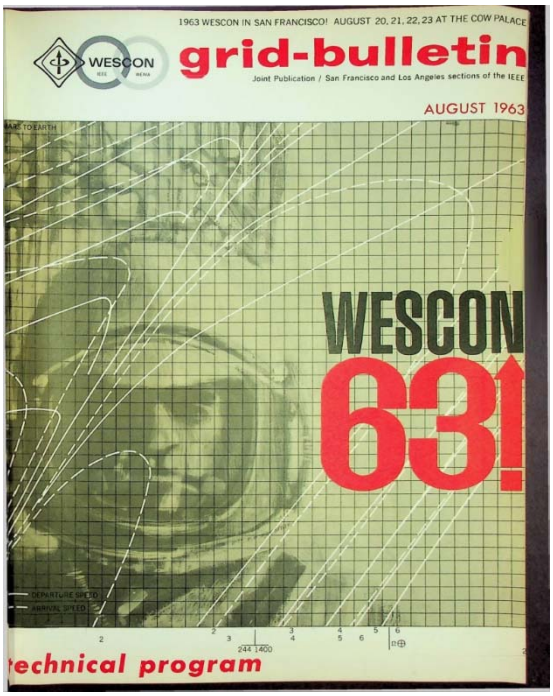
# EDITOR'S PROFILE of this issue

*from a historical perspective …*

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




August, 1963:

Cover: Same image of an astronaut that was used for the July issue.

Page 5: The "welcome" from the Region 6 Director hints at the financial difficulties involved with the AIEE/IRE merger, and anticipates it should be resolved by 1965.

Page 20: One of the panelists in Session 8 on Semiconductor Microelectronics is Gordon Moore of Fairchild, who'll leave that company in 1968 to form NM ("Noyce-Moore") Electronics which became Intel ("integrated electronics"). In an article in ELECTRONICS Magazine in 1965, he postulated that density in ICs would double in component count every year – the original Moore's Law. Photo below.

Page 24: A Power Division is formed within IEEE, to absorb the AIEE's 12 technical committees and 97 subcommittees that had covered this set of fields; it becomes the Power Engineering Society. This shows the considerable simplification that resulted from the AIEE/IRE merger.

Page 28: The IEEE announces a new periodical for all 150,000 IEEE members (except students): SPECTRUM Magazine. The first issue will be January 1964. The PROCEEDINGS of the IEEE will also begin publishing. A separate student journal will go to the 27,000 student members.

Page 32: Donald Fink becomes the General Manager of IEEE. He had been editor-in-chief of ELECTRONICS magazine, in San Francisco. When Bud Eldon (future IEEE president) was attending Stanford, he told fraternity brother Frederick Terman (also a student, and the brother of Lew Terman, the future IEEE president) that he'd like to do some writing; Frederick said to talk to his Dad, Prof. Fred Terman, who referred Bud to Don Fink, who welcomed several articles. I once wrote a short article about a calculator algorithm that got published in ELECTRONICS.

Page 34: Hewlett Packard announces eight $500 scholarships to high school grads who are children of their employees. HP is known for "The HP Way", an enlightened approach to management and community involvement. Dave Packard wrote a small book about it entitled "The HP Way", and Michael Malone covers it in his book, "Bill and Dave". This philosophy was carried on to many new local startups, including Tandem Computers, where I worked for 17 years. All employees say it is the best company they ever worked for. As an example of the philosophy: If someone brought up a new idea in a meeting, no one was allowed to say anything negative about it for the first 5 minutes. It was the first company in the Valley to have a tennis court and swimming pool, and we got a 6-week sabbatical every 4 years. President Jimmy Treybig (a Texan who came from HP) didn't like hierarchy, so we had an "open door" policy; I recall going into Jimmy's office, putting my feet up on his desk, and sayin', "Jimmy, we have a problem.". We are both Hams (KM6LH and W6JKV).

Page 68: The WESCON special session has several high-powered speakers. Stanford's Joshua Lederberg (Nobel prize winner in 1958) talks on "Origins and Directions of Life", while Barney Oliver, HP's Director of Research, speaks on "The Possibilities of Interstellar Communication". In session X, Stanford's Donald Kennedy talks on "Unit Properties in Nervous Integration"; he goes on to become the Commissioner of the USA Food and Drug Administration in 1977, and Stanford's president in 1980.

Archive of available SF Bay Area GRID Magazines is at this location:
**https://ethw.org/IEEE_San_Francisco_Bay_Area_Council_History**

At time of scanning, the bound volumes are held by Paul Wesling. July, 2021 Contact p.wesling@ieee.org

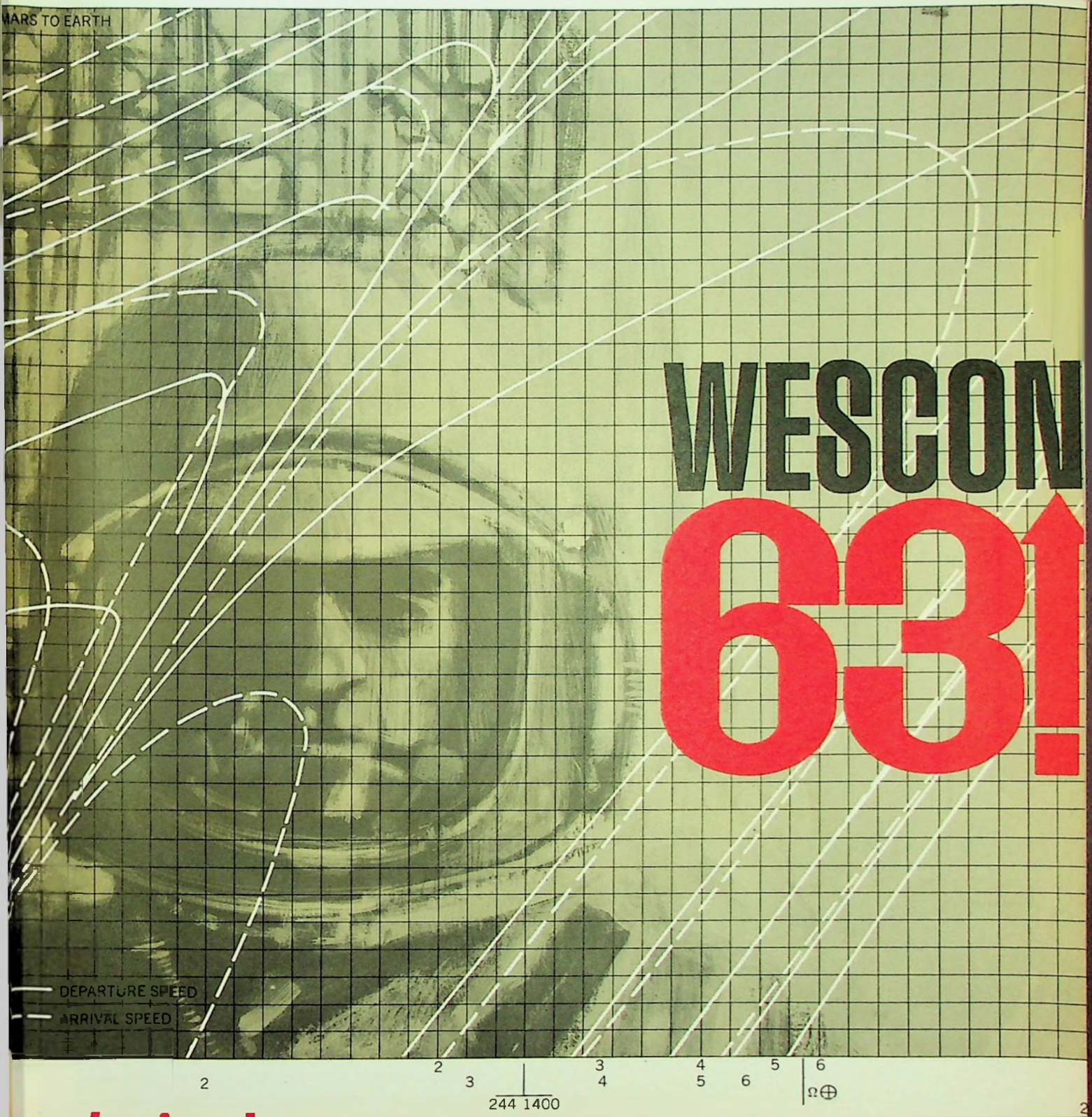
1963 WESCON IN SAN FRANCISCO! AUGUST 20, 21, 22, 23 AT THE COW PALACE

WESCON
IEEE WEMA

# grid-bulletin

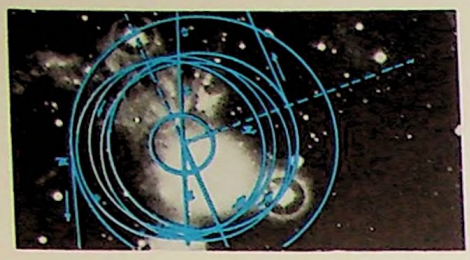
Joint Publication / San Francisco and Los Angeles sections of the IEEE

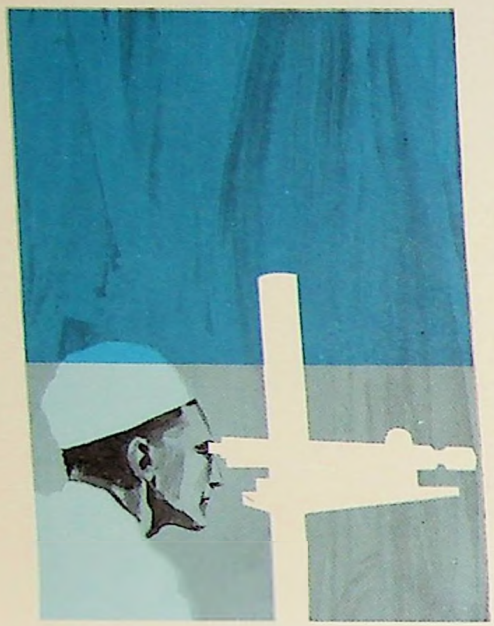
AUGUST 1963

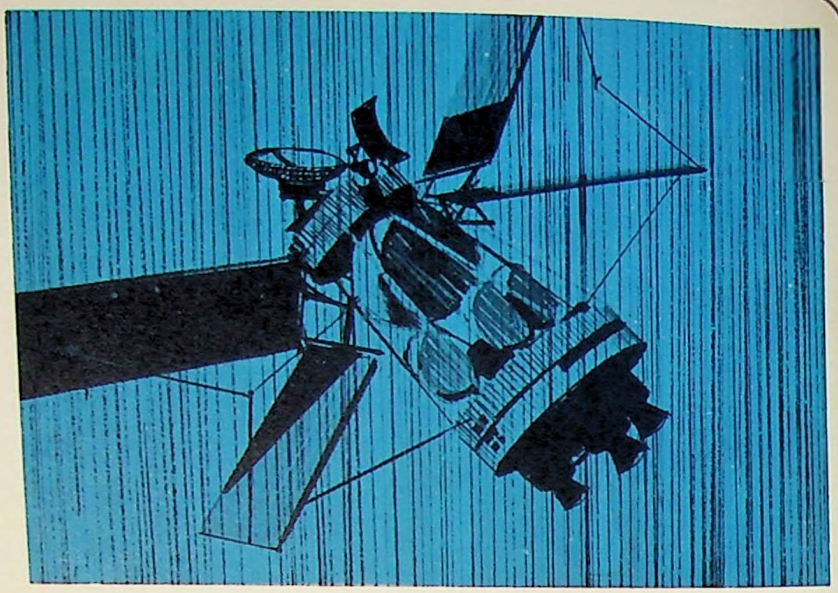



## WESCON 63!

## technical program







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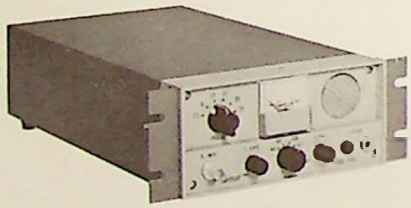

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Phase Comparison Receiver — used with local frequency standards accurate to 1 part in $10^7$ or better. Instrument utilizes the propagation stability of low-frequency waves, allowing comparisons to an accuracy of 5 parts in $10^{10}$ to be made in one hour. Higher accuracies, proportionately longer. This all solid-state unit also includes a built-in servo-driven, strip-chart recorder. Front-panel frequency selection permits rapid switching of up to 4 frequencies within the range of 10 to 100 KC. Send for Bulletin PCR-1.

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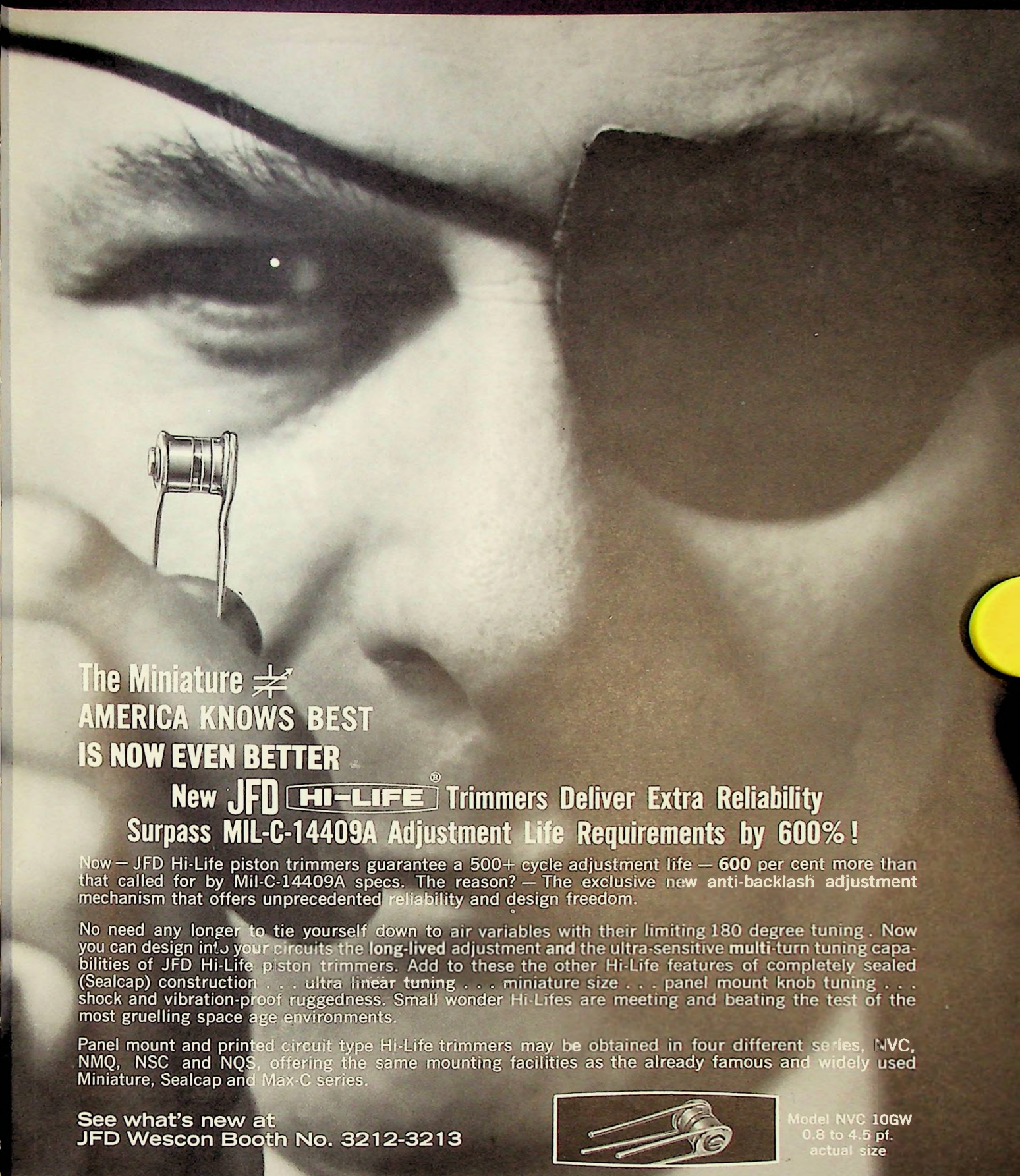
SEE US AT WESCON, BOOTHS 1621-23



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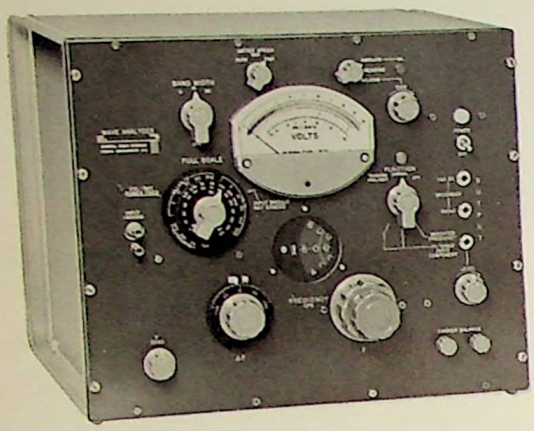
# NEW at WESCON

## from GENERAL RADIO

Booths 2215 — 2218



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**New**

**Digital Time and Frequency Meter**

A general-purpose counter with a full complement of input controls and switching program needed for period, multiple-period, and ratio measurements. Measures: frequency from dc to 300 kc; period from dc to 20 kc (1, 10, 100, or 1000 period averaging); frequency ratios from 1 to 100,000 . . . Input sensitivity is 0.1v at 100 kilohms or 1v at 1 megohm . . . Internal 100-kc crystal time base with better than 0.5ppm short-term stability . . . In-line NUMERIK digital indicators provide a bright, easily read display . . . **Type 1151-A, $1195** (1151-AP, designed for use with data printer, $1250).

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WESCON grid-bulletin

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For Los Angeles:
Executive Editor: Ray Banks
Managing Editor: Jeanne Mohit

*contents*



*cover and credits*


Lockheed's Mars to Earth space travel timetable provides the cover theme, frontiers in electronics, Wescon 63. Design and women's activities art on page 39 by West Associates. **Grid-Bulletin** is also indebted to WEMA for the industrial statistics charts on pages 42 and 43. **Grid** and the **Bulletin**, as well as the combined publication, are particularly indebted to Peter Sherrill, retiring San Francisco publications advisor, and William E. Wilson, retiring Los Angeles editor, for many years of excellent counsel.

