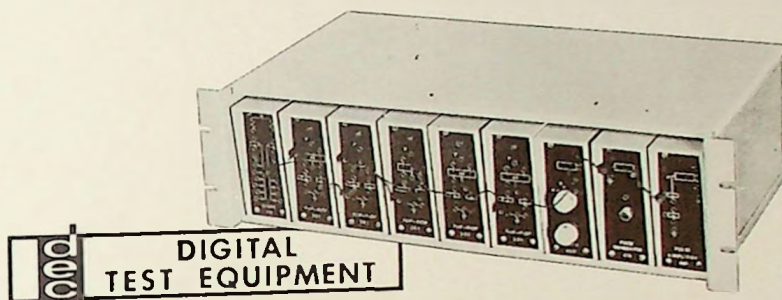


Olof Landeck, program chairman, PGPT

digital offers all the advantages of the

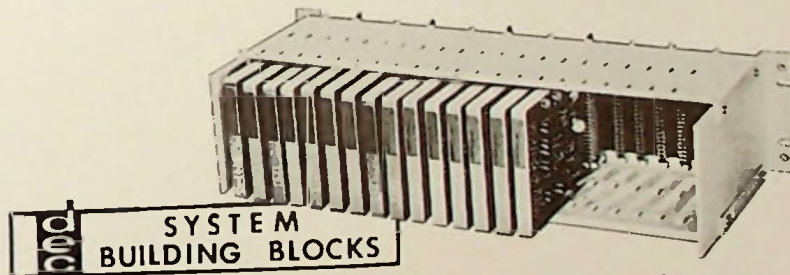
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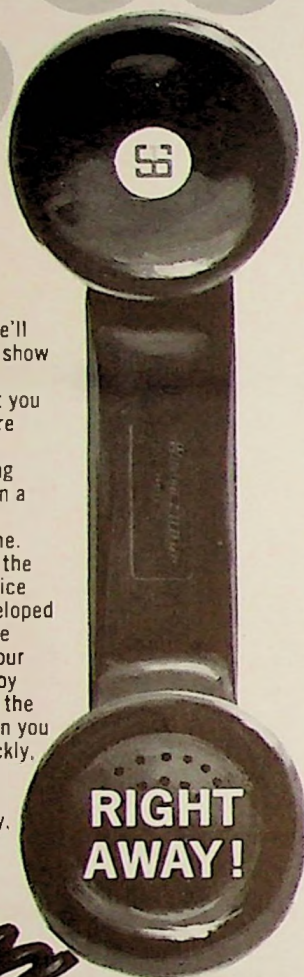
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## MORE ELECTION



*Gerald O. Moore, chairman, PGSET*

technical committee on this project. He was technical consultant to Philco International Corporation in charge of overseas assembly of radio and television receivers and became manager of the electronic department of the Philco plant in Mexico City in 1954.

In 1957 he joined the western development laboratories in Palo Alto as a group supervisor in charge of design and development of data transmission devices for a classified space-communications project. He is currently Philco project manager for the Courier communications satellite sponsored by the Signal Corps.

**Louis H. Smaus, Lockheed, vice chairman.** A research scientist and section supervisor on satellite-borne telemetry and communications systems in the missiles and space division, Smaus was formerly in the Ames Aeronautical Laboratory at Moffett Field during two periods separated by a year in the instrumentation laboratory at Massachusetts Institute of Technology. He has



*Louis H. Smaus, vice chairman, PGSET*

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Charles Nater, chief engineer

*Beckman & Whitley*  
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also been with the Naval Research Laboratory and Pacific Gas and Electric Co.

He has a BSEE from the University of California at Berkeley, is a senior member of the Institute, and a member of the Engineering Management Professional Group.

**Robert Bernard Morgan, Lockheed, secretary.** A staff scientist in the missiles and space division, Morgan has been with Lockheed since 1957. He was formerly associated with Hughes Aircraft Co., Bell Aircraft Corp., and the Uni-

*(Continued on page 26)*



*Robert B. Morgan, secretary, PGSET*



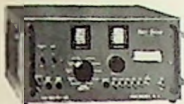
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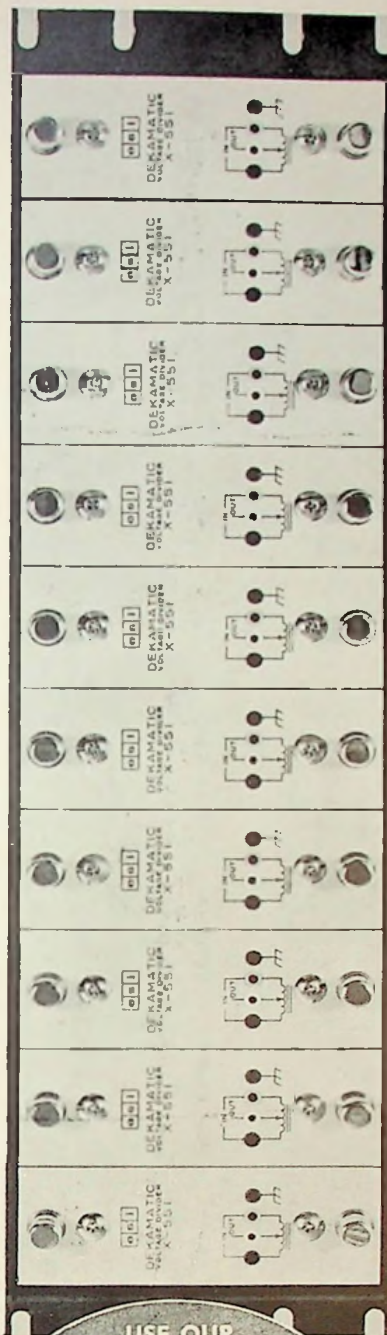
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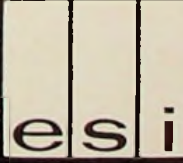
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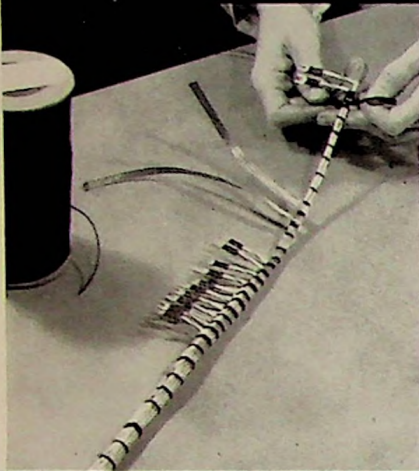
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## GRID SWINGS

### It Is Reported:



Bowles

Jipp

Neal K. McNaughten, manager of Ampex Corporation's professional products division, has been appointed a vice president. Along with McNaughten, four other Ampex executives were named vice presidents. They are John Jipp, manager of the instrumentation division; Herbert L. Brown, manager of Ampex Audio; Walter T. Selsted, director of research; and John M. Leslie, Jr., manager of Orr Industries, an Ampex subsidiary.

Ampex' month-old computer products organization is headed by James D. Bowles.

Ampex has been appointed sole authorized distributor in the United States for Marconi television cameras, television equipment, and broadcasting equipment. Under terms of the arrangement, Ampex also will be authorized distributor in the United States for the range of television camera tubes manufactured by the English Electric Valve Company, Ltd.

Lynch Carrier Telephone Systems, Inc., San Francisco, has announced the appointment of Edward E. Combs to the position of vice president of engineer-

### MORE EVENTS

#### Papers Calls

**November 1**—Papers for 1960 SWIRECO and National PGME Conference (Houston, Texas, April 20-22). Send to: Ralph T. Doshier, P.O. Box 6027, Houston 6, Texas.

**November 2**—Paper (limited to Confidential) for the Winter Convention on Military Electronics (Ambassador Hotel, Los Angeles, February 3-5). Send to: Gordon B. Knoob, Motorola, Inc., Military Electronics Division, 1741 Ivar Avenue, Hollywood 28, California.

**November 9**—Original draft of the complete paper, in triplicate, for 1960 Western Joint Computer Conference (San Francisco, May 3-5). Send to: H. M. Zeidler, Stanford Research Institute, Menlo Park, California.

ing. Combs is one of the senior employees of the Lynch organization, having joined the company in 1946. Prior



Combs

Kuhn

to his present advancement, and since 1956, he was chief engineer.