*1963-64 section chairmen*

San Francisco: William A. Edson  Los Angeles: Willard H. Fenn

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# WESCON Quick-Check List

## EVENTS — TIME — COSTS

### TUESDAY, AUGUST 20

| | |
|---|---|
| 8:30 AM to 6:00 PM | Women's hospitality room, California room, Fairmont hotel |
| 8:45 AM | Press conference, west entrance, Cow Palace |
| 9:30 AM to 6:30 PM | Wescon exhibits, Cow Palace |
| 9:30 AM to 6:30 PM | Future Engineers show, convention hall, Cow Palace |
| 9:30 AM to 6:30 PM | Industrial Design exhibit, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 1, Room A, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 2, Room B, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 3, Room C, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 4, Room D, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 5, Room E, convention hall, Cow Palace |
| 10:00 AM to 5:00 PM | Jedec Semiconductor Device council, International room. Fairmont hotel |
| 1:00 PM to 5:00 PM | Technical tour 1, University of California electronic research laboratory |
| 1:00 PM to 5:00 PM | Technical tour 2, Kaiser Aircraft and Electronics |
| 1:00 PM to 5:00 PM | Technical tour 3, Westinghouse/Sunnyvale |
| 2:00 PM to 4:30 PM | Special session W: extraterrestrial life, detection, communication and exploration, Room E, convention hall, Cow Palace |
| 6:00 PM to 8:00 PM | All-industry cocktail party, grand ballroom, Fairmont hotel |

### WEDNESDAY, AUGUST 21

| | |
|---|---|
| 8:30 AM to 10:00 PM | Women's hospitality room, California room, Fairmont hotel |
| 8:30 AM to 12:00 NOON | IEEE national PTG committee, French room, Fairmont hotel |
| 9:00 AM to 5:00 PM | IEEE Region 6 committee, Vanderbilt room, Fairmont hotel |
| 9:00 AM to 5:00 PM | IEEE PTGEM adm. committee, Frontier room, Fairmont hotel |
| 10:00 AM to 12:30 PM | Technical session 6, Room A, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 7, Room B, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 8, Room C, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 9, Room D, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 10, Room E, convention hall, Cow Palace |
| 10:30 AM to 11:30 AM | Wescon exhibitors meeting, Hunt room, Fairmont hotel |
| 11:00 AM to 4:30 PM | Women's bay cruise and Tiburon tour, departure from pier 43½ |
| 12:00 NOON to 10:00 PM | Wescon exhibits, Cow Palace |
| 12:00 NOON to 10:00 PM | Future Engineers show, convention hall, Cow Palace |
| 12:00 NOON to 10:00 PM | Industrial Design exhibit, convention hall, Cow Palace |
| 12:00 NOON to 2:00 PM | WEMA 20th anniversary luncheon, Gold room, Fairmont hotel |
| 12:30 PM to 5:00 PM | IEEE PTGED adm. committee, 20th Century room, Fairmont hotel |
| 1:00 PM to 5:00 PM | Technical tour 4, Microwave Electronics Corporation |
| 1:00 PM to 5:00 PM | Technical tour 5, Systron-Donner Company |
| 1:00 PM to 5:00 PM | Technical tour 6, Ames Laboratory, NASA |
| 2:00 PM to 4:30 PM | Special session X: information processing in living systems, Room E, convention hall, Cow Palace |

### THURSDAY, AUGUST 22

| | |
|---|---|
| 8:30 AM to 6:00 PM | Women's hospitality room, California room, Fairmont hotel |
| 9:00 AM to 12:30 PM | Technical tour 7, Stanford Linear Accelerator |
| 9:00 AM to 12:00 NOON | IEEE student activities committee meeting, Empire room, Fairmont hotel |
| 9:30 AM to 6:30 PM | Wescon exhibits, Cow Palace |
| 9:30 AM to 6:30 PM | Future Engineers show, convention hall, Cow Palace |
| 9:30 AM to 6:30 PM | Industrial design exhibit, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 11, Room A, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 12, Room B, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 13, Room C, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 14, Room D, convention hall, Cow Palace |
| 10:00 AM | Future Engineers symposium, Room E, convention hall, Cow Palace |
| 12:00 NOON | Women's Far East fashion show and luncheon, Garden Court, Sheraton-Palace hotel |
| 12:00 NOON | Future Engineers award luncheon, Hunters Point |
| 12:00 NOON to 5:00 PM | IEEE PTGANE adm. committee, Far East room, Fairmont hotel |
| 12:00 NOON | Purchasing Agents Assoc. of Northern California luncheon, Skyline room, Hilton Inn |
| 1:00 PM to 5:00 PM | Technical tour 8, Jennings Radio Manufacturing Corporation |
| 1:00 PM to 5:00 PM | Technical tour 9, United Technology Corporation |
| 1:00 PM to 5:00 PM | Technical tour 10, Spectra-Physics/Sylvania |
| 2:00 PM to 4:30 PM | Special session Y: recent advances in lasers, Room E, convention hall, Cow Palace |
| 8:00 PM | Wescon annual banquet and dinner dance, grand ballroom, Fairmont hotel |

### FRIDAY, AUGUST 23

| | |
|---|---|
| 8:30 AM to 6:00 PM | Women's hospitality room, California room, Fairmont hotel |
| 9:00 AM to 12:30 PM | Technical tour 11, Station KPEN transmitter site |
| 9:00 AM | Women's continental breakfast and Wescon tour, California room, Fairmont hotel |
| 9:30 AM to 6:30 PM | Wescon exhibits, Cow Palace |
| 9:30 AM to 6:30 PM | Future Engineers show, convention hall, Cow Palace |
| 9:30 AM to 6:30 PM | Industrial Design exhibit, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 16, Room A, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 17, Room B, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 18, Room C, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 19, Room D, convention hall, Cow Palace |
| 10:00 AM to 12:30 PM | Technical session 20, Room E, convention hall, Cow Palace |
| 2:00 PM to 4:30 PM | Special session Z: active communication satellites, Room E, convention hall, Cow Palace |

All technical tours depart from the east entrance of the Cow Palace at time designated.

**YOUNGSTERS:** No one under ten admitted. Youngsters 10-18 admitted to Future Engineers show only, no charge, run of show. Youngsters admitted to full exhibit area FRIDAY ONLY, for $1.00 per person fee. Must be accompanied by registered adult.

WESCON

# grid-bulletin

Joint Publication / San Francisco and Los Angeles sections of the IEEE


The cooperative spirit demonstrated repeatedly by the Sixth Region members insures, for our area, the successful weathering of the institute financial-transition merger problem. The Sixth Region is cooperating with the board of directors and the general manager in every possible way to minimize the financial strain in '63 and '64, with the hope that the institute will move to a balanced budget in '65.

The IEEE Sixth Region committee meeting will be held at Wescon, in the Vanderbilt Room of the Fairmont Hotel, starting at 9:00 a.m., Wednesday, August 21.

The 1964 Sixth Region convention and committee meeting will be held in Salt Lake City, and technical coverage will be extended to include the power, as well as the electronic, interests of the members. This will be the first "merged" Sixth Region convention. Continuing this pattern, the expanded regional meeting in 1965 will be held in Las Vegas, Nevada.

DANIEL E. NOBLE, Director, Region 6, IEEE

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Our industry, during the bustling years since the war, has seen many mergers, acquisitions, and joint ventures, as electronics people have sought and found optimum combinations of men, money, and machinery. One of the most successful joint ventures has been Wescon, a happy collaboration between WEMA, the trade association for Western electronics, and the Western IEEE as represented by its Los Angeles and San Francisco sections.

WEMA people are proud of the unqualified success of this unusual coalition. It is typical of our industry—in which so many management people are technically oriented and where technical considerations play such a large part in business decisions—that the principal organizations representing scientific and engineering activity on the one hand, and management matters on the other hand, should work together to arrange and present our annual Western convention and trade show.

WEMA hopes that IEEE members attending Wescon this year, which is WEMA's 20th anniversary year, will find rewarding its technical sessions, exhibition, social affairs, and the many special meetings and conferences.

EMMET G. CAMERON, President, WEMA

---

It's that time again—and Wescon '63 is just around the corner. This year, as last, the theme "Frontiers in Electronics" describes well the forward-looking nature of the technical program and of the many exhibits demonstrating the latest advances in the state of the art. An outstanding series of technical tours offers something of interest for all disciplines in the newly merged IEEE.

Again this year, multiple technical sessions in the mornings will present contributed papers in twenty different fields; while single afternoon sessions will make available to all a series of invited papers in the most challenging of the new areas of research and development. For these afternoon sessions, leaders in the various fields will come from all parts of the country.

It should indeed be a full week. The Los Angeles Section of the IEEE is pleased to join with the San Francisco Section, with the Sixth Region, and with WEMA in saying, "Welcome to Wescon '63! See you there!"

WILLARD H. FENN, Chairman,
Los Angeles Section, IEEE, 1963-64

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The San Francisco Section of the IEEE is proud of the contribution it has made to the 1963 Wescon, which is about to open its doors.

The newly formed Institute of Electrical and Electronics Engineers has a vast accumulation of experience in the IRE and AIEE that merged to form it. The extent to which this accumulated strength and experience has been preserved is evidenced by the variety and vitality of the program offered.

The many excellent and varied features of the Wescon show and convention are adequately described elsewhere in this issue. I urge you to acquaint yourself with the program and exhibits available to you and to attend those that best serve your interests.

The San Francisco Section of the Institute of Electrical and Electronics Engineers extends a cordial welcome and a sincere invitation to attend the many valuable and interesting events of the 1963 Wescon.

WILLIAM A. EDSON, Chairman,
San Francisco Section, IEEE, 1963-64


*At left, in barker costumes and in a setting suggesting the circus theme for the all-industry cocktail party Tuesday evening, August 20, at the Fairmont hotel, are committee chairmen Phillip L. Gundy (left), executive vice president of Technical Systems, Inc., of Palo Alto, and A. George Ewing, vice president for manufacturing, Lenkurt Electric Co.*

*Left below, inaugurating Wescon's advance registration trailer, several chief figures of the 1963 Wescon greeted technical executives of Eitel-McCullough, Inc., at San Carlos. Receiving registration forms at left are Dr. Jules W. Needle, Eimac manager of engineering, power tube division, and Jeff Montgomery, product manager of the accessory products division. Greeting them is John A. Chartz, vice president and general manager of Dalmo Victor Co., Wescon show director. On the steps are Don Larson, manager of Wescon, and Fred A. MacKenzie of Stanford Research Institute, chairman of the Wescon registration committee.*

*Below, at opening of Wescon industrial design award exhibition at San Francisco Museum of Art—In the foreground, George Kosmak, chairman of the San Francisco Chapter, Industrial Designers Institute (left), and George D. Culler, director of the San Francisco Museum. In the background: Don Brundage and Frederick C. Hill, vice chairman and chairman of the IDA Committee, with John A. Chartz (right), show director.*

*broadcast notes*

## WESCON ON THE AIR

Wescon is planning some unusual radio production this year. A number of session chairmen and contributors to the technical sessions will be interviewed on a technical level. The edited interviews will be broadcast on Bay Area radio, to give a preview of the sessions. Stations KPEN, KAFE, and KMPX have already indicated willingness to broadcast this special material in advance of Wescon.

*symposium notes*

## POTENTIOMETERS

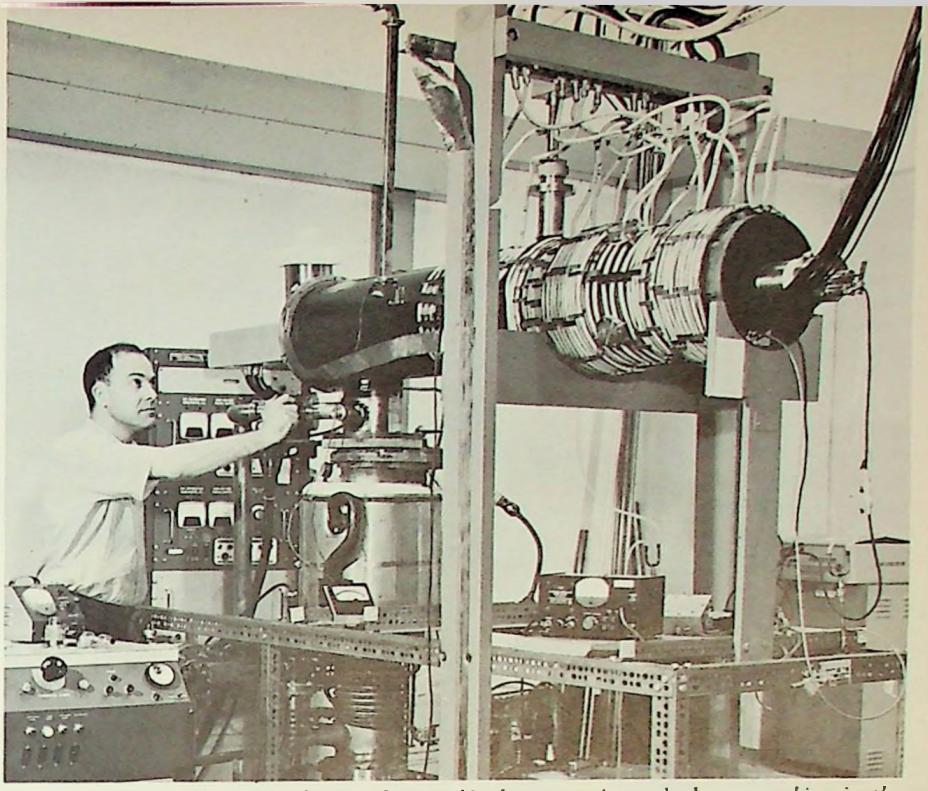
The state of the art for non-wirewound potentiometers will be discussed at a technical symposium, sponsored by the Precision Potentiometer Manufacturers' Association, in San Francisco on Monday, August 19, 1963, the day prior to Wescon.

The symposium, to be held at the Sheraton Palace Hotel, will be a full-day session beginning at 9:00 a.m. Papers will be presented by recognized experts from the industry.

Systems and circuit design engineers, reliability and component engineers, and other technical personnel are invited to participate.

Advance programs and registration blanks may be obtained from D. C. Fleming, program chairman, Spectrol Electronics Corporation, 1704 South Del Mar Avenue, San Gabriel, California.

*Members of the Wescon board of directors, in addition to the executive committee pictured in the July issue, are, above, S. H. Bellue and Edward C. Bertolet; below, Hugh P. Moore and Ralph A. Lamm.*



*Technical tour 1 will feature the "working end" of an experimental plasma machine in the electronics research laboratory at the University of California at Berkeley. The tour is scheduled for 1:00 p.m. on August 20.*

# TECHNICAL PROGRAM

## SESSION 1

### PATTERN RECOGNITION

*Tuesday, August 20, 10:00 A.M.-12:30 P.M.*
*COW PALACE – ROOM A*

Session Chairman:
PHILIP E. MERRITT
*Stanford Research Institute*
*Menlo Park, California*

### 1/1 THE ELECTRONIC INSTRUMENTATION OF PHOTOGRAMMETRIC SYSTEMS

P. M. SALOMON
*General Precision, Inc.*
*Glendale, California*

This paper describes the various electronic techniques used in automating the process of map compilation from aerial photography. Such subject matter as the following is discussed: the high-speed reduction of photographic information by the use of special scanning and correlation techniques; the instrumentation necessary for the real-time production of contour and profile maps; the production of orthophotographs; and the extension of survey control by electronic correlation and measurement techniques. The paper also includes a brief history of past attempts to automate the process of map compilation and a discussion of current state-of-the-art techniques.

### 1/2 THE USE OF THRESHOLD LOGIC IN PATTERN RECOGNITION

S. B. AKERS, JR., BARRY H. RUTTER
*General Electric Company*
*Syracuse, New York*

The fact that many complex counting functions can be realized quite simply with threshold gates suggests that they may be used to considerable advantage in problems of pattern recognition. A simplified recognition problem is considered involving the identification of any one of 12 letters when it is superimposed on an m x n matrix. Translation, stretching, and compression of the letter are permitted. It is shown that the number of threshold gates required increases linearly as the dimensions of the matrix with about 300 gates being necessary for a 20 x 20. On such a matrix, several hundred thousand configurations of the 12 letters can be correctly identified with each pattern being insensitive to varying degrees of "noise." A threshold gate having the necessary fan-power for this application is described together with its implementation in a small experimental model. Extensions of the methods to larger numbers of letters and to include rotation and magnification are discussed.

### 1/3 AN ITERATIVE DESIGN TECHNIQUE FOR PATTERN CLASSIFICATION LOGIC

J. A. DALY, R. D. JOSEPH,
D. M. RAMSEY
*Astropower, Inc.*
*Newport Beach, California*

A new method for the design of pattern recognition devices is presented. The method is iterative, utilizing multivariate statistical techniques to specify optimum linear logic elements and utilizing a heuristic rule for weighting elements in the signal space. A requisite for the operation of the technique is a representative set of classified patterns. Information is generated, as part of the design program, as to the efficiency of various subsets of the logic.

The input patterns for the recognition device

## TRADITIONAL LUNCH SET

Charles B. Thornton, chairman of the board and chief executive officer of Litton Industries Inc., will be the featured speaker at the annual WEMA luncheon, August 21.

The association's annual luncheon has been a traditional highlight of Wescon week, and will be staged on Wednesday, in the Gold Room of the Fairmont Hotel.

Thornton was elected president and chairman of the board of Litton Industries in late 1953 and, in 1961, became chairman and chief executive officer. Earlier he had been vice president and assistant general manager of Hughes Aircraft Company and director of planning for Ford Motor Company, following World War II service in the Air Force.

*Charles B. Thornton*

Litton Industries, with more than 43,000 employees, now has 72 engineering laboratories and manufacturing plants with more than 2,000 sales and service branches located throughout the United States and in 70 other countries.

The company is engaged in the research, development, and production of a wide range of electronics and related products, including the Monroe line of business and office machines, as well as nuclear-powered submarines by its Ingalls Division in Pascagoula, Miss.

He is also a member of the board of trustees of the University of Southern California and the Harvey Mudd College of Science and Engineering.

are considered as points in an n-dimensional vector space. Pattern recognition consists of partitioning this signal space into regions according to an externally imposed classification. Such a partitioning is often extremely difficult to achieve with physically realizable devices because the shapes of the specified regions are complex. It is often desirable, therefore, to map the input vector into a new vector space in which the pattern classification regions are more simply defined.

Under the restriction that a linear logic unit serve as the recognition device, it is required that any two classes of patterns be separable by a hyperplane. The recognition space should be such as to minimize the error necessarily associated with this classification procedure. The coordinates in the recognition space are defined by the activity of (linear) logic elements. Optimum design of the network would require the simultaneous selection of all the coordinates, but would present a computational problem of incredible magnitude.

The method proposed iteratively selects the coordinates of the recognition space, choosing at each step the most favorable of a set of candidate logic units. Although it is possible to define the most favorable unit among all linear logic units, the method compromises the optimality of the logic unit selected for the sake of ease of computation and hardware implementation.

The signal space is projected onto various subspaces, which may be selected randomly and/or with the aid of heuristic rules. Optimum hyperplanes are determined for these subspaces using multivariate discriminant analyses. Each hyperplane represents a candidate logic unit. A candidate logic unit is evaluated by computing the separability of the pattern classes in the augmented recognition space.

A "goodness" function is defined, which not only takes into account the errors made in passing the optimum hyperplane through the recognition subspace, but the seriousness of the errors and the sensitivity of the error function to movements of the hyperplane. This function is used to evaluate the separabilities of the augmented recognition spaces, and hence provides a basis for selecting the most favorable coordinate. The function is also used to weight patterns in the signal space in preparation for the next iteration.

A description of the networks designed for several test problems will be given, and a comparison drawn with networks designed utilizing more traditional techniques.

### 1/4 A PATTERN RECOGNITION METHOD BASED ON THE LINEAR SEPARABILITY OF THE SIGNAL SPACE

GABRIEL E. LOWITZ
*Data Systems Division*
*Litton Systems Inc.*
*Canoga Park, California*

This paper describes a general process of pattern recognition based on the linear separability of the signal space of time bandwidth limited signals.