Henry G. Kuhn becomes chief engineer. His most recent employment was with Lenkurt Electric Company as executive staff engineer.

Hewlett-Packard Co. has acquired Palo Alto Engineering Co., Dymec Inc., and Boonton Radio Corporation. All become wholly owned subsidiaries of h-p.

Jose A. Samaniego of Shell Development Co. has been appointed general chairman of the 1960 Bay Area Committee for Engineers' Week, the San Francisco Engineering Council has announced. Engineers' Week, co-sponsored (Continued on page 30)

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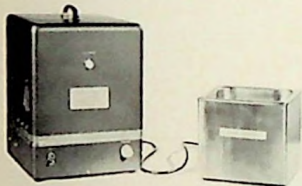
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## MORE SWINGS

by Bay Area engineering societies and industry, is traditionally held in February during the week of George Washington's birthday. The theme for the 1960 Engineers' Week is "Engineering's Great Challenge—The 1960's."

**William G. Coe** has been appointed field engineer for the **J. T. Hill Company** and will work out of the San Francisco office at 1682 Laurel Avenue, San Carlos. Coe comes to Hill from the Mycolex Corporation of America, where he was manager of their Pacific division office.



Coe

Johnston

**Cetec Electronics Company** has been formed in Redwood City to manufacture electronic display equipment. **Harrison Johnston** is president. Johnston was formerly president of Production Research Corporation in Thronwood, N.

Y., and previously was managing director, Ampex International; and general sales manager, Ampex Corp.

**Sylvania** has broken ground for a 40,000-sq-ft component-laboratories building in Mountain View and made plans for construction of a 32,000-sq-ft computer-component manufacturing plant in Santa Cruz. Personnel shifts include: **A. H. Brolly** to direct activities of a newly created equipment-fabrication facility; **F. E. Butterfield** to become manager of a new equipment-engineering laboratory; **Earle Eldredge** to be assistant director for operations; **James A. Howard** to head the newly created data-handling section; **Jesse R. Lein** to move up from laboratory manager to director (all in the electronic-defense laboratory). **David H. Simon** becomes advertising and merchandising manager and **William Tiffany** (both in special tube operations) has left for Germany to study under a Fulbright scholarship. **Dr. B. A. Wambsganss** becomes manager of the newly created systems-engineering laboratory in the electronic-defense laboratories.

**International Business Mahines Corporation's** product development laboratory at San Jose has announced the

(Continued on page 32)

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New Lockheed satellite production building in Sunnyvale



Shown preparing for Sylvania ground-breaking ceremony are Samuel A. Ferguson, divisional vice president and general manager—Mountain View operations; Dr. Frederick E. Terman, Stanford University; Robert C. Harper, vice president of Pacific Coast sales; Dr. R. G. E. Hutter, manager, Mountain View components laboratories; Mayor John Anderson of Mountain View; E. Finley Carter, Stanford Research Institute; and Meyer Leifer, general manager, special tube operations



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- Optical Design Engineer**—Develop optical devices for electronic mark reading equipment. Evaluate and/or develop marking materials and processes. B.S. in Physics or equivalent.
- Power Supply Design Engineer**—Develop transistorized regular power supplies for digital data processing equipment and industrial control applications. B.S. in E.E. or Physics.
- Servo Design Engineer**—Design servomechanisms for industrial control applications. B.S. in E.E. Servo design experience, knowledge of standard servo circuitry.

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## MORE SWINGS



*Bennett*



*Lehman*

promotion of **Dr. Byron J. Bennett** to senior engineer. Bennett is manager of basic technology in the basic development area of the San Jose laboratory. He has been an advisory engineer since 1957.

**Pulse Engineering Inc.** has added 12,000 sq ft to double the production capacity at its Santa Clara plant. Appointed to the post of manufacturing manager is **Robert E. Lehman**, formerly with Lenkurt Electric Co.

**Dwight Aitchison** and **Bernard Carpe** have been promoted to senior engineers in **Dalmo Victor Company's** microwave department.



*Disman*



*Arfin*

Three senior scientists, all of whom received their PhDs from Stanford University, have been named to positions in the research and engineering division at **Eitel-McCullough, Inc.**, San Carlos.

**Dr. Donald A. Dunn**, senior research associate and lecturer in the electrical engineering department at Stanford, will be manager of a newly created supporting research group and will also continue his microwave research work at the university; **Dr. Murray I. Disman** has been appointed leader of the traveling-wave-tube group; and **Dr. Bernard Arfin**, who is a staff member of the sup-



*Hunter*



*Ruck*

porting research group, joins Eimac from Philips Laboratories. From 1955 to 1957 he was employed by Sperry Gyroscope Company.

**Gould Hunter**, executive vice president, has been named to the company's board of directors.

**William F. Ruck** has been named manager of engineering services and controls in **Dalmo Victor Company's** engineering division.

**Watkins-Johnson Co.** has added three men to key positions on its technical staff: **Eugene A. Kinaman**, primarily concerned with the development of low-noise traveling-wave tubes, spent the past six years with the Radio Corporation of America at Harrison, N. J.; **Charles A. Arnold**, whose work will be mainly in the field of high-power electronically tunable oscillators, came from General Electric Microwave Laboratory; and **Robert E. Vehn**, who will conduct research on beam-interaction structures for traveling-wave tubes, was previously engaged in research on microwave tubes at the Sylvania Microwave Tube Laboratory.

**William Theisner & Co.** has been appointed sales representatives for **Gianini Controls Corporation** (precision potentiometers, digital stepping positioners, and pressure switches).

**Olof Landeck** has rejoined **Electro Engineering Works** as production manager. He has been production manager at the Berkeley Division of Beckman Instruments since 1954, prior to which he was plant supervisor at Electro.

**Dr. Edward L. Ginzton** has been elected chairman of the board of **Varian Associates** to fill the vacancy left by the recent death of Russell Varian. Ginzton has, for the past several years, been assistant to the board chairman. He is director of the microwave laboratory and professor of applied physics and electrical engineering at Stanford University.

**Long & Associates**, manufacturers' representatives, now located in Redwood City, has added **George H. Grinnell**, sales engineer, to the staff. Grinnell has been with Monroe Calculating Machine Co. and the Alwac Division of El-Tronics Inc. The organization has been appointed representatives by Tape Cable Corp. (flat-conductor cable) and Crest Transformer Corp.

In Sunnyvale, the **Lockheed** missiles and space division has transferred all

(Continued on page 34)



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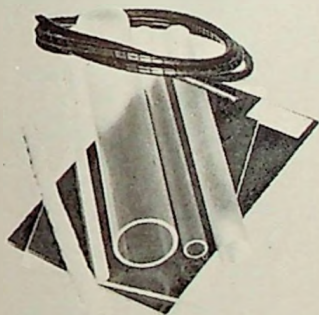
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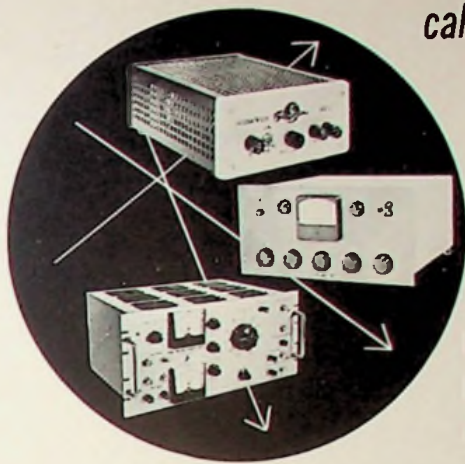


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## MORE SWINGS

the major functions of its three advanced satellite programs into its newly activated \$8 million satellite production building which will be headquarters for the Discoverer, Midas, and Samos satellite developments.

Creation of a **Dr. Louis N. Ridenour** memorial fellowship, in honor of one of the principal architects of the Space Age, has been announced by the Massachusetts Institute of Technology and the Lockheed Leadership Fund.

**William R. Rambo**, professor of electrical engineering and director of the Stanford electronics laboratories, has been elected to the board of directors of Applied Technology, Inc., Palo Alto.

**Ralph Kalibjian**, formerly of Hughes Research and Development Laboratories, has joined the staff of the Electronics Engineering Department at the **Lawrence Radiation Laboratory**, Livermore. In his new position he will be in charge of special electron-tube development for the laboratory.