The method of recognition is based on the existence of an optimum map, a unique point in the Hilbert space $L^2$ for each pattern of the signal space. An equivalence relation is established between measurable patterns and time bandwidth limited signals. The optimum map is independent of the translation of the pattern. A rotation of the pattern is equivalent to an expansion $a$ of the basis $H_k(at)$ of the mapping space $L^2$.

The optimum mapping operation of a given pattern $g(t)$ consists in the cross-correlation of all possible translations $g(t+\tau)$ of the pattern with a set of orthonormal functions $H_k(at)$ complete in $L^2$. The readout of the coordinates of the map occurs only for that particular translation $\tau_0$ which maximizes the output signal to noise ratio. This condition reduces to a linear decision on the coordinates of the map and gives the process an important adaptive property. The completeness of the mapping of the shape information of the pattern into a finite number of dimensions of the mapping space is discussed as well as the invariant metric distances of the maps of an alphabet when different sets of orthonormal complete reference functions are used.

This method has a specific application as a technique for automatic printed character recognition. The paper contains results of a simulation on a 7090, and includes encoding of the data and actual maps of an English alphabet.

The optimum mapping in $L^2$ is also proposed as a research tool in Bionics, since it yields a mathematical model of the pattern recognition properties of the biotransducers. As applied to the Cochlea, the model gives a simple explanation of displacusis effects and a Weberian Law more general than recent formulations. The model makes great use of the analogs of interconnecting fibres and efferent nerves of the Cochlea.

### 1/5 ADAPTIVE PATTERN RECOGNITION

A. B. BISHOP
*North American Aviation Inc.*
*Columbus, Ohio*

A generalized adaptive threshold-logic approach involving the use of non-linear terms in the classification model is formulated. Relationships among the number of input (pattern) variables, the number of units in the classification device, and the number of patterns which can be recognized are developed.

## SESSION 2

### FEEDBACK SYSTEMS

*Tuesday, August 20, 10:00 A.M.-12:30 P.M.*
*COW PALACE — ROOM B*
Session Chairman:
GEORGE N. ORNSTEIN
*North American Aviation, Inc.*
*Columbus, Ohio*

### 2/1 INTERACTING DOMAIN IN MULTIVARIABLE CONTROL SYSTEMS

LOUIS G. BIRTA,
MIHAJLO D. MESAROVIC
*Case Institute of Technology*
*Cleveland, Ohio*

Problem of synthesis of interactions in a multivariable system is approached by taking into con-

*Salomon*

*Akers*

*Ramsey*

*Joseph*

*Daly*

*Lowitz*

*Ornstein*

*Mesarovic*


*Setting the scene for the 1963 Distributor-Manufacturer-Representative conference August 19 at the Jack Tar Hotel, San Francisco: seated is "Director" Elvin W. Feige, chairman; standing, left to right, Charles N. Meyer, vice chairman; V. N. Zachariah, publicity chairman; and David H. Ross, chairman of registration*

*region 6 nominations*

## ANGWIN AND ILLMAN VIE FOR REGION 6 DIRECTOR

*Bruce S. Angwin, manager, western region receiving tube dept., General Electric Co., electronic components division, Los Angeles. B.S., electrical engineering, University of California at Berkeley, 1941. Registered professional engineer, California. IEEE (IRE) experience: regional committee, Los Angeles Section executive committee, section chairman, vice chairman and program director, secretary, chairman of membership committee, merger committee, nominating committee, region and section bylaws committees. Wescon: chairman of executive committee, convention director, member of board, 1955-62. Senior member, IEEE. Active in WEMA.*

*Robert W. Illman, staff engineer, electrodynamics, airplane division, Boeing Airplane Co., Seattle. B.S., magna cum laude, electrical engineering, University of Washington, 1942. IEEE (AIEE) experience: national papers review committee; chairman, Seattle Section basic sciences committee; chairman, United Engineering Center local fund-raising campaign; chairman of the nominating committee; secretary-treasurer, vice chairman, and chairman, Seattle Section. (IRE): membership chairman, awards chairman, Seattle Section. Chairman, merger committee; chairman, IEEE nominating committee. Life member, Tau Beta Pi; senior member, IEEE.*

**WATCH FOR YOUR BALLOT AND RETURN IT PROMPTLY**

*dist./mfgr./rep. conference*

## ANNUAL REP MEETING SET

On Monday, August 19—the day prior to Wescon's opening—the annual conference for distributors, manufacturers, and representatives will take place in the International Room of the Jack Tar Hotel in San Francisco. This will be the eighth such conference in conjunction with Wescon, and several hundred men involved with marketing through distributors will take part.

This day starts off with a breakfast and the first morning conference period at 8:30 a.m. After luncheon there will be a second session. Each of the two sessions will have ten 20-minute conference periods each, whereby interested parties can meet with key people representing companies they are anxious to see or contact. Registration is required for this event.

A cocktail hour and dinner, followed by entertainment, will complete this very full day.

## SPEAKER: LEE DuBRIDGE

Dr. Lee A. DuBridge, president of California Institute of Technology, has accepted the invitation of the Wescon board of directors to address the banquet that traditionally concludes the social program of Wescon week..

The event will take place the evening of Thursday, August 22, in the Grand Ballroom of the Fairmont Hotel atop San Francisco's Nob Hill.

Prior to the dinner there will be an invitational reception in the Terrace Room honoring Dr. and Mrs. DuBridge and distinguished visitors, including national officers and directors of the Institute of Electrical and Electronics Engineers and officials of the Western Electronic Manufacturers Association.

*Lee A. DuBridge*

Dancing will take place during intervals of the dinner and following the program, to the music of a 15-piece orchestra led by Walt Tolleson.

Toastmaster for the program will be Emmet G. Cameron, president of the Western Electronic Manufacturers Association and executive vice president of Varian Associates.

Committee planning for the affair is headed by Cortland Van Rensselaer, general manager of the oscilloscope division of Hewlett-Packard Co., and William A. Melchior, vice president of Eichorn & Melchior, Inc., San Carlos.

President of CalTech since 1946, Dr. DuBridge is one of the nation's leading educators in science and engineering. He is a native of Terre Haute, Ind., is a graduate of Cornell College in Iowa, and holds Master's and Ph.D. degrees (majoring in physics) from the University of Wisconsin.

During his teaching career Dr. DuBridge served on the faculties of Washington University in St. Louis and the University of Rochester in New York State. At Rochester he was dean of the faculty of arts and science from 1932 to 1942.

During the war years, on leave from the University of Rochester, he was engaged in radar research as director of the Radiation Laboratory at M.I.T. under the U.S. Office of Scientific Research and Development.

He was recently appointed to the Distinguished Civilian Service Awards Board by President Kennedy.

*Smith*

*Swenson*

*Clark*

*Frazier*

---

ration the changes in the environment in which system will operate. Concept of interacting do- is introduced to denote the set of environmen- conditions in which the interaction will improve performance of the system. Analytical results ained so far for determination of the interacting ains for different classes of problems are re- ved and some typical examples discussed.

### 2 ENHANCING THE RESOLUTION OF A POTENTIAL PLANE ANALOG BY CHANGING THE VARIABLE TO TRANSLATE THE ORIGIN

OTTO J. M. SMITH
*University of California*
*Berkeley, California*

EDWARD SWENSON
*Electro Scientific Industries*
*Portland, Oregon*

A technique is presented for increasing the accuracy of root locus plots obtained by using a potential plane analog. This is done by translating the origin of co-ordinates to the area of interest by an appropriate change of variable. Examples discussed include the translations used to examine closely spaced pole zero pairs and angle locus breakaway points.

### 3 REAL TIME SYSTEM EQUATION IDENTIFICATION IN THE PRESENCE OF NOISE

RICHARD A. RUCKER
*Berkeley, California*

Equations are derived which allow simultaneous and continuous calculation of the coefficients of the differential equation of a linear system when the response is known and is the superposition of several inputs, of which only one is known. A restriction is that the unknown inputs must not correlate with the observed input. An analog computer realization is discussed which demonstrates the scheme on a simple system.

## SESSION 3

## OMPONENT RELIABILITY

*esday, August 20, 10:00 A.M.-12:30 P.M.*
*OW PALACE – ROOM C*

sion Chairman:

BRUCE CLARK
*Stanford Research Institute*
*Menlo Park, California*

### 3/1 TEMPERATURE DEPENDENT FLUORESCENT PAINTS-A GRAPHIC DISPLAY OF TEMPERATURE DISTRIBUTION

H. D. FRAZIER
*Pacific Semiconductors, Inc.*
*Lawndale, California*

A graphic display of temperature distribution with rapid reversible response in the ranges from 25°C to 410°C is possible and will be shown in color movie and slide form. In most electronic applications, sooner or later the hot spots become important. This technique allows visual observation of such areas and allows studies of thermal distribution with all the implications attendant to reliability, package and heat sink design. Entered in as an integral part of a production line, each part can be tested for unexpected faults or interrupted heat flow paths before closure for sale. Observations can be made on items of microscopic size under as high as 100X or as large as is desirable up to the side of large furnaces. Four steps are required in observing temperatures between 25°C and 410°C.

### 3/2 CONNECTOR RELIABILITY BASED ON ACTUAL FIELD MEASUREMENTS

JAMES E. ATKINSON, HUGH C. EDFORS
*Amphenol-Borg Electronics Corp.*
*Chicago, Illinois*

This paper deals with actual field histories of electrical connectors under various stress levels. The connector application involved is in commercial jet aircraft and the data emanates from major domestic and international carriers.

The data involves a study of connectors under the various aforementioned environments and includes information covering total connector operation hours in excess of 500,000,000.

### 3/3 USE OF CONDUCTIVE EPOXIES FOR ELECTRICAL INTERCONNECTIONS

Panel Discussion:

J. M. OKADA
*Douglas Aircraft Company*
*Santa Monica, California*

STANLEY STUHLBARG
*P. R. Mallory & Company*
*Indianapolis, Indiana*

FRANK UNMACK
*Astronautics Division*
*General Dynamics Corporation*
*San Diego, California*

LESTER FEINSTEIN
*Stanford Research Institute*
*Menlo Park, California*

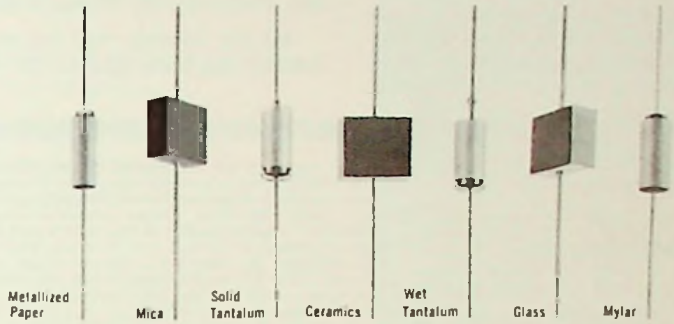
*(Continued on page 12)*

# The Greatest Response Ever Accorded ANY New Capacitor BECAUSE...

**Never before, such a combination of performance characteristics in a tantalum capacitor— solid or wet.**
**Never before, such a combination of performance characteristics in ANY capacitor— of this size and weight.**

***Hi-VolTan***
© Pat. Pend.

actual size




JUST A FEW weeks ago, we announced a radically *new* kind of capacitor — the *"Hi-VolTan"*.

THE RESPONSE to our initial announcement has been remarkable . . . here's why:

UNIQUELY, *Hi-VolTan* is a tantalum capacitor with NO ELECTROLYTE of any sort — wet or dry. The cathode connection is metallic. With no electrolyte, there is no electrolytic *ionization* — therefore, no built-in potential for *instability*. Here's how its basic parameters compare with other types of high-quality capacitors:

▸ ***Hi-VolTan* vs. Solid Tantalum:** No solid tantalum capacitor can withstand 200 V test (breakdown) voltage, and 125 V working voltage — *HiVolTan* does. Moreover, *Hi-VolTan* is smaller and lighter, with far higher Q (greater than 150 @ 1000 cycles), lower leakage (higher dielectric resistance — more than 100,000 megohms @ 100V) . . . and with substantially greater stability of parameters with variations in temperature, frequency and voltage, *plus* greater reverse voltage capability.

▸ ***Hi-VolTan* vs. Wet Tantalum:** Compared with wet tantalums, all of *Hi-VolTan's* advantages over solid tantalums apply in even greater degree, except the voltage capability which wet tantalums do match.

▸ ***Hi-VolTan* vs. Mylar:** *HiVolTan*, with *only one-tenth the volume and one-sixth the weight*, offers operating characteristics equal to those of Mylar . . . *plus* significantly higher storage temperatures.

▸ ***Hi-VolTan* vs. Metallized Paper:** Again, with only one-seventh the volume and one-seventh the weight, *Hi-VolTan* offers equal operating characteristics . . . *plus higher Q* (better Dissipation Factor) . . . *plus* higher storage temperatures . . . *plus* lower temperature coefficient.

▸ ***Hi-VolTan* vs. Ceramics:** *Hi-VolTan*, in addition to its substantial size and weight advantages over ceramics, has higher stability which is especially impressive in terms of three parameters: capacitance, dissipation factor, and leakage, under widely varying conditions of temperature, frequency and/or voltage. Parameter changes in the *Hi-VolTan* are, in fact, the smallest of *any* comparable capacitor; moreover (unlike ceramics) these extremely small variations are uniform, smooth and predictable.

▸ ***Hi-VolTan* vs. Mica and Glass:** If size and weight in your circuit are of little consequence, mica and glass need not be replaced by *Hi-VolTan*. But, certainly, in *any* case, *Hi-VolTan's* characteristics should be carefully evaluated.

### ▸ *Hi-VolTan* — Range and Characteristics

| Type | Case Size | Weight ozs. | Capacitance Range-mmf | Volts D.C. Operating 85°C | D.F. @ 1000~ 25°C | % Cap. Change −55°C to 25°C | % Cap. Change 25°C to 85°C | Insulation Resistance Megohms @ 25°C |
|---|---|---|---|---|---|---|---|---|
| HVT-A* | .065"D x .183" | .004 | 400-3000 | 125 | .005 | 2 | 2 | 150,000 @ 100V |
| HVT-B | .065"D x .183" | .004 | 400-3000 | 100 | .005 | 2 | 2 | 100,000 @ 100V |
| HVT-C | .065"D x .183" | .004 | 3100-5000 | 50 | .007 | 3.5 | 3.5 | 100,000 @ 50V |
| HVT-D | 065"D x .183" | .004 | 5100-10000 | 25 | .009 | 4.5 | 4.5 | 100,000 @ 25V |

For 125°C operation, derate operating voltage by 30%.
*All HVT-A capacitors factory tested for breakdown @ 200V.

**Operating Temperature Range: —100°C to 125°C**

For complete data, and a free sample that can be evaluated in your own laboratory, please write us on your company letterhead, stating capacitance range in which you are most interested.

**GENERAL INSTRUMENT CORPORATION**
**CAPACITOR DIVISION**
65 Gouverneur St., Newark 4, New Jersey

GENERAL INSTRUMENT
CAPACITORS

*future engineers*

## 37 TO EXHIBIT PROJECTS

Thirty-seven youths have accepted invitations to display science projects in the seventh annual Wescon Future Engineers show.

The students, ranging in age from 13 to 18, will come to San Francisco from as far away as Cedar Rapids, Iowa; Seattle, Wash.; and Alamogordo, N.M. They will bring exhibits with such titles as "Electricity from the Sea," "Plasmatic Radio Blackout," and "A Mathematical Machine."

All the projects have taken honors at local science fairs, where they were selected by judging panels from local sections of the IEEE.

The student projects will be judged again at Wescon and the winners will receive scholarship awards totaling $2,300. First-place winner will receive the Lee de Forest Award of $1,000.

In addition to their exhibits, students are invited to enter the Future Engineers symposium. Here they will make technical paper presentations before an audience and a panel of judges. First-place winner will receive the Frederick E. Terman Award.

All the awards will be made at a special luncheon August 22, following an address by Dr. L. C. Van Atta, chief scientist at Lockheed.

*Waterman*

*Schlobohm*

Chairman for this year's Future Engineers show is Dr. Alan T. Waterman, Jr., of Stanford University. Vice chairman is John C. Schlobohm of Stanford Research Institute, Menlo Park. Other committee members are: Bertram G. Ryland of Physical Electronics Labs, East Palo Alto, exhibits; William R. Luebke of Eitel-McCullough, San Carlos, symposium; Harry K. Berland of Philco Western Devel-

*(Continued on page 14)*

## SESSION 4

### MICROWAVE COMPONENTS

*Tuesday, August 20, 10:00 A.M.-12:30 P.M.*
*COW PALACE – ROOM D*
Session Chairman:
RICHARD C. HONEY
*Stanford Research Institute*
*Menlo Park, California*

### 4/1 BROADBAND STRIP-TRANSMISSION LINE Y-JUNCTION CIRCULATORS

J. W. SIMON
*Sperry Microwave Electronics Co.*
*Clearwater, Florida*

adband circulators have been developed below nce which operate over bandwidths in excess s in the frequency regions .600–8000 Gc. The elationship of VSWR and isolation between us ports is established without imposing sym-y. The fact that building a 3-port circulator is ivalent to a matching procedure is used as a asis for a highly successful experimental develop-ment procedure. Empirically determined criteria for broadbanding is reported with particular emphasis placed in discussing optimization of $4\pi M_s$, $\Delta H$, strip width, and magnetic biasing field. The importance of having a ferrite with low dielectric loss tangent is also discussed. The empirical data is discussed in light of theoretical considerations made in this laboratory and in the light of the recent paper of Bosma's insofar as is possible at this time.

### 4/2 A SINGLE JUNCTION 4-PORT COAXIAL CIRCULATOR

D. H. LANDRY
*Sperry Microwave Electronics Co.*
*Clearwater, Florida*

A light weight miniaturized four port single junction "C" band coaxial circulator has been developed. To the author's knowledge, it is the first of its kind. Four port coaxial circulators to date have been the outgrowth of two three port circulators in cascade. These units have two junctions as opposed to the single junction circulator described here.

The circulator will handle 40 kilowatts of peak power and 40 watts of average power over a frequency range of 5.4 to 5.9 Gc. The VSWR to any port is less than 1.3 and the isolations are 15 to 20 db with insertion losses of .75 to .90 db. The unit weighs less than 14 ounces and will fit in a 2 inch cube. Lower insertion loss has been obtained at reduced power levels.

### 4/3 FIELD OPERATIONAL TRAVELING-WAVE MASER AMPLIFIERS

J. R. YAEGER, L. D. BUCHMILLER,
W. P. JONES, W. A. PETERSON
*Microwave Electronics Corporation*
*Palo Alto, California*

As a result of the availability of reliable closed-cycle refrigerators, successful operation of traveling-wave masers in field installations has been achieved. This paper describes design considerations and operational characteristics of two such maser amplifiers operating at S-band and X-band. This paper will describe the operating characteristics of the S-band, 2300 Mc, and X-band, 8000 Mc, amplifiers and give results on the performance in a closed-cycle refrigerator.

The status of operational characteristics of closed-cycle refrigerators will be reviewed with particular emphasis on data obtained in the field regarding reliability and maintenance requirements.

The S-band, 2300 Mc amplifier discussed gives gain in excess of 26 db, an instantaneous bandwidth greater than 16 Mc, and a noise temperature of 13°K. Significant improvement in structure fabrication techniques, ruby quality and amplifier design were required to obtain this performance in a 4.2°K liquid helium refrigerator, the A. D. Little "Cryodyne."

The second amplifier operates at approximately 8000 Mc with a minimum gain of 25 db, at 15 Mc instantaneous bandwidth, tuning range in excess of 300 Mc, and has a noise temperature less than 15°K. This amplifier employs a super-conducting magnet and also is designed for operation in a 4.2°K closed-cycle refrigerator.

Details on the performance obtained to date with field operation of traveling-wave masers integrated with closed-cycle liquid helium refrigerators will be discussed.

### 4/4 SIDE-WALL-COUPLED STRIP-TRANSMISSION-LINE, MAGNETICALLY-TUNABLE FILTER EMPLOYING YIG RESONATORS

P. S. CARTER
*Physical Electronic Laboratories*
*Palo Alto, California*

A new type of magnetically-tunable bandpass filter is described. The filter, containing YIG resonator elements, employs strip-transmission-line input and output sections with an iris in the common side wall of the input and the output line. Performance curves i.e., insertion loss, bandwidth, tuning range and off-channel rejection are presented for two- and three-resonator versions of this filter. The performance of a new high-speed sweep version of the two-resonator filter is also presented and discussed.

### 4/5 THE GROOVE GUIDE, A LOW-LOSS WAVEGUIDE FOR MILLIMETER WAVES

F. J. TISCHER
*University of Alabama*
*Huntsville, Alabama*

A new waveguide for the low-loss transmission of millimeter waves is presented. The guide consists of two parallel conducting walls with grooves in the central region of the guide cross-section. The grooves run along the guide in the direction of the wave propagation. It is shown that the waveguide, if excited in the TE-wave mode, has properties similar to those of the H-guide, which contains a dielectric slab between the conducting walls in the center. The new guide is characterized by an exponential transverse decrease of the field distributions in direction from the center and by low attenuation. Theoretical considerations dealing with the field distribution and the data of the guide are presented.

*(Continued on page 14)*

*Honey*

*Simon*

*Landry*

*Yaeger*

*Buchmiller*

*Jones*

*Peterson*

*Tischer*

# *High-Speed* Oscilloscopes
## *with General-Purpose Utility*
### TEKTRONIX TYPE 580A SERIES

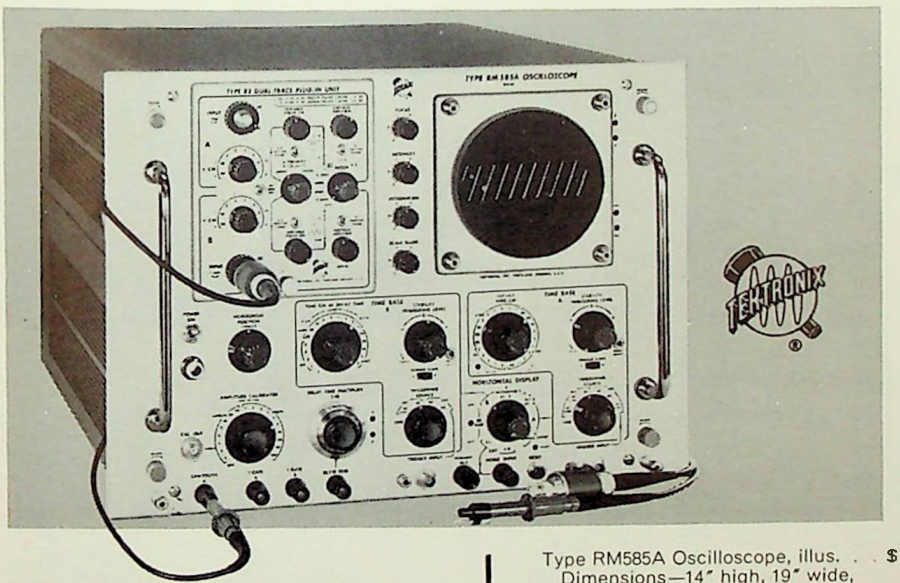
Used with a Type 82 dual-trace unit, a Type 580A-Series Oscilloscope offers new measurement convenience for high-sensitivity, wide-band, dual-trace applications.

Here are some of the features:

- **DUAL-TRACE OPERATION** with 4 operating modes and independent controls for each channel—for individual attenuation, positioning, inversion, and ac or dc coupling as desired.
- **PASSBAND** typically DC-TO-85 MC (3-db down) at 100 mv/cm (12-db down at 150 Mc), and typically DC-TO-80 MC (3-db down) at 10 mv/cm.
- **CALIBRATED SENSITIVITY** in 8 steps from 100 mv/cm to 20 v/cm, and in *10X Amplifier Mode*, from 10 mv/cm to 2 v/cm, variable between steps.
- **INTERNAL AND EXTERNAL TRIGGERING** to 150 Mc.
- **SWEEP RANGE** from 10 nsec/cm to 2 sec/cm.
- **SINGLE-SWEEP PHOTOGRAPHY** at 10 nsec/cm.
- **BRIGHT, HIGH-RESOLUTION DISPLAY** with small spot size.
- **CONVENTIONAL PASSIVE PROBES** for convenience.

**PLUS**

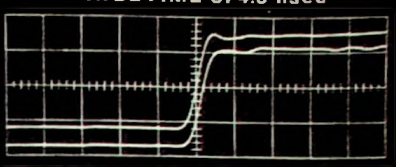
- **COMPATIBILITY WITH 17 LETTER-SERIES PLUG-INS** to permit differential, multi-trace, sampling, other laboratory applications—when used with Type 81 adapter.



Supplied small size passive probes provide high input impedance characteristics. Probes increase input R to 10 megohms and decrease input C to approximately 7 pf.

Risetime (of supplied probe, plug-in unit, oscilloscope) at over-all sensitivity of 0.1 v/cm is approximately 5¼ nsec.

**RISETIME of 4.3 nsec**



**Dual-trace display of input and output pulses of a transistor amplifier at 10 nsec/cm—with lower trace delayed 1 nsec by amplifier under observation. Type 585A/82 combination can display time coincidence between input channels with no measurable difference at 10 nsec/cm.**

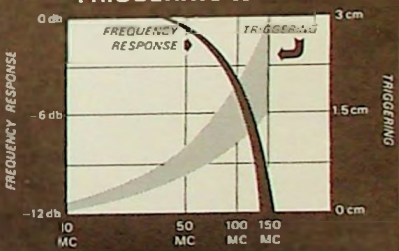
**HIGH-FREQUENCY SYNC to 250 Mc**

**Display of a 250 Mc Sine Wave at 10 nsec/cm, using the H. F. Sync Mode. In this mode, the Type 585A/82 combination can display steady signals from 5 Mc to 250 Mc, with a fraction of a cm of displayed amplitude.**

**SINGLE SHOT at 10 nsec/cm**

**Display of a fast transient at 10 nsec/cm, using single-sweep operation and the Tektronix C-19 Camera. Single-sweep feature of the Type 585A/82 combination facilitates photographic recording of most one-shot phenomena.**

**TRIGGERING to 150 Mc**




**Typical frequency response and internal triggering characteristics of Type 585A/82 combination—showing minimum number of cm necessary for triggering.**

Type RM585A Oscilloscope, illus. . . $1825
Dimensions—14″ high, 19″ wide, 22¾″ deep.
Weight—81 pounds, approx.

Type 585A Oscilloscope. . . . . $1725
Dimensions—16⅞″ high, 13⅜″ wide, 23¾″ deep.
Weight—74 pounds, approx.

Types RM585A and 585A have 2 modes of calibrated sweep delay—either triggered or conventional—ranging from 1 μsec to 10 seconds.

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No sweep-delay capabilities . . . but other features similar to Type 585A Oscilloscope.

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*re engineers*

## SIX IN SYMPOSIUM

youths will present technical
s at the 1963 Wescon Future
neers symposium, Thursday, Au-
22. All six have exhibits in the
re Engineers show.

e students, selected from region-
ience fairs by local members of
EEE, will present their papers at
chnical session similar to those
by engineers and scientists dur-
Vescon.

ne presentations will be judged
panel of engineers, and the win-
student will receive the Freder-
ick E. Terman Award, which carries a $300 scholarship. The award will be presented at a luncheon following the symposium.

The students and their papers are: Leigh Gunnell of Sandy, Utah, "The Effects of Magnetism on Crystals"; Michael Hutchinson of Menlo Park, Calif., "A New Idea in Microscopy"; Thomas Norris of Sacramento, Calif., "A Method of Determining the Pressure of Light."

Also, James Cooperman and Stephen Thein of San Diego, Calif., "Amplification of Nerve Impulses"; and David Hammond of Newport Beach, Calif., "The Period of a Pendulum."

MORE FES

opment Labs, Palo Alto, evening tour; Matt Lehmann of Stanford Electronics Labs, publicity; Jack L. Melchor of H-P Associates, Palo Alto, exhibit judging; Arthur G. Anderson of IBM Research Labs, San Jose, awards luncheon; and Owen K. Garriott of Stanford Electronics Labs, field trip.

### Students and projects

Following are FES participants and their display titles:

Northern California — Mark Banwarth of St. Dunstan's School, Millbrae, "Binary Counter"; Bill Blankenburg of Fairfax Central High, Fairfax, "Proximity Detector"; Tom Decker of Harry Ells High, Richmond, "Electricity from the Sea"; Douglas Faust of Blackford High, Campbell, "An Automatic Tic-Tac-Toe Computer"; Kevin Glading of Albany High, Albany, "Proton Magnetic Resonance"; Douglas Glen of George Washington High, San Francisco, "Parametrics"; Michael Hutchinson of Menlo-Atherton High, Menlo Park, "A Television Microscope"; David Jenson of El Cerrito High, El Cerrito, "Magnetic Core Shifting"; George McKenna of Carmel High, Monterey, "Sound Transmission in Gases at Low Pressure"; Lonnie Masouredis of San Venetia Junior High, San Rafael, "Effect of Pressure

*Shultz*

*Sear*

*Newhall*

*Perucca*

*Gray*

*Kitsopoulos*

## SESSION 5

### IG CIRCUITS

*ugust 20, 10:00 A.M.-12:30 P.M.*
*ACE — ROOM E*

irman:

RT M. SHULTZ
*hild Semiconductor*
*ntain View, California*

bers:

BARTLETT
*A*
*Meade, Maryland*

RT LOHMAN
*o Corporation of America*
*nerville, New Jersey*

RT H. OKADA
*Associates*
*Carlos, California*

PH KAREW
*oughs Corporation*
*i, Pennsylvania*

### LOITATION OF INITIAL IDITIONS TO ACHIEVE FLUX N IN BALANCED MAGNETIC CUITS

NEWHALL, J. R. PERUCCA
*Telephone Laboratories, Inc.*
*ray Hill, New Jersey*

ation consisting of two balanced mag- connected with a single turn cou- g has been shown to have two stable as been found to be capable of signal over a drive current range of at . A single balanced circuit has been ely interrogated, using irreversible t a 2 megacycle rate, over a wide ving currents.
mental results outlined above will be hese results are not predicted by a model involving a current sink in a resistor. This suggests a careful of the physical phenomena dominating ments as a first step in setting up models to represent them. The re- experiments can readily be explained by using a model which takes into effect of overdrive on nucleation cen- relationship between degree of set . Some simple experiments on slotted her experiments on the core equiva- ced circuits demonstrates the plausi- model.
iding conclusion is that insufficient been given to the effect of initial the behavior of magnetic circuits equivalent.

### 5/2 NOVEL NANOSECOND CIRCUITS USING STORAGE DIODES AS CHARGE TRANSFORMERS AND TUNNEL DIODES AS CHARGE AMPLIFIERS

BRIAN E. SEAR

*Martin Company*
*Baltimore, Maryland*

The storage diode as a current amplifier is described, and the maximum and minimum frequencies of operation given in terms of diode physical parameters. The unique combination of tunnel diode and storage diode is discussed showing the improved gain bandwidth tolerance performance over other high speed circuits to date. Three applications of this new nanosecond technique are described: a general purpose high performance "NOR" "OR" circuit, a simple charge transformer, recirculating register or memory, and a non return to zero shift register. It is shown that practical high gain circuitry is now possible with considerable system flexibility for the logical designer. Finally, details of the packaging problem are outlined for operation at 250 mc/s and 500 mc/s.

### 5/3 A PRECISION SAMPLE AND HOLD CIRCUIT WITH SUBNANOSECOND SWITCHING

J. R. GRAY, S. C. KITSOPOULOS

*Bell Telephone Laboratories, Inc.*
*Murray Hill, New Jersey*

This paper is concerned with the analysis, design, and physical embodiment of a sample and hold circuit for use in a high speed, high performance (9 digit) PCM system. A precision bilateral Lewis gate employing gallium arsenide diodes is at the heart of the circuit. Subnanosecond recovery time, low capacitance ($< 1$ pf), and large forward conductance characterize the gate diodes. Switching of the gate is accomplished at about a 12 Mc sampling rate by a fast driver circuit. To prevent excess current drain from the signal source, the driver switches in a constant current source to dominate charging of the holding capacitor when the difference between the input and held voltages is large. As the input and output signals approach correspondence, RC charging from the signal source predominates.

The approximate dual mode operation of the gate permits a piecewise linear analysis applicable to transmission and switching performance. An equivalent block diagram for the sample and hold circuit is developed that contains linear filters and zero memory nonlinear networks. Nonlinear distortion is evaluated for a bandlimited white noise probe.

To approach an over-all system performance limited largely by quantizing noise, the sample and hold circuit must be designed to introduce minimum signal impairment. This necessitates switching in less than one nanosecond and maintenance of the held waveform flat to within about one part in 5,000. Achievement of these difficult requirements is assured through careful analysis, design, and embodiment and has been verified by experiment.

*(Continued on page 16)*

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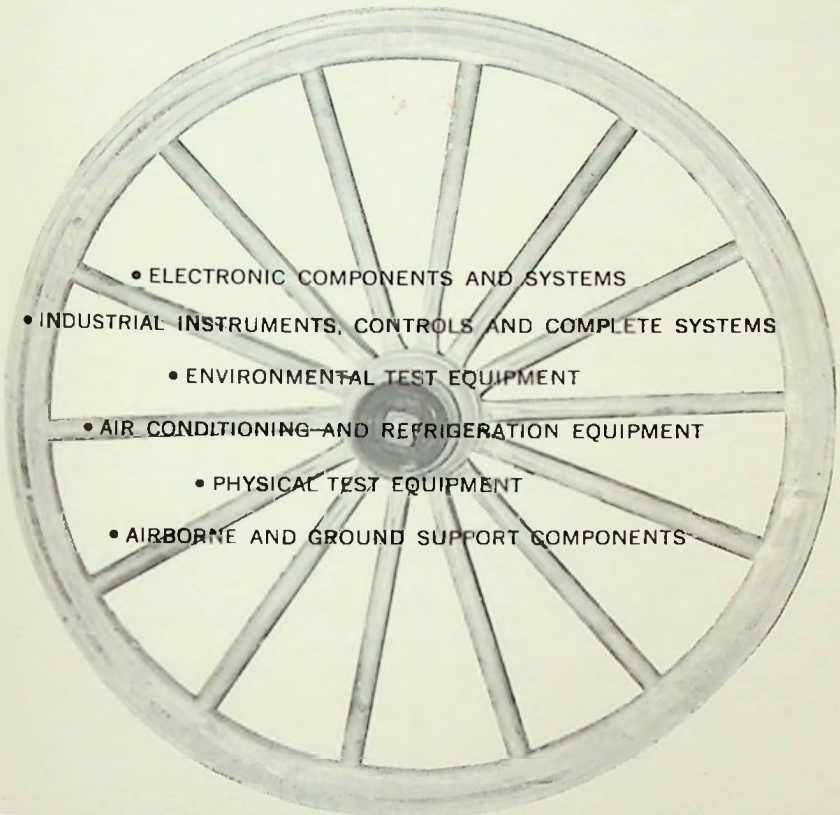


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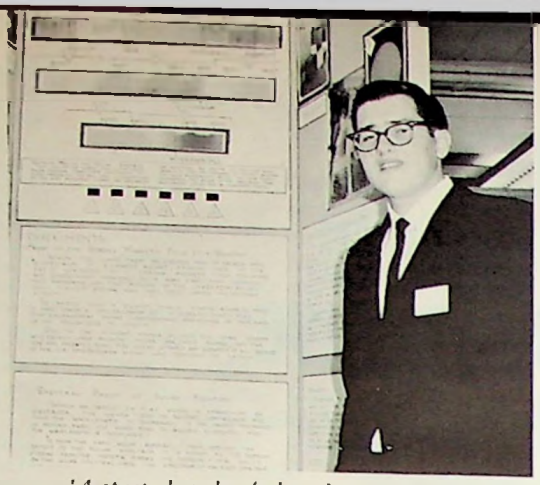
*pendulum'—David Ham- each high school*



*'A spectral study of the solar atmosphere'— Bruce Lites, Highland high school, Albuquerque, N.M.*

**PPLICATION OF DSECOND LOGIC CIRCUITS**

AMISON, T. E. GILLIGAN,

ON

*ughs Corporation Pennsylvania*

objective for these circuits was the of high response speeds by extending ques and employing new techniques hey naturally apply. The choice of pes was also guided by ready avail- ge quantity, and at relatively low circuit application, the components used in their most favorable high- erating regions, and were not to be excessive range or tolerance require-

nfigurations were chosen to combine c operations into functional blocks ssible. This approach lightens the ie interconnecting networks, as com- elementary-building-block technique. multicircuit logic cards are internally d, where possible, rather than through pins. The resultant increase in speed ial efficiency compensates for any nience and standardization.

tional nature of the circuits and ng with the quality required in the iring, demanded an unusually close between the system, electrical, and lesign groups.

## SESSION 6

**LE SYSTEMS — TION AND SIMULATION**

*, August 21, -12:30 P.M. ACE — ROOM A*

airman:

S B. ANGELL

*ford University ford, California*

**ARGE, SELF-CONTAINED RNING MACHINE**

BRAIN, G. E. FORSEN,

HALL, C. A. ROSEN

*'ord Research Institute 'o Park, California*

mental learning machine, primarily pattern recognition, is described. It essentially of two subsystems: anization of adaptive networks con- by logic units, and ical non-adaptive data preprocessor. -adaptive preprocessor, a single im- ally duplicated to form 100 high licas, which can be sampled simultaneously using 100 optical masks and associated electronics to yield 100 binary electrical outputs.

In the adaptive subsystem, one hundred binary inputs are connected via approximately 6600 adaptable analog storage units ("weights") to 66 threshold logic units. From 6 to 9 binary outputs can be formed using majority logic decisions.

### 6/2 DESIGN OF A MAGNETIC VARIABLE-GAIN COMPONENT FOR ADAPTIVE NETWORKS

H. S. CRAFTS

*Stanford Research Institute Menlo Park, California*

A recent development in the field of variable-gain components for adaptive systems, the Second Harmonic Magnetic Variable-Gain Component, is discussed in considerable detail. This component utilizes a pair of tape-wound magnetic cores, which are driven from an RF power source. The output winding is arranged so that the fundamental component of the RF voltage induced in it cancels out, leaving a second-harmonic distortion voltage proportional to the remanent flux in the cores. The remanent flux level can be altered by passing a direct current through the output winding. Due to an interaction between the dc adapt current and the RF drive current, the rate of change of the remanent flux with respect to the adapt current, is quite constant and reversible, thus providing a smoothly variable gain with permanent memory.