*Kalibjian*

*Bourret*

**Raymond R. Bourret** has been named manager of manufacturing at **Precision Instrument Company**, San Carlos. Previously, he was for eight years with Ampex Corporation.

**James J. Hill** is branch manager of the new **Richard A. Strassner Co.** office in San Carlos. Hill was for 12 years in the J. T. Hill Co. of San Gabriel.

**Samuel P. Hunter**, former partner in the firm of Cerruti-Hunter, will head **Kittleson Company's** Palo Alto office and direct sales in that area.



*Hunter*

*Holland*

**Thomas E. Holland** is director of the recently formed research and development division and vice president of **Beckman & Whitley**, San Carlos, manufacturer of instruments and missile components. Holland joined Beckman & Whitley in 1958.

**McCarthy Associates, Inc.**, have been appointed to represent Wayne Kerr Corporation, Philadelphia.

## Membership Status

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

Joy L. Acker	Richard L. Luedtke
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Richard C. Alberding	Timothy O. McMahan
Bernard Arfin	Gary R. Marchant
Ray Aylsworth	David D. Meacham
Sadao Baishiki	Ronald P. Melnik
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Elmer R. Bodnar	Richard H. Ohtomo
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Lawrence P. Borden	Edward L. Pack
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Stuart E. Butterfield	Jere W. Patterson
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Bertil V. Carlson	Kenneth L. Pekarek
John Carstou	Ernest W. Piini
Louis J. Carter, Jr.	John A. Piper
Peter S. Castro	Oto Pulcins
Rudolph S. Cazanjan	James S. Roby
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4602-E	1.0 uh.
4604-E	1.5 uh.
4606-E	2.4 uh.
4608-E	3.9 uh.
4609-E	5.5 uh.
4610-E	6.2 uh.
4611-E	8.2 uh.
4612-E	10.0 uh.
4580-E	0.1 uh.
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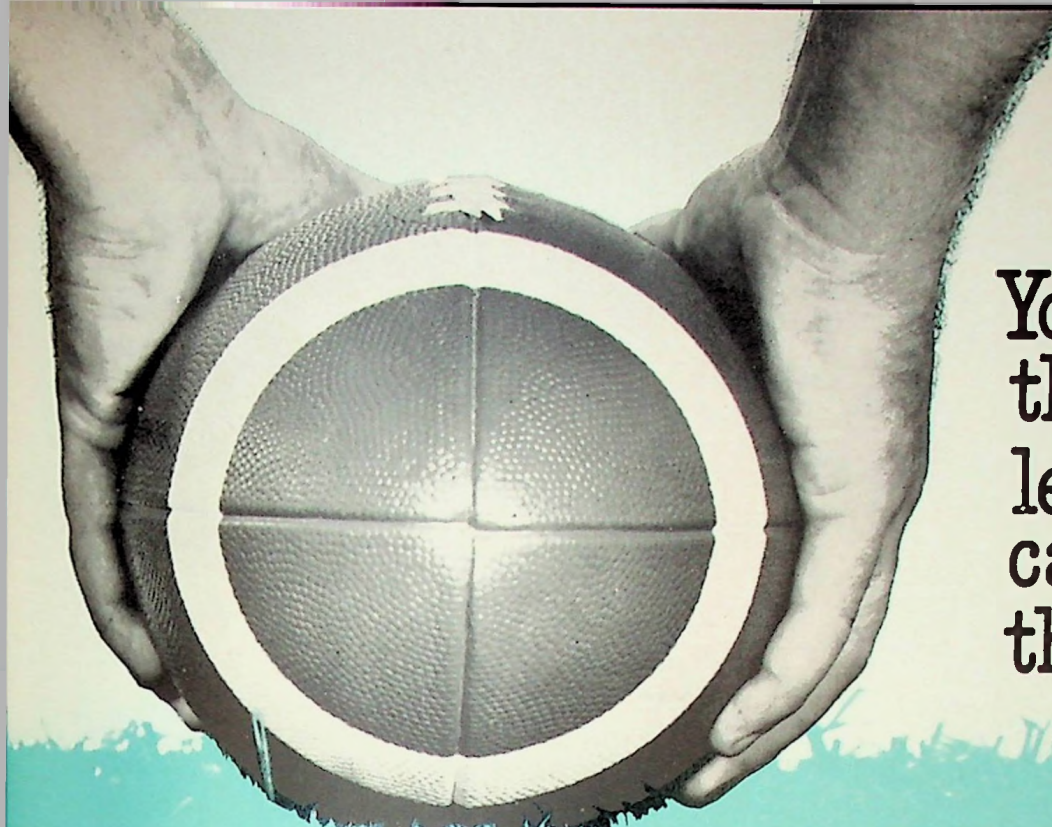
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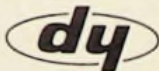
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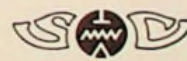
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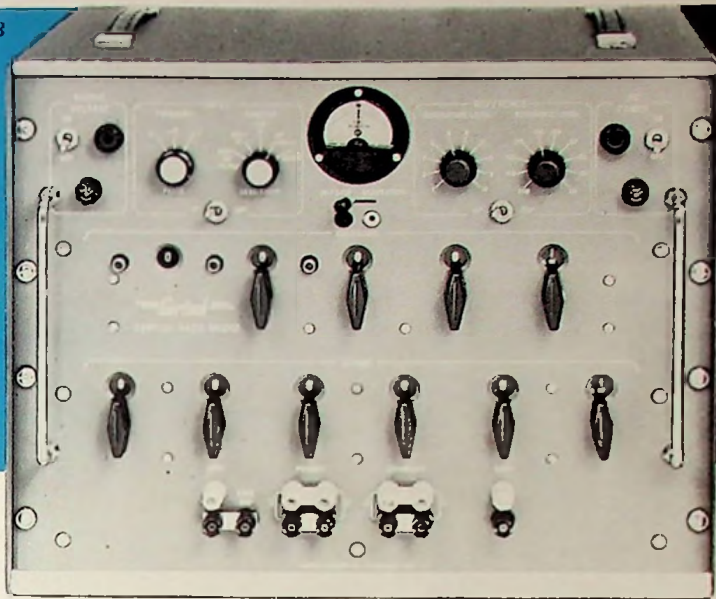
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Model CRB-1B