Due to the adaption threshold, coincidence of the RF drive and the dc adapt current is required to change the remnant state. Advantage may be taken of this phenomenon to construct a random-access, analog memory plane. This matrix arrangement makes an important contribution toward the reduction of costs for complex adaptive systems. Methods of organizing such systems are also discussed in the concluding section of this article.

### 6/3 INFLUENCE OF COMPONENT IMPERFECTIONS ON PERFORMANCE OF TRAINABLE SYSTEMS

P. R. LOW

*IBM Corporation Poughkeepsie, New York*
*Stanford University Stanford, California*

Numerous investigators have considered the behavior of trainable threshold logic systems using somewhat idealized training procedures. Actual systems built with present-day components seldom implement these training rules. This paper will consider the effect of such component defects on system stability, generalization, and learning time. Experimental results will be presented which indicate that stability and generalization remain relatively unaffected while learning time is generally increased. An analytical technique called the rate vector analysis will be introduced which can be used to provide an estimate of the increase in learning time due to component variations.

*(Continued on page 18)*

on Gas Discharge"; Brian Nelson of Reed School, Tiburon, "Digital Computer."

Also, Tom Norris of Sacramento, "The Pressure of Light"; David O'Neill of Oak Grove Intermediate School, Concord, "The Electron Using Ions to Determine Its Charge"; Robert Reading of Vallejo High, Vallejo, "Ruby Crystallization by the Flame Fusion Process"; Larry Sorensen of Patrick Henry School, Santa Clara, "Can I Bounce and Receive Signals?"; Robert Tkock of Abraham Lincoln High, San Jose, "Van de Graaf Proton Accelerator"; Richard Walton of Fairview Intermediate School, Lafayette, "A Mathematical Machine"; and Robert Woolley of Alameda High, Alameda, "Transistorized Wide - Band Amplifier."

Southern California—James Cooperman and Stephen Thein of Point Loma High, San Diego, "Amplification of Nerve Impulses"; David Hammond of Newport Harbor High, Newport Beach, "The Period of a Pendulum"; David Ladd of Los Angeles, "Morse Code Translator"; John Olson of Santa Clara High, Oxnard, "Infrared Guidance System"; Robert Roseler of Don Bosco Technical High, Los Angeles, "The Electronic Stethoscope"; James Shepherd of John Burroughs Junior High, Los Angeles, "Nuclear Magnetic Resonance"; Michael Simmonds of San Bernardino, "Solving Linear Differential Equations by Digital Computer"; Sheldon Smilo of Horace Ensign School, Newport Beach, "Light Follower"; and Cliff Megerle of Wilshire Junior High School, Fullerton, "The Hum-A-Tron."

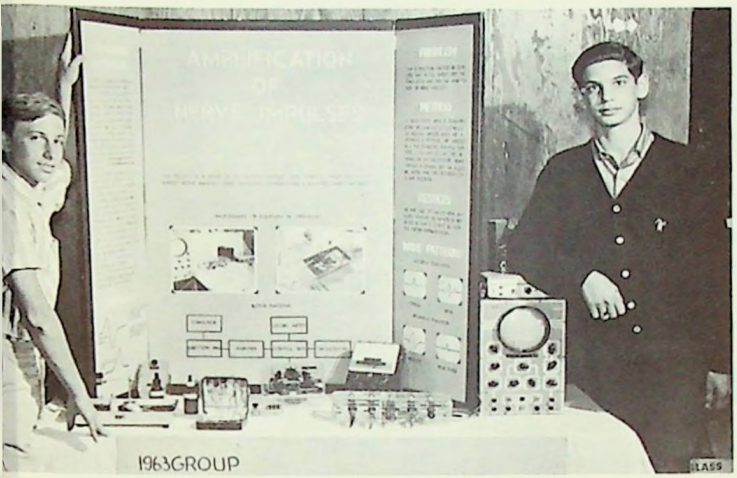
Arizona-New Mexico—Allen Divis of Tucson (no title given); Bruce Lites of Highland High, Albuquerque, "A Spectral Study of the Solar Atmosphere"; Allan Mense of West High, Phoenix, "Plasmatic Radio Blackout"; Ray Roth of Alamogordo High, "Electromagnetic Storage and Reproduction of Photographic Negatives"; and Andrew Smith of Arcadia High, Phoenix (no title given).

Northwest—Thomas Green of McMinnville High, McMinnville, Ore., "Vibration Frequency of the Ammonia Molecule by Microwave Resonance"; and Eric Lindahl of Ballard High, Seattle, Wash., "Magneto Hydrodynamic Propulsion System for Deep Space Probes."

Leigh Gunnell will bring his as yet unnamed project from Sandy, Utah, and Richard Olson will do the same from Cedar Rapids, Iowa.

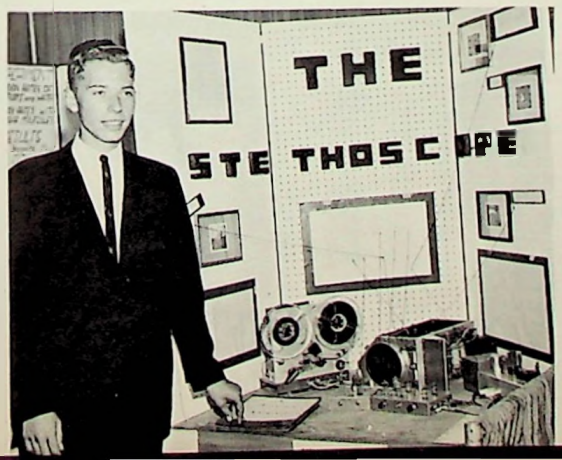
The students will be guests of Wescon during the show and each will receive a $25 United States Savings Bond.


*nfrared guidance stem' — John Ol- n. Santa Clara high hool, Oxnard*




*'Amplification of nerve impulses'—James Cooperman and Stephen Them, Point Loma high school, San Diego*


*'Electromagnetic storage and reproduction of photographic negatives'—Ray Roth, Alamogordo high school*




*be electronic steth- cope' — Robert seler, Don Bosco echnical high hool, San Gabriel*

*region 6*

## ACHIEVEMENT AWARD: D. K. WEAVER

Recognition of unusual initiative in the field of engineering education has been exercised by Region 6 of the IEEE in making its 1963 Electronic Achievement Award.

Dr. Donald K. Weaver, Jr., professor of electrical engineering at Montana State College, Bozeman, has been voted the coveted achievement award "for outstanding service in electrical engineering education" by ballot of the IEEE membership in 11 Western states (including Hawaii and Alaska).

Presentation of the award will be made at the annual banquet concluding the 1963 Western Electronic Show and Convention in San Francisco the week of August 19.

Announcement of Dr. Weaver's selection was made in Phoenix, Ariz., by Dr. Daniel E. Noble of Motorola, Inc., director of Region 6 of the IEEE.

A native of Great Falls, Mont., the 39-year-old Dr. Weaver has Bachelor's, Master's, and Ph.D. degrees in electrical engineering from Stanford University.

His principal fields of professional specialization are network theory, communication theory, and communication systems and components. He holds two U.S. patents (for single-sideband generator modulating negative feedback and for a single-sideband modulator).

*Donald K. Weaver*

During 1948-50 he was a research assistant at Stanford electronics laboratories and from 1950 to 1956 he was a research engineer at Stanford Research Institute, for which he remains a consultant.

Dr. Weaver joined the faculty of Montana State College in 1956. In

*(Continued on page 36)*

### 6/4 PATTERN IDENTIFICATION USING ADAPTIVE LINEAR DECISION FUNCTIONS

J. S. GRIFFIN, JR., J. H. KING, JR., C. J. TUNIS

*IBM Corporation*
*Endicott, New York*

This paper is concerned with the simulation and application of a particular subclass of decision functions, the adaptive linear decision function, to the problem of character recognition. Previous relevant work has been done by Rosenblatt, Widrow, and Highleyman. The present work considers the practical implementation of linear decision functions, and their application to a "real" problem, e.g., the recognition of the ABA E-13 B Magnetic Character Font, taking into account realistic component specifications and tolerances.

The work has been both theoretical and empirical. The theoretical work has resulted in a geometrical description of the effect of component tolerances on various linear decision functions. These effects are related to desirable "reject" regions in measurement space and the substitution reject rates of a particular classifier that may result from attempts to build the "nominal" classifier.

The empirical approach is based on experiments with digital computer programs that simulate various linear decision functions. The simulation experiments fall into two categories: experiments with simulated adaptive linear decision functions; and simulated performance tests on fixed parameter linear decision functions (the parameters having been determined by a previous adaption). Simulation of an adaptive linear decision function provides a means of sequentially synthesizing a fixed parameter system on the basis of a representative sampling of measurements where the class associations are known *a priori*. For the particular problem under study, the simulation programs have allowed the detailed study of the character distributions in measurement space.

## SESSION 7

## MODULATION THEORY AND TECHNIQUES

*Wednesday, August 21,*
*10:00 A.M.-12:30 P.M.*
*COW PALACE — ROOM B*

Session Chairman:

MALCOLM MC WHORTER
*Vidar Corporation*
*Mountain View, California*

### 7/1 A TWO-STATE MODULATION SYSTEM

AMAR G. BOSE

*Massachusetts Institute of Technology*
*Cambridge, Massachusetts*

A modulation system is described that converts a continuous signal into a two-state signal having the property that the modulating signal can be recovered by lowpass filtering. The modulation system combines aspects of frequency and pulsewidth modulation in a manner that enables its realization in terms of a simple closed-loop system having a nonlinear forward path and a linear passive feedback path. Some of the system properties and limitations are developed through an analysis that is independent of any particular circuit realization. Applications to problems of high-efficiency audio power amplification, power regulation and tape recording are presented.

### 7/2 A NEW FM MULTIPLEX SYSTEM FOR PRECISION DATA RECORDING

DALTON MARTIN

*Vidar Corporation*
*Mountain View, California*

This paper describes an FM multiplex system capable of recording 78 channels of 1-2kc continuous data on one 14-track tape recorder. Since frequency translation techniques are used to develop the multiplex several desirable features are provided:

a. All 78 VCO's are identical.
b. All data bandwidths are identical.

A companion playback system is also described. This system provides both analog outputs as well as 10-100 sample/sec digital data.

### 7/3 MAGNETIC FEEDBACK MODULATOR IMPROVES ACCURACY IN FM RECORDING

R. LEE PRICE

*Minnesota Mining & Manufacturing Co.*
*Los Angeles, California*

A new method of applying negative feedback to a square loop core magnetic multivibrator has been developed. Based on Faraday's Law, it is possible to derive a voltage from the magnetic circuit which is a linear function of frequency. This voltage is then used as negative feedback to the DC differential amplifier which drives the magnetic multivibrator. Any frequency errors occurring in the modulator cause a corresponding change in the magnetic feedback voltage. The errors are then reduced in magnitude by the negative feedback. The stability and linearity of this system are improved by at least an order of magnitude over conventional circuits without feedback. Circuit complexity is reduced considerably over previous methods using conventional frequency detectors to derive feedback voltage.

*(Continued on page 20)*

*Griffin*

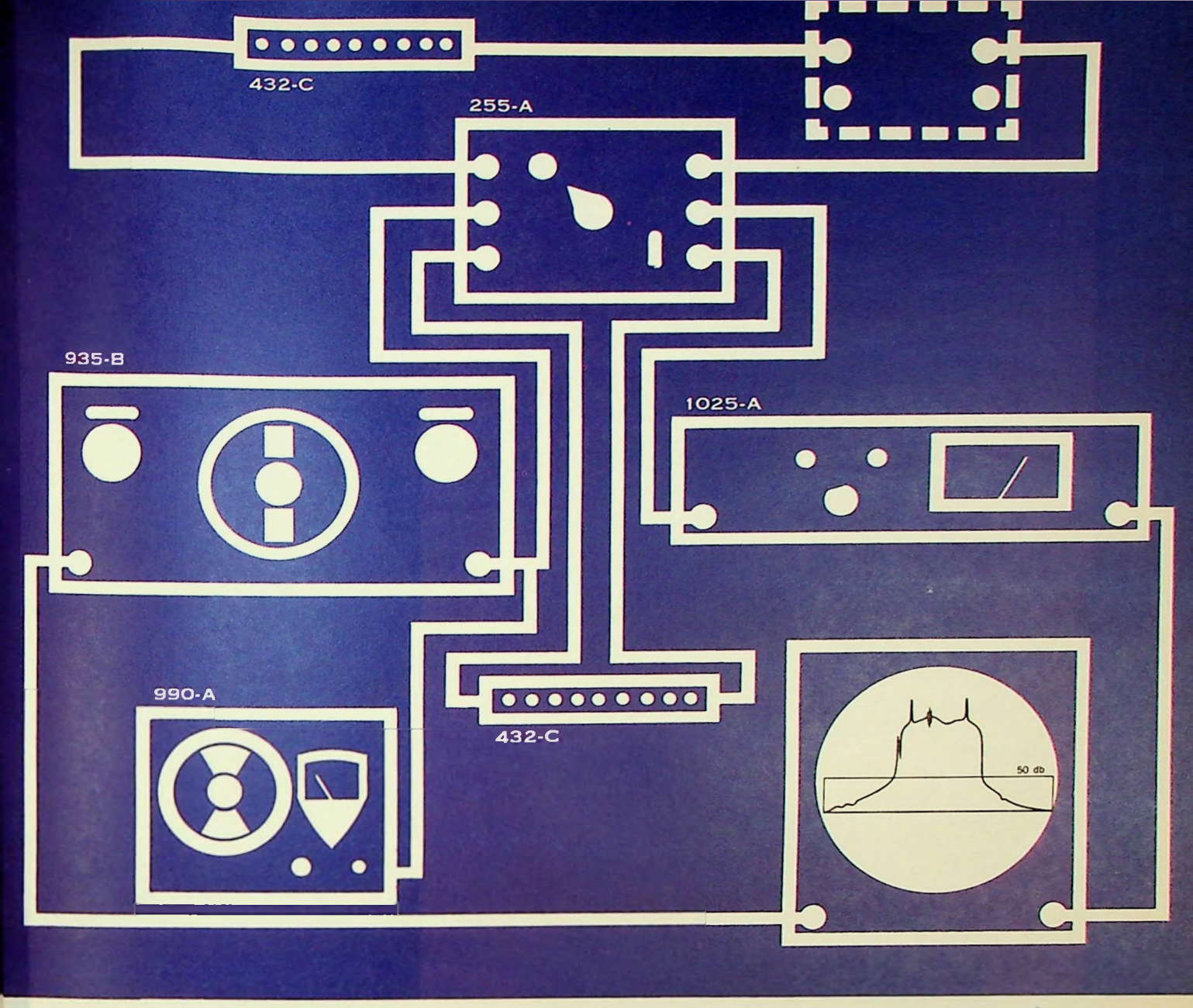
*Tunis*

*McWhorter*

*Martin*

*Price*

*Rowlands*

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## NEW OFFICERS NOMINATED

rence H. Linder, Schenectady, retired vice president of the ral Electric Company, has been nated for the office of president e IEEE. The board of directors nced that his name would head of nominees on a ballot of 1964 rs and directors to be submitted ting members later this year.

rmer president of the American tute of Electrical Engineers h merged with the Institute of o Engineers in January to form the IEEE with a world-wide membership of 150,000. Linder was active in merger negotiations and presently is on the board of directors. He also served as treasurer and as a director of AIEE.

He has managed both engineering and manufacturing operations relating to a wide variety of General Electric products, ranging from heavy apparatus to consumer goods. In 1951 he became general manager of the company's activities in the large-appliance field. He was elected vice president in 1953. From 1953 through 1959 he was vice president, engineering.

In 1960, he became vice president and group executive, electric utilities group. In this office he was responsible for those General Electric business components whose prime business is to serve the electrical utilities field. He retired in early 1963.

He is a fellow of IEEE and served as past president of AIEE, member of the board of directors, member of the executive committee, the Edison Medal committee, and the John Fritz Medal board. He was president of United Engineering Trustees, Inc.

*(Continued on page 22)*

*Alberts*

*Moore*

*Pepper*

*Lesk*

*Loebner*

*Galindo*

*Luecke*

*Platzek*

*Ayer*

*Kino*

## SIGNALS TAILORED TO CIFIC SONAR AND RADAR UIREMENTS

ARD O. ROWLANDS
*sylvania State University*
*ersity Park, Pennsylvania*

r reviews the various types of signals ar and radar and discusses their limitaconflicting requirements are: 1) the of being able to discriminate between jects and moving targets, and 2) that e to detect the Doppler shifted echoes inimum number of matched filters. m noise and Doppler invariant FM reme examples of signals which respecthe first and second of these requireing with an FM signal in which the s frequency is given by $f=kt^{\alpha}$, it is the values of K and $\alpha$ may be chosen to legree of compromise between Doppler nd moving target indication.

## SESSION 8

## NDUCTOR LECTRONICS

*y, August 21,*
*1.-12:30 P.M.*
*LACE – ROOM C*

hairman:
HARD ALBERTS
*ight Air Development Center*
*yton, Ohio*

mbers:
DON MOORE
*rchild Semiconductor*
*o Alto, California*

ERT PEPPER
*iversity of California*
*keley, California*

. LESK
*torola Inc.*
*oenix, Arizona*

NK AUBIN
*borne Instrument Laboratories*
*g Island, New York*

E. LOEBNER
*wlett-Packard Associates*
*o Alto, California*

## EMETRY ENCODER

. GALINDO, G. ANTLE
*as Instruments*
*las, Texas*

This paper will describe the system performance of a molecular electronic 21-channel PCM Telemetry Encoder. Particular emphasis will be placed on the cyclic analog to digital conversion technique. Implementation of this technique will be discussed in some detail. In addition, the special integrated circuits which were developed for this specific application will be described. The system problems, possible solutions, and the solution which Texas Instruments chose will be discussed. This will include the application of special integrated circuits to show specifically their function in solving the system problems.

### 8/2 MICROELECTRONICS AND MINUTEMAN

RICHARD PLATZEK
*North American Aviation*
*Downey, California*

Background studies in microelectronics at Autonetics are presented and related concepts proposed for incorporation in the Improved MINUTEMAN guidance and control system are discussed, including factors influencing the adoption of these concepts.

The hardware design of the central guidance and control computer for the Improved MINUTEMAN is presented from the microelectronics point of view, as well as specific integrated circuit mechanizations of guidance and flight control analog circuitry.

### 8/3 INTEGRATED CIRCUIT PACKAGING AND INTERCONNECTION

W. H. AYER, T. E. KIRCHNER
*Sippican Corporation*
*Marion, Massachusetts*

The semiconductor industry has given the electronic systems engineer the integrated circuit to meet his requirements for increased system capability and reliability in a smaller package. To take advantage of this, parallel strides must be made in the efficient packaging and interconnection of these new devices. This paper will concentrate on the evolution of a high density packaging technique that is consistent with the size and reliability of the integrated circuits. In the course of this development effort several packaging approaches were investigated; these will be discussed in terms of their merits and deficiencies.

## SESSION 9

## PLASMAS

*Wednesday, August 21,*
*10:00 A.M.-12:30 P.M.*
*COW PALACE – ROOM D*

Session Chairman:
GORDON S. KINO
*Stanford University*
*Stanford, California*

*(Continued on page 24)*

# EIMAC

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# MICROWAVE TUBE ENGINEERING

Continuing growth of Eimac's Microwave activity has resulted from demand for Eimac's new products in communications, missile and space activity, and ordnance. Projects on new developmental tubes and associated equipment make necessary additions to our engineering staff. These positions are immediately available:

### RELIABILITY ENGINEER

Will be responsible for establishing and monitoring the reliability aspects of microwave tube programs, life testing programs and failure analysis. BSEE, BSIE or Mathematics required, with specific experience in test program administration, working knowledge of statistics with Normal, Poisson and Weibull distributions.

### TWT DEVELOPMENT ENGINEERS

Position currently open will require recent experience in developing pulse or c-w TWT's. Assignments will be on significant new development work currently under way. Requires BSEE or Physics degree, and ability rapidly to assume greater responsibility.

### QUALITY CONTROL ENGINEER

To establish and monitor quality control criteria on small microwave tubes, parts, and sub-assemblies, control of all QC records, cognizance of environmental and electronic test equipment. Requires BSEE or BSIE with directly related microwave tube experience, and knowledge of statistics as applied to QC activity.

### PHYSICIST

For work on processes in support of high reliability tube projects. Will develop new vacuum equipment for microwave tube processing, incorporating mass spectrometers. Experience should incorporate development work in the areas of physics, vacuum tube processing, and mass spectrometry. Requires minimum of BS Physics or Chemistry.

### TEST ENGINEER

Will be responsible for establishing test specifications and test procedures on major projects, including equipment design. Experience in RF and environmental testing necessary, preferably with TWT's. BSEE required.

### SENIOR PRODUCTION ENGINEER

To develop and incorporate new or improved production techniques with emphasis on transition of tubes from development to production. Extensive experience with yield problems, RF test, fabrication technique and cost reduction is necessary, preferably on high power microwave tubes. BSME required.

Successful candidates for these positions will be associated with technical staff members noted in the industry. Eimac's engineering activity is organized in small groups for technical effectiveness and recognition of individual accomplishment. They will work with the latest of equipment in modern facilities.

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*Clarence H. Linder*

(1962-63); a member of the board of trustees, chairman of the executive committee; a member of the finance committee, the real estate committee, the engineering societies library board and engineering foundation, the latter activities leading to successful completion of the United Engineering Center, now housing many society headquarters, including a portion of IEEE headquarters staff and facilities.

Walter E. Peterson, president of the Automation Development Corp., Los Angeles, was nominated to be vice president of IEEE. He also is a member of the IEEE board of directors and has been chairman of the IRE Los Angeles Section and of the Wescon

*Walter E. Peterson*

board of directors. Peterson was born in Los Angeles in 1921 and was graduated from the University of California in 1943 with a B.S. degree in electrical engineering.

Two directors-at-large each will be elected for the one-year, two-year, and three-year terms.

Candidates for directors-at-large

*(Continued on page 26)*

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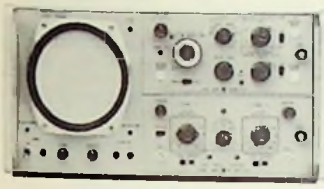

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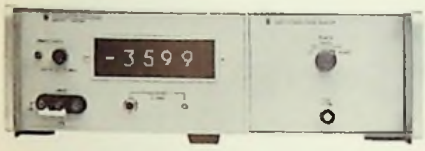


**INTRODUCING 3440A DIGITAL VOLTMETER** with plug-in versatility. The compact, solid state 3440A provides visual and electrical four-digit readout, offers 0.05% accuracy, 10.2 megohm input impedance. $1160, without plug-ins.

SEE 200 WATT PULSES from the new 214A Pulse Generator. Big, clean 100 v pulses, positive or negative, into 50 ohms!

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INTRODUCING the new solid state 208A Test Oscillator; adjustable calibrated output into 600 ohms, 5 $\mu$v to 2.5 v, 5 cps to 560 kc!

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## POWER PTG FORMED

The Power division of the IEEE has roved recommendations of an ad committee to reorganize into a er professional technical group. A. Woodrow, General Electric Co., enectady, N.Y., chairman of the ision, has announced.

t is expected that the committee on ofessional technical groups and the ecutive committee will approve the ommendation in the fall, and the w power group will be implemented the year's end, Woodrow said.

In the reorganization move, the wer division's 12 technical committees and 97 subcommittees, now a rt of the technical operations committee, will become a single professional technical group with scope and nctions essentially the same as those eviously covered in the technical erations department of the AIEE nd the technical operations department of IEEE.

The PTG form of organization will rovide an opportunity for direct participation by some 30,000 members nown to have technical interests ithin the Power division scope, Woodrow pointed out.

The new power group will embrace planning, research, development, design, application, construction, installation, and operation of apparatus, quipment, structures, and systems for he safe and economic generation, ransmission, distribution, conversion, nd control of electrical energy primarily for industrial, commercial, or esidential use; and shall include cientific, technical, industrial, and ther activities that contribute to this eld, or utilize the techniques or products of this field, subject, as the art develops, to additions, subtractions, or other modifications, directed or approved by the IEEE committee on professional technical groups. . . . "

L. F. Kennedy, General Electric Company, Schenectady, N.Y., was chairman of the ad hoc committee. Other members were W. A. Lewis, professor of electrical engineering, Illinois Institute of Technology, Chicago, and J. R. Linders, Cleveland Electric Illuminating Company.

The chairman of the Power division was authorized to nominate members of the initial power professional technical group administrative committee, subject to the approval of the IEEE committee on professional technical groups.

The ad hoc committee, which reported to the Power division meeting at Toronto during the summer meeting of IEEE, recommended that as a professional technical group it would have full authority within its scope to carry on its program of meetings, symposiums, conferences, studies, and publications; to initiate and write standards; and in general to manage and conduct its affairs under the gen-

*(Continued on page 26)*

*Swan*

*Kino*

*Stauffer*

*Eckhardt*

### 9/1 GENERATION OF HARMONICS IN A MICROWAVE DISCHARGE HAVING A LARGE ELECTRIC FIELD GRADIENT

C. B. SWAN

*Bell Telephone Laboratories, Inc.*
*Murray Hill, New Jersey*

The efficiency of the electrodeless microwave gas discharge harmonic generator has been exceeded only by the varactor diode. The average power capability of the gas discharge, however, is one to two orders of magnitude greater. Experiments have demonstrated that high efficiency requires a large electric field gradient in the discharge. This effect has been analyzed for a cylindrical geometry with radial RF electric fields and computed results are given. The analysis shows that under special conditions this mechanism can account for the high efficiencies observed and, furthermore, it appears that these conditions can be achieved at millimeter wavelengths.

The operation of the experimental gas discharge harmonic generator is described and problems anticipated in achieving the required conditions at millimeter wavelengths are discussed.

### 9/2 HARMONIC GENERATION AND PARAMETRIC OSCILLATIONS IN A PLASMA DISCHARGE

J. H. KRENZ, G. S. KINO

*Stanford University*
*Stanford, California*

It has been well known, for some time, that an rf discharge emits hormonics of the driving frequency. Recently, it has been observed by us, as well as Swan, that in a small spherically shaped rf discharge at low pressure, conversion efficiencies to the second harmonic of the order of 25 per cent can be observed. Such results rule out a resistive type mechanism due to the change of the elastic collision frequency with velocity. This was suggested in the past as the source of this harmonic output.

We have also observed efficient harmonic generation to higher order harmonics. We have carried out a theory based on reactive effects due to spatial variations of density and field which yields good agreement with our experimental results.

We have found that there is an optimum input power for maximum output of a particular harmonic. This corresponds to a power sufficient to give plasma density for which the plasma has an electrostatic resonance at the harmonic of interest. Such a resonance is analogous to the magnetostatic one used in ferrite parametric amplifiers and harmonic generators. We nave shown, in addition, that with the resonant frequency at half the driving frequency, parametric oscillations occur. As far as we are aware, this is the first time that parametric oscillations in a plasma have been observed. Both the high efficiencies and the presence of the parametric oscillation indicate that the nonlinear mechanism must be reactive in nature.

In general, neither the rf electric field, nor the plasma density is uniform over the volume of the plasma. If there are spatial variations of the rf electric field over the path of an electron moving in the field, the electrons are no longer exposed to a purely sinusoidal time dependent field and thus, their motion is not sinusoidal. Also, if there is a spatial variation of plasma density there will be an rf variation of charge density even a uniform rf field. Both effects may give rise harmonic components of current. The rf density variation is, however, mainly respon for the parametric oscillations which we observed. The theory will be described and will be included a calculation of effects o the presence of a dc magnetic field. We found that if the rf electric field is held at resonance at the cyclotron frequency of h output power is to be expected. However, constant input power no resonance of the power would be expected theoretically or been observed experimentally.

We have obtained good agreement betwee theory and the experimental results for s harmonic generation. The calculations fo higher harmonics, however, require a more tailed knowledge of the plasma sheath regio is available at present.

### 9/3 MODULATED PLASMA ELECTRON BEAM

L. H. STAUFFER

*General Electric Company*
*Schenectady, New York*

Techniques have been developed for pro electron beams of two amperes or more, f plasma within a hollow cathode. Electron energies of 20 kilovolts are readily obtain power densities of the order of 10,000 k per square inch can be obtained with the auxiliary electromagnetic focusing. An atmosphere of a few microns pressure is use initiate and maintain the beam.

Beam intensity increases with both gas p and cathode potential but may be contro varying the potential of an internal elec Under constant pressure and cathode po the beam intensity may be varied over a range by adjusting the potential of the control electrode.

The effect of cathode design on the volt characteristics of the beam and the desi control electrodes are described. Also perfor data on both helium and argon is presen tentative theory of the origin of the electron of beam formation is proposed.

Application to vacuum metallurgy and to tron beam welding are described and illus by photographs.

### 9/4 RECENT ADVANCES IN THE PHYSICS OF ION EXTRACTIO FROM PLASMAS

W. O. ECKHARDT

*Hughes Research Laboratories*
*Malibu, California*

The requirement for generating inte beams, to be used for electric propulsion of vehicles, has prompted considerable resea forts aimed at a better understanding physics of ion extraction from plasmas.

In this paper, several different extraction nisms will be described, and the results of retical and experimental investigations physical phenomena connected with these nisms will be discussed.

The emphasis will be on problems of formation in the cases of ion extractio electron-bombardment plasmas and (thermal) plasmas, using either electrod nated extraction fields or extraction fields by the space charge of an electron beam.

*(Continued on page 28)*

# Systems test engineers for airborne weapon systems

## MISSILE SYSTEM TEST AND EVALUATION

**Responsibilities:** The planning, performance, and evaluation of data resulting from laboratory functional and environmental evaluation and testing of missile systems; the coordination and integration of systems tests with test programs on individual units of the missile system; the engineering solution of design problems arising from the evaluation effort.

**Experience:** One year or more in one or more of the following fields: System evaluation and test and environmental testing; system engineering involving missile or fire control systems; field engineering on missile or fire control systems; flight testing of missile or fire control systems; radar systems, particularly pulse doppler, electrical power and armament control subsystems, fuze systems, autopilot and control systems and target tracking systems; microwave components and circuit design.

**Academic Background:** A degree from an accredited university—B.S. in E.E., M.E. or Physics. U. S. citizenship required.

## FIRE CONTROL SYSTEM TEST AND EVALUATION

**Responsibilities:** The planning, performance and evaluation of data resulting from laboratory functional evaluation and testing of complex advanced fire control systems; the engineering solution of design problems arising from the evaluation effort.

**Experience:** One year or more in one or more of the following fields: System evaluation and test; system engineering involving missile or fire control systems; field engineering on missile or fire control systems; flight testing of missile or fire control systems; radar systems, particularly pulse doppler; microwave components; circuit design; electrical power subsystems; target tracking systems; digital computers, particularly airborne systems; analog computers; inertial components; infrared detection and track systems; aircraft displays and controls; navigation systems.

**Academic requirements:** B.S. in M.E., E.E., or Physics degree from an accredited university. U. S. citizenship required.

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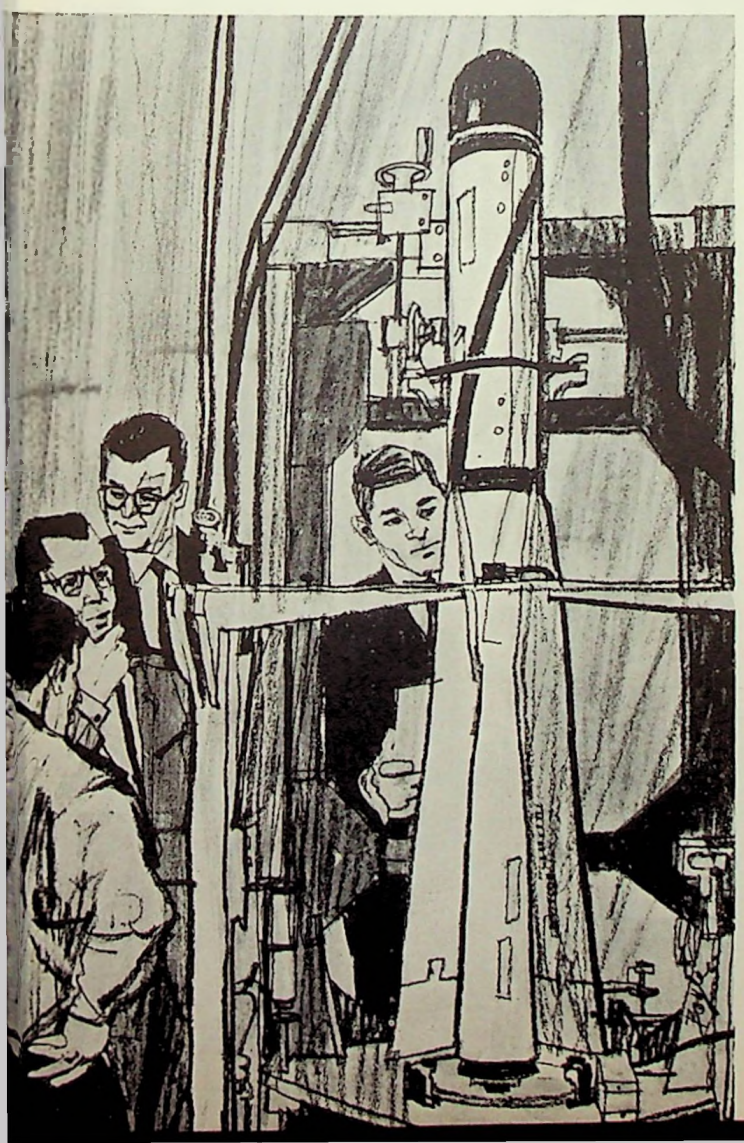
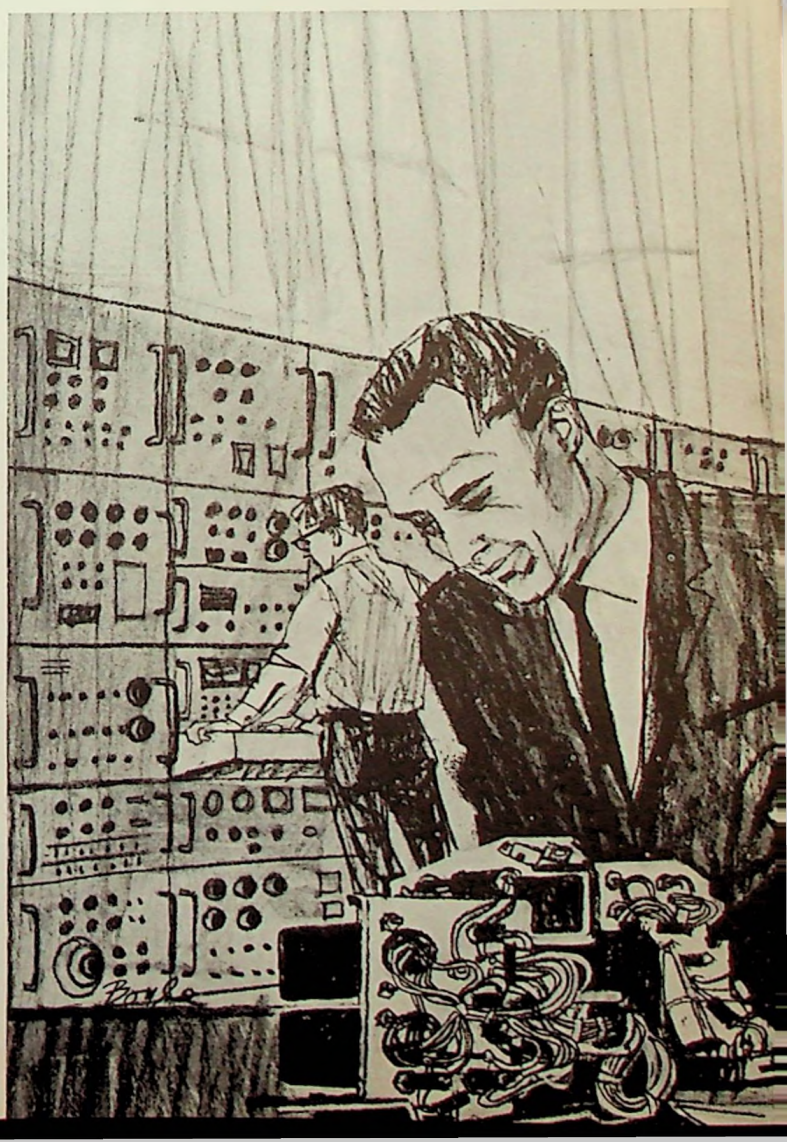




MORE OFFICERS

are (one-year term): John H. Chapman, Defense Research Board, Ottawa, Canada; Frank A. Jenkins, assistant transmission engineer, Duke Power Co., Charlotte, N.C.; Dr. William G. Shepherd, professor and head of electrical engineering, University of Minnesota, Minneapolis; Eugene C. Starr, consultant, Bonneville Power Administration, Portland, Ore.

Two-year term: Bradley Cozzens, assistant chief electrical engineer, Los Angeles Department of Water and Power; Dr. Seymour W. Herwald, vice president, Westinghouse Electric Corp., Pittsburgh, Pa.; Walter K. MacAdam, vice president, American Telephone and Telegraph Co., New York; Dr. George Sinclair, professor, University of Toronto and president of Sinclair Radio Laboratories, Ltd., Toronto.

Three-year term: Dr. Pier A. Abetti, General Electric Co., Schenectady, N.Y.; Dr. Thomas F. Jones, Jr., president, University of South Carolina, Columbia; Dr. Richard L. Petritz, director, Semiconductor Research & Development Laboratory, Texas Instruments, Inc., Dallas; Dr. F. Karl Willenbrock, associate dean of engineering and applied physics, Harvard University, Cambridge, Mass.