**NEW**

# Gertsch Complex Ratio Bridge



## measures both in-phase and quadrature voltage ratios — with high accuracy

**Unique versatility.** This instrument cancels quadrature effects, giving a sharp, true null.

In eliminating quadrature voltage, this Gertsch bridge achieves an in-phase ratio accuracy as good as 0.001%. Quadrature voltage ratios are read as rectangular coordinates, tangent of phase-shift angle, or magnitude of phase-shift angle in degrees directly. Harmonics and noise are rejected by use of band-pass filters.

**Self-contained phase-sensitive detector** gives excellent sensitivity with only 2-volt reference.

**Six-place resolution.** The magnitude of the transformation ratios of  $R + jX$  voltages are readable to 6 places.

**Applications.** Unit is used with both 3- or 4-terminal networks such as transformers, synchros, transducers, and resolvers.

**Two frequency ranges** — 30 to 1000 cps (Model CRB-1B), and 50 to 3000 cps (Model CRB-2B).

*Write for complete data in Bulletin CRB.*

*—Gertsch—*

**GERTSCH PRODUCTS, Inc.**, 3211 South La Cienega Boulevard, Los Angeles 16, California / Upton 0-2761 — Vermont 9-2201



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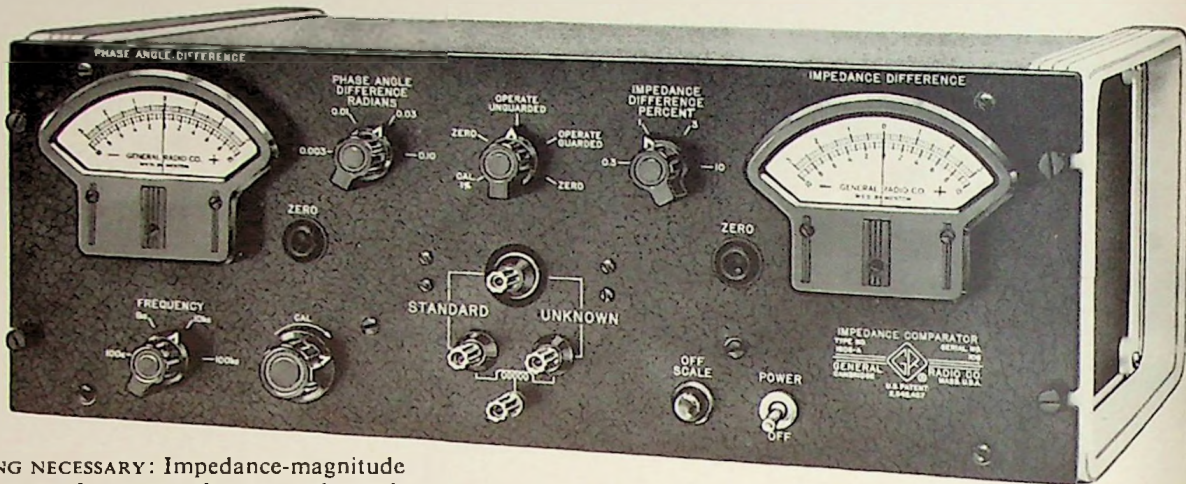


## IMPEDANCE COMPARATOR

For Testing Components Automatically or Semiautomatically

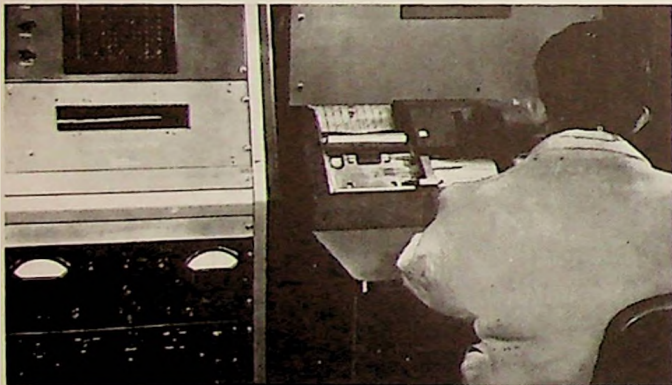
### TYPE 1605-A IMPEDANCE COMPARATOR ... \$790

Also available, the Type 1605-AS3, with a 10-to-1 increase in sensitivity. This special design can measure impedance differences as small as 0.001% and phase-angle differences of 0.00001 radian. Price on request.



- ★ NO MANUAL BALANCING NECESSARY: Impedance-magnitude and phase-angle differences between unknown and standard are indicated directly on two panel meters.
- ★ Impedance Ranges: Resistance 2Ω to 20 MΩ; Inductance 20 μh to 10,000h; Capacitance 40 μμf to 800 μf (to 0.1 μμf with reduced sensitivity).
- ★ Full-Scale Meter Ranges:  
Impedance-Magnitude Difference: ±0.3%, ±1%, ±3%, ±10%  
Phase-Angle Difference in Radians: ±0.003, ±0.01, ±0.03, ±0.1
- ★ Accuracy is 3% of full scale (±0.009% on smallest range)

- ★ 100c, 1 kc, 10 kc, 100 kc internal test frequencies.
- ★ D-C voltages proportional to percentage deviation from standard are provided for control of automated sorting systems.
- ★ Excellent guard circuitry permits long cable runs for remote measurements.
- ★ No excess switches or complex controls.
- ★ Constructed for reliable service, long life.
- ★ May be rack or bench mounted.



G-R Impedance Comparator is the heart of a highly-automated system designed under Signal Corps contract by the Inland Testing Laboratories of Morton Grove, Illinois. This system measures and records in sequence insulation resistance, capacitance, and power factor of 12,000 capacitors of several different values. All three parameters for each capacitor are measured without need of resetting controls.

Comparator metering voltages are fed into a digital voltmeter and converted into digital form for IBM-card recording. The program will provide detailed information concerning reliability and life cycles of capacitors operating under various voltages and environmental conditions.



Centralab uses G-R Impedance Comparators in production testing micro-miniature ceramic-disc and feed-thru capacitors produced at their Milwaukee Plant. The speed and ease with which the Comparator makes these measurements permits Centralab to maintain continuous quality-control checks without adding significant manufacturing time or cost to their product.



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