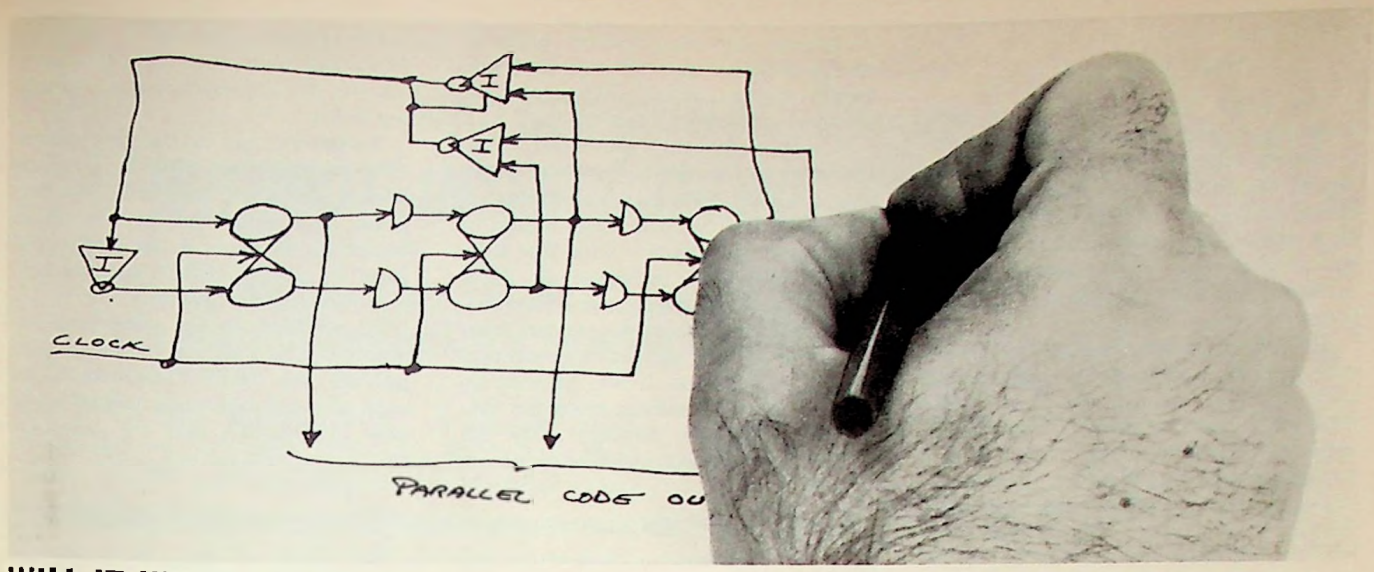
Nineteen regional directors were nominated, one to be elected by each region. Nominated to serve one year as Region 6 director are: Bruce S. Angwin, manager, Western Region, receiving tube department, General Electric Co., Los Angeles, and Robert W. Illman, systems technology manager, military aircraft systems division, The Boeing Co., Seattle, one of whom will be elected by vote of IEEE members within Region 6.

Ballots will be mailed out to the membership in August and the results of the mail vote will be announced in November.

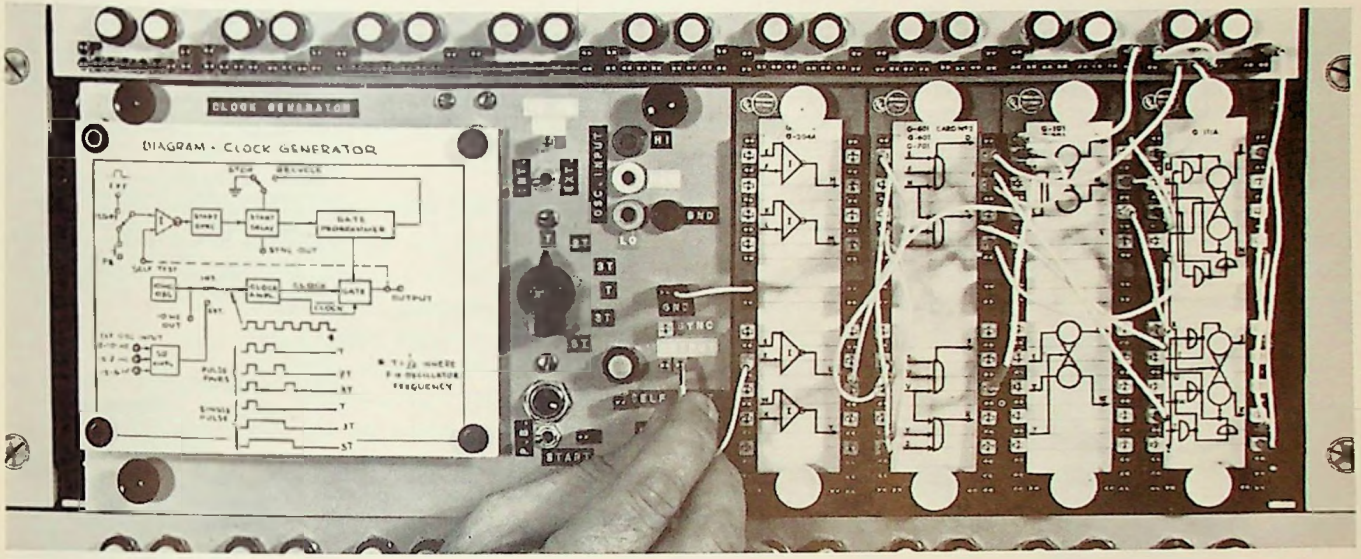
By virtue of being past presidents, Dr. Ernst Weber, president of Polytechnic Institute of Brooklyn; Warren H. Chase, director of commerce, State of Ohio, and retired vice president, Ohio Bell Telephone Company; and Patrick E. Haggerty, president of Texas Instruments, Inc., Dallas, will automatically be on the 1964 board of directors of IEEE. Dr. Weber will become junior past president, and Mr. Chase and Mr. Haggerty, senior past presidents. The three were active in the merger plans.

MORE POWER

eral policies of the IEEE and within its own technical scope and financial budget.




# WILL IT WORK AT 10 MC?

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This versatile transistor equipment lets you patch up trial circuit combinations with the same catalog modules that go into the final system, perform tests at operating frequencies by pushing a button on the control panel, and get a "stop-action" look at the over-all logic flow.

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## "IEEE SPECTRUM"

The IEEE has announced a new long-range publications program designed to advance the technical abilities of the society's 150,000 members. Heart of the plan is the inauguration of a major new publication to serve the engineering and scientific community and the interested public at large.

Effective January, 1964, the IEEE will publish two monthly periodicals. One will be a totally new "core" publication, titled "IEEE Spectrum," which will be distributed to all IEEE members, except student members. Its primary editorial mission will be to present technical articles of high professional quality written so as to be meaningful to a wide audience. The subject matter will cover the entire spectrum of electrical and electronics engineering. Special emphasis will be placed on the clarity of the articles—both staff-written and contributed by leading authorities in the field—to insure that members can grasp and keep abreast of important technical developments outside their own particular fields of specialization.

The "IEEE Spectrum" will include review, tutorial, and application papers; occasional theoretical papers of outstanding significance; news of the profession and of the institute; letters to the editor; abstracts; book reviews; and other departments.

A second monthly periodical, "Proceedings of the IEEE," will be available to members and nonmembers on a subscription basis. A continuation of the present publication with that title, but expanded to embrace all fields served by the IEEE, the "Proceedings" will be a research-oriented journal for advanced papers of broad and lasting significance. It will provide an avenue for introducing scientific discoveries and new concepts into the electrical and electronics engineering field. Special issues will be published from time to time to lay a foundation for the development of newly emerging fields.

Announcement of the new publications program was made by Dr. Ernst Weber, president of IEEE. The program was approved by the IEEE board of directors at its meeting on June 21 during IEEE's summer general meeting in Toronto.

In addition to the periodicals announced, the institute will continue to publish the IEEE Transactions" in each of a number of specialized fields, now totaling 33, that are served by

*(Continued on page 32)*

*Damonte*

*Andreasen*

*Hennessey*

*Tai*

*Cheng*

## SESSION 10

### ANTENNA ARRAYS I

*Wednesday, August 21,*
*10:00 A.M.-12:30 P.M*
*COW PALACE — ROOM E*

Session Chairman:

JOHN B. DAMONTE
*Dalmo Victor Company*
*Belmont, California*

Panel Members:

MOGENS ANDREASEN
*TRG-West*
*Menlo Park, California*

FRANK HENNESSEY
*Dalmo Victor Company*
*Belmont, California*

CHEN T. TAI
*Ohio State University*
*Columbus, Ohio*

### 10/1 APPLICATION OF PERTURBATION TECHNIQUES TO SIDELOBE REDUCTION OF TAPERED AMPLITUDE ARRAYS AND SURFACE WAVE STRUCTURES

DOMINICK J. CERMIGNANI
*Grumman Aircraft Engineering Corporation*
*Bethpage, L.I., New York*

In 1960, R. F. Harrington of Syracuse University introduced a perturbation method pertaining to sidelobe reduction of isotropic linear antenna arrays. In this paper the technique is modified and extended to two further applications: 1) a controlled sidelobe level improvement of Dolph-Tschebyscheff optimized broadside antenna arrays by perturbing the array factor element spacings non-uniformly, and 2) controlled sidelobe reduction of a surface wave antenna consisting of an end-fire array of small conducting rods embedded in a semi-infinite dielectric panel by perturbing the surface wave phase velocity non-uniformly. Both the techniques discussed do not increase the half-power beamwidths of the subject antenna patterns nor significantly increase the physical antenna size; in fact, no increase in size is introduced in the surface wave antenna.

### 10/2 UNEQUALLY SPACED ARRAYS FED FROM TRAVELING WAVE SOURCES

A. ISHIMARU, J. N. LAHTI
*University of Washington*
*Seattle, Washington*

This paper presents a method of synthesizing desired radiation pattern by means of unequa spaced array fed from a travelling wave sour The theory of unequally spaced arrays develop recently by one of the authors is employed to det mine the source distribution. The phase modulati of the aperture field is chosen and the method stationary phase is employed to evaluate integral.

Next, the problem of physically realizing source distribution is investigated. It is then sho that the resultant source amplitude expression d pends upon the source position function. A gene differential equation for the source position funct is developed and the solution determines uniqu the source amplitude and the source positi function.

Results of experimental work are included to su stantiate the theory. The "cosecant squared patter is chosen as the desired pattern. The phase modu tion is achieved by varying the H-plane dimensi of a rectangular waveguide in a programmed tape The amplitude modulation is achieved by the vari tion of the element spacing. The experimental re sults are shown to agree very well with theoretic predictions.

### 10/3 A SYNTHESIS TECHNIQUE FOR LINEAR ARRAYS WITH WIDE-BAND ELEMENTS

F. I. TSENG, DAVID K. CHENG
*Syracuse University*
*Syracuse, New York*

This paper presents a new technique for synthe sizing linear arrays with wide-band elements. will be shown that, by using unequal element spac ings and a matched filter, these arrays will consi of a less number of elements and have smal overall dimensions than conventional arrays for th same performance. An example will be include which shows that, for a 20 percent bandwidth, a array with 16 elements and a total length of 18.3 can yield a pattern with 2.06° beamwidth and db sidelobes. This compares with the single-fr quency, equispace, Dolph-Chebyshev array of elements with half-wavelength spacing (arra length = 32.5λ) for similar performance.

### 10/4 NON-UNIFORM TWO DIMENSIONAL SCANNING ARRAYS

ROBERT F. TIGHE
*University of Washington*
*Seattle, Washington*

There has been considerable recent interest non-uniformly spiral antenna arrays as a means obtaining desired radiation patterns with reduc numbers of elements. This paper extends recen work on non-uniformly spaced linear arrays to two dimensional scanning case. A method is giv for achieving desired beamwidth, sidelobe lev and scan angle, by employing non-uniformly spac concentric ring arrays. A procedure is develop by which the exact locations of the concentric ri may be calculated. It is shown that a spectacu reduction in the number of radiators is possible w this method, as compared to the conventional t dimensional uniform array.

*(Continued on page 30)*

# *Microcircuitry...*
# *WITHOUT INTERCOUPLING PROBLEMS!*

### GI MULTICHIPS: The Advantages of Packaged Circuitry— The HIGH-FREQUENCY PERFORMANCE of Discrete Components

THE FAMILIAR "MONOLITHIC" or fully-integrated microcircuit has been—and, of course, still is—the ideal solution to many problems of reliability, miniaturization, switching time, performance and cost.

BUT, as we all know, the applicability of monolithic ICP's is far from universal. There are many circuits in which they are technically *not* suitable—not, at least, in the present state-of-the-art.

ONE OF THE MAJOR problems is parasitic *intercoupling* between component elements. Since all these elements share a single *common* substrate, some intercoupling is virtually inevitable...and can seriously limit high-frequency performance.

### How to Have Your Cake—and Eat It, Too!

SUCH CONSIDERATIONS need not, of course, cause you to fall back on conventional circuitry or to abandon the very tangible advantages of ICP's. Increasingly, design engineers are relying on GI's highly developed technology of *multichip*, interface circuitry. General Instrument multichip ICP's give you all the major advantages of monoliths in essentially the same degree ...plus component *isolation* that closely approaches that of conventional, discrete elements on a conventional, much-bulkier circuit board. And many *other* advantages, as well!

Typical example of multichip circuits: General Instrument NAND-Gate on TO-5 header

GENERAL INSTRUMENT MULTICHIP components are batch-manufactured on individual wafers or substrates by the same techniques as we use for monolithic circuits—but each silicon wafer contains *identical* components, which are later diced apart and assembled into "custom-designed" multichip assemblies to your design. This means each subtrate can be specifically optimized for *one* component—resistor, capacitor, transistor, or other element. In a monolith, obviously, the common subtrate must be a *compromise* between the parameter's ideal for one component, and those ideal for the others...and this, too, may limit the performance of each individual device, especially at extremely high frequencies.

### ...Plus Freedom of Design, at Low Cost!

EVEN WHERE "standard" circuitry is involved, however, many engineers sometimes prefer to design minor modifications in order to obtain performance which is not merely "adequate" but definitely superior in terms of some specific, overall objective. Here, again, it may well pay you to investigate General Instrument's facilities for interface microcircuitry. The multichip technique allows you to specify virtually any arrangement of components of any values obtainable by microcircuit techniques...at a total tooling-up cost, usually, of only a few hundred dollars compared with the thousands required for a fully integrated monolith created to your own specs.

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NATURALLY, there are many borderline cases where it may be difficult to decide between a standardized, fully integrated monolith and a partially integrated, custom-built multichip. In such cases, we suggest you call on General Instrument's broad experience for advice. We manufacture *both* types, and are not biased in favor of either.

THIS ADVERTISEMENT, of course, barely scratches the surface of the subject of multichips. We have available considerable data on the subject—data you should find interesting and helpful. A note to Jerry Fishel at the address below will bring it to you by return mail.

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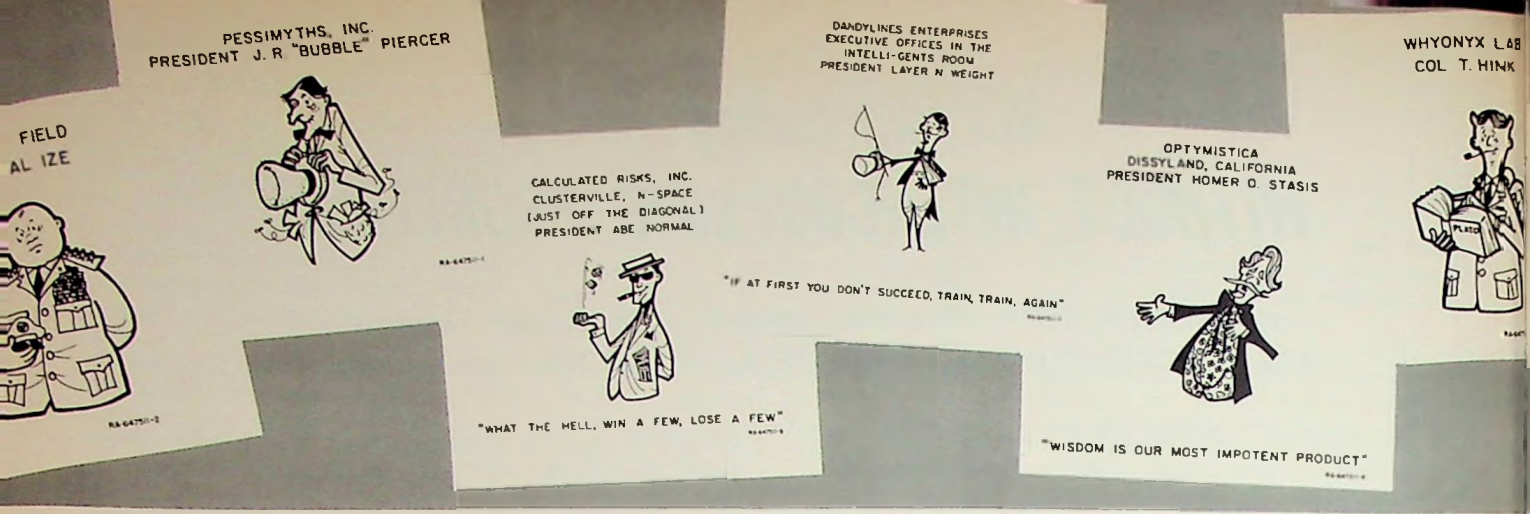


*fein's fable*


*Fein*


*Rosenblatt*


*Talbert*


*Groner*


*Smith*


*Hu*


*Widrow*


*Specht*

## SESSION 11

### TRAINABLE SYSTEMS — THEORY AND APPLICATIONS

*Thursday, August 22,*
*10:00 A.M.-12:30 P.M.*
*COW PALACE — ROOM A*

Session Chairman:

NILS NILSSON
*Stanford Research Institute*
*Menlo Park, California*

### 11/1 THE ARTIFICIAL INTELLIGENTSIA

LOUIS FEIN
*Palo Alto, California*

This paper describes and reviews, compares, contrasts and assesses, three classes of information processors intended for performing, and for learning to improve their performance on, certatin "intellectual" tasks hitherto exclusively entrusted to animate organisms. These tasks include predicting weather, classifying graphical patterns, playing games, proving theorems, diagnosing diseases, and reading handwritten characters. In particular, design methods and philosophies, learning and operational modes, and processor effectiveness and improvement rates will be considered. The designers of such processors may not know beforehand

1) whether the tasks can be successfully learned and performed, in principle, by such processors, or if they can, in principle, be learned and performed successfully,
2) whether there are any practical and efficient processors for performing such tasks and for improving their performance; and, if there are such,
3) what the processors are.

One class of processor, of which a perceptron is an example, is ordinarily in practice, a concurrently operating, combinational circuit of M inputs and N outputs built of threshold logic units and weights; the threshold logic units and weights are considered by some to be rough approximations to neurons of biological brains and nervous systems.

The second class of processor is ordinarily, in practice, a heuristic program running on a predesigned, sequentially-operating structure built of gates and stores as in a digital computer.

The third class of processor, heretofore infrequently implemented, of which statistical-decision theory is a model, may be a concurrently-operating, combinational circuit of M inputs and N outputs built of squarers, summers, maxima detectors and weights or alternatively simulated by a program on a digital computer.

To highlight the similarities and differences of these schools of thought, we will pretend that a sponsor lets out for bid to various companies, the design of processors or programs to perform certain cognitive tasks. Each company writes a proposal. All proposals are evaluated technically. The paper itself will consist of the request to bid, the proposals, and the technical evaluation.

### 11/2 SIMULATION STUDIES OF FOUR-LAYER AND CROSS-COUPLED PERCEPTRONS

FRANK ROSENBLATT
*Cornell University*
*Ithaca, New York*

In previous work on perceptron theory it h been demonstrated that adaptive four-layer p ceptrons and cross-coupled perceptrons could gra ually improve their generalizing capabilities, as result of prolonged exposure to an environme in which stimuli were more likely to be follow in a temporal sequence, by "similar" than by "d similar" stimuli. It has also been demonstrated th fixed networks could be constructed in wh similarity generalization is effectively "built i as a basic property of the system.

A number of simulation experiments have n been completed which were designed to compa the performance of these different types of ne works and training methods. The main conclusion are that a four-layer similarity-constrained pe ceptron (with a fixed preterminal network) pe forms considerably better than an adaptive fou layer model or cross-coupled perceptron, the lat systems may have an advantage, however, in en vironments where the similarity transformation are likely to take a complicated form, or are n known in advance.

### 11/3 AN ADAPTIVE PREDICTION TECHNIQUE AND ITS APPLICATION TO WEATHER FORECASTING

RICHARD O. DUDA, JACK W. MACHAN
*Stanford Research Institute*
*Menlo Park, California*

A prediction technique is described which us a trainable machine built of threshold logic un having adjustable weights. The inputs to the ma chine are coded versions of the predictors, and th output is the coded predictand. The machine i trained by iteratively adjusting the weights to yi good performance with a statistically representati body of data.

A machine organization, input and output cod and adjustment procedure which have been su cessful are described. The machine has been simu lated on a digital computer, and two series o weather prediction experiments have been pe formed. In the first of these the machine was trai to predict the values of atmospheric pressure ge erated by a mathematical model. In the secon series of experiments the machine was trained o measured data to predict 11-hour changes in s level atmospheric pressure. The results of th experiments are compared with the prediction pe formance of more conventional statistical tec niques.

### 11/4 PRACTICAL APPLICATIONS FOR ADAPTIVE DATA-PROCESSING SYSTEMS

BERNARD WIDROW, LEE TALBERT, GABRIEL GRONER, FRED SMITH, MICHAEL HU, DONALD SPECHT
*Stanford University*
*Stanford, California*

*(Continued on page 32)*

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| Insertion loss | 1 db |
| Isolation | 45 db |
| VSWR | 1.4 |
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|---|---|---|
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HIGH ISOLATION
to 150 db

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RELIABILITY
to meet missile requirements

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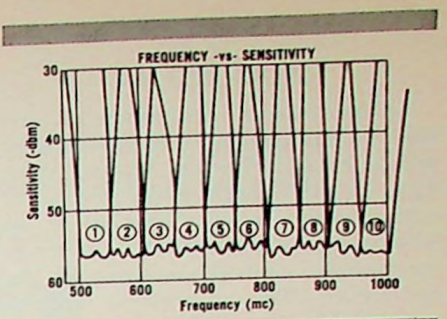



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## PHOENIX MEET SET

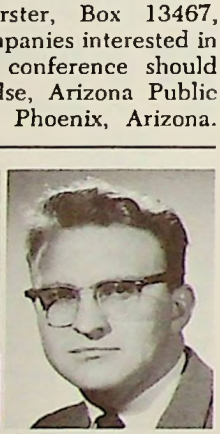
An international conference and exhibit on aerospace electro-technology will be held in Phoenix, Arizona, from April 19 through 25, 1964, it was announced by A. J. Wesolowski of AiResearch Manufacturing Company in Phoenix, general chairman of the conference. The conference will be presented by the IEEE in cooperation with other technical societies.

The conference will present a technical program reflecting the latest advances in the application of electricity in the nation's space program and will feature panel discussions, technical papers, and exhibits. Included will be sessions on educational, management, and training programs now being carried out to meet new needs. Exhibits will allow presentation and demonstration of systems and hardware.

Registration opened July 1, 1963, and 250-word abstracts of technical papers are due by August 19. Complete papers are due by November 1, and final papers should be in by December 15, on IEEE format. Abstracts should be sent to the technical program chairman, A. A. Sorensen, Mail 3016, The Martin Company, Baltimore 3, Maryland. Papers from all nations are being solicited, and the authors of the five best papers will receive certificates of merit from the IEEE and cash awards of $100 each.

Advance registration can be made by writing the conference secretary, D. J. Schoephoerster, Box 13467, Phoenix, Ariz. Companies interested in exhibiting at the conference should contact R. D. Hulse, Arizona Public Service Company, Phoenix, Arizona.

*Eaton*



*Stubberud*

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MORE SPECTRUM

IEEE professional technical groups and technical committees. The "IEEE Student Journal" will continue to be published for 27,000 student members. In addition, special publications devoted to convention and conference papers will be published from time to time.

The new publications policy will be carried out under the general supervision of the IEEE editorial board and the general manager of the IEEE, Donald G. Fink.

Members of the editorial board are: Dr. John D. Ryder (chairman), editor of IEEE and dean of engineering, Michigan State University; Dr. Thomas F. Jones, Jr. (vice chairman), president, University of South Carolina; E. K. Gannett, head of editorial operations, IEEE headquarters; Charles T. Hatcher, division engineer, Consolidated Edison Company of New York; Seymour Herwald, vice president, Westinghouse Electric Corp.; Walter MacAdam, vice president, American Telephone & Telegraph Co.; and Dr. Donald B. Sinclair, executive vice president, General Radio Co.

Distribution of technical information through publications, meetings, and other media is among the prime purposes of IEEE.

Adaptive data-processing systems which can be trained to classify complex digital and analog patterns have been under development over the past several years. Methods of adaptation, convergence rates, statistical memory capacities, and generalization capabilities have been studied for single threshold elements (Adaline) and for certain networks of adaptive threshold elements (Madaline). In addition, simple Adaline networks have been used successfully in recognition of human speech, weather forecasting, in an automatic control system, and in diagnosis of electrocardiographic waveforms.

A real-time adaptive speech recognition system has been constructed which is composed of a preprocessor with a microphone input which feeds a bank of eight band-pass filters spaced throughout the audio spectrum. Spectral power is quantized and sampled to form a 240-bit pattern for each spoken word. These patterns are applied to Adaline networks for classification. With an 18-word vocabulary, after training on only 8 samples per word, the system was able to make correct identification of new samples of these words with better than 95 per cent reliability. When interrogated by new voices of the same sex, the average reliability was better than 85 per cent.

A single 100-weight Adaline was applied to the task of forecasting rain or no rain for San Francisco during the rainy season. It was adapted to read "today's" weather in response to an input corresponding to "yesterday's" pressure pattern. When this was done a number of times, the Adaline read "tomorrow's" weather when "today's" pressure pattern was inserted. So far, performance has been at least equal to the best in human forecasting.

Automatic control can be regarded as a form of pattern classification. A fourth-order "bang-bang" system has been controlled by a single Adaline. The state variables of this system have been encoded to make patterns which are linearly separable. Learning a strategy of control is the same as learning to classify state patterns.

Vector cardiograms have been sampled and applied to a simple Madaline which was taught to distinguish abnormals from normals. After training on 100 cases (abnormals and normals), the reliability was 81 per cent when tested on 57 new cases not contained in the training set.

The inherent ability of adaptive neural nets to generalize, i.e., to extrapolate and interpolate a means of behavior from a very limited amount of training, has been crucial in making all the above applications possible.

## SESSION 12

### CONTROL THEORY

*Thursday, August 22,*
*10:00 A.M.-12:30 P.M.*
*COW PALACE — ROOM B*

Session Chairman:

JAMES EATON
*University of California*
*Berkeley, California*

### 12/1 A CONTROLLABILITY CRITERION FOR A CLASS OF LINEAR SYSTEMS

A. R. STUBBERUD
*University of California*
*Los Angeles, California*

In a series of papers, R. E. Kalman has pr sented a theory of controllability of linear syste described by a vector-matrix equation of the for

$$\frac{dx}{dt} = A(t)x + B(t)u \qquad (1$$

In these papers he presents a criterion for t testing of linear systems described by equati (1) for "Complete Controllability." This criter involves the testing of a symmetric matrix

$$W(t_o,t_1) = \int_{t_o}^{t_1} \phi(t_o,t)B(t)B'(t)\phi'(t_o,t)dt \qquad (2$$

for positive definiteness for some $t_1 > t_o$. In t expression $\phi(t_o,t)$ represents the transition ma of equation (1). Actual determination of t transition matrix for time-variable systems is general a very difficult task.

In this paper another criterion for testing t complete controllability of a class of linear syste described by equation (1) is developed. The c of systems to which the criterion is applicable that for which A(t) has at least n-2 derivati and B(t) has at least n-1 derivatives where n the order of the system. This criterion does require the determining of the transition ma of the equation, but instead requires the determ ing of the rank of a matrix formed by operati involving differentiation and matrix multiplicati applied directly to A(t) and B(t). The techniq while general, is particularly convenient in t case the input u of equation (1) is a scal function.

### 12/2 USE OF A COORDINATE TRANSFORMATION IN THE INCREMENTAL PHASE PLANE

DAVID P. LINDORFF
*University of Connecticut*
*Stoors, Connecticut*

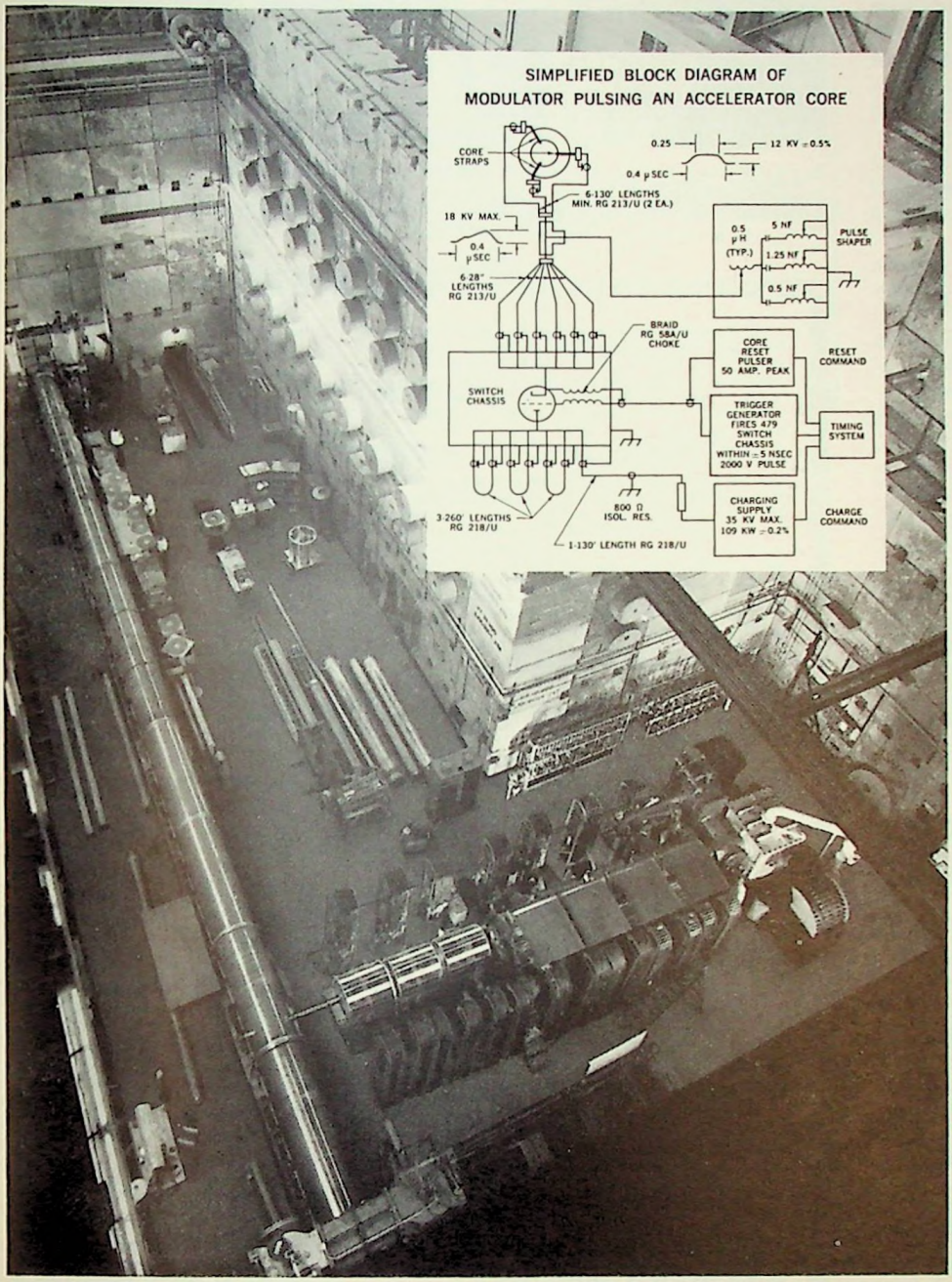
A coordinate transformation in the increme phase plane is introduced which permits the d sign of sampled-data control systems with discontinuous nonlinearities to be accomplished u path tangent techniques. A simple form of co pensation is derived which is shown to produ the desired rotation of the switching boundary the new coordinate system. Application of th concepts is made to systems involving several ty of nonlinearities.

### 12/3 SYMBOLIC REPRESENTATION OF COORDINATE TRANSFORMATIONS

R. L. PIO
*Hughes Aircraft Company*
*Culver City, California*

*(Continued on page 34)*

**LIKE CHALLENGING PROBLEMS?**
**Our Electronics Engineers had to solve this one: Develop 36-megawatt modulators for the Astron 1000-megawatt electron accelerator.**

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*education notes*

## H-P SCHOLARSHIPS

Eight graduating seniors from Peninsula high schools have been awarded $500 cash scholarships from the Hewlett-Packard company employees' scholarship fund.

The fund was started in 1951 to assist children of H-P employees pursue higher education at the college of their choice. Scholarships are awarded on the basis of scholastic achievement, participation in activities, and educational objectives.

In the 12 years the program has been in operation, 45 awards of $500 each have been granted to graduating seniors in the local area.

This year's scholarship winners, their high schools, and the colleges they plan to attend are:

Sheryl Fong, Palo Alto, Univ. of Pacific; Lesley Leghorn, Cubberley, U.C. at Santa Barbara; Mary McCarthy, Cubberley, San Jose State; Anthony Hill, Campbell Union, U.C., Berkeley; William Lyon, Cupertino, U.C. at Santa Barbara; Shirley Walling, Sunnyvale, San Jose State; Frederick Fischer, Mountain View, U.C., Berkeley; and Michi Hayashi, Hillsdale, U.C., Berkeley.

*aerospace electro-technology notes*

## PAPERS CALL

**August 19:** 250-word abstracts for International Conference & Exhibit on Aerospace Electro-Technology (IEEE et al.), Phoenix, Ariz., April 19-25, 1964. Finished manuscripts due November 1. Papers invited in electrical systems, electronics systems, energy conversion, and thermoelectricity. A. A. Sorensen, mail 3016, Martin Co., Baltimore 3, Md.

*Pepper*

*Knudsen*

*Wanless*

*Garibetti*

*Ray L. Wilbur, Jr., (right) vice president of personnel for Hewlett-Packard Company, congratulates scholarship winners (left to right) William Lyon, Fred Fischer, Michi Hayashi, Lesley Leghorn, Mary McCarthy, Shirley Walling, and Anthony Hill. Not shown is Sheryl Fong, another winner.*

A technique using a symbolic representation of the coordinate transformation for a rotation of axes is presented. The common symbol for a resolver is used together with a simple sign convention. The representation has all the characteristics of a transformation matrix together with the advantages of a block diagram. The characteristics of the symbolic representation are defined. The method of obtaining the inverse transformation is shown. Rules for representing a sequence of rotations are given. Vector scalar products can be read directly from the symbolic representation of a sequence of rotations. Problems involving the angular velocities of rotating coordinate systems are conveniently treated using the symbolic representation. Analog computer diagrams for a sequence of resolutions can be drawn directly from the symbolic representation of the sequence. Examples are given which illustrate application of the technique to several typical problems encountered with rotating coordinate systems.

### 12/4 AN ITERATIVE PROCEDURE FOR COMPUTING TIME-OPTIMAL CONTROLS

HAROLD KNUDSEN
*Lincoln Laboratories*
*M.I.T.*
*Lexington, Massachusetts*

An iterative procedure for computing time-optimal controls for linear, time-invariant, regulator systems is developed. This procedure is based on the parameterization of the time-optimal control in terms of the initial conditions of the system's adjoint equation.

The procedure is used to compute time-optimal controls for a fourth order system with complex roots.

## SESSION 13

## INTEGRATED CIRCUITS

*Thursday, August 22,*
*10:00 A.M.-12:30 P.M.*
*COW PALACE — ROOM C*

Session Chairman:

R. S. PEPPER
*University of California*
*Berkeley, California*

### 13/1 AN APPROACH TO LOW-COST HIGH-PERFORMANCE MICROELECTRONICS

E. M. DAVIS, W. E. HARDING,
R. S. SCHWARTZ
*IBM Corporation*
*Poughkeepsie, New York*

This paper describes an integrated digital circuit module technology that significantly reduces the difficulties of interconnections, thermal dissipation, fabrication and flexibility generally present in the field of microelectronics.

The salient features of this technology are:

1. Semiconductor elements are interconnected without the use of thermal compression bonding. A soldering process is employed to join multiple "chip" diodes and transistors to a substrate containing passive components.
2. These multiple semiconductor devices are protected by a glassing process in order to eliminate the requirement for a hermetically sealed package.
3. Graphic arts techniques are used to produce high quality, tight tolerance, passive components. (1% resistors; 5% capacitors.) As with the semi-conductor elements, these devices do not require hermetic sealing.
4. Thermal difficulties are minimized through the use of:
   a. Materials and configurations with low thermal resistance, and
   b. High tolerance circuit components which reduce the power required to perform a circuit function.

The design criteria for these integrated circuit modules, fabrication techniques, examples of circuit functions, and typical performance results will be presented.

### 13/2 METAL-OXIDE-SEMICONDUCTOR FIELD EFFECT TRANSISTORS AND MICROCIRCUITRY

F. M. WANLASS
*Fairchild Semiconductor*
*Palo Alto, California*

Field effect Metal-Oxide-Semiconductor-Triodes (MOSTs) have been fabricated from single crystal silicon by a planar diffusion process. A MOST has an input resistance of $> 10^{15}$ ohms, input and output capacities of $\sim 1$ $\mu\mu$f, and a transconductance of $\sim 2000$ $\mu$mhos. These devices operate in the enhancement mode so that it is possible to directly couple them without using level shifting resistors. It is very easy, in fact, to diffuse large arrays of MOSTs into a silicon wafer without isolation problems. The paper will describe the properties of individual MOSTs in detail and will describe some simple integrated circuits that have been constructed using them.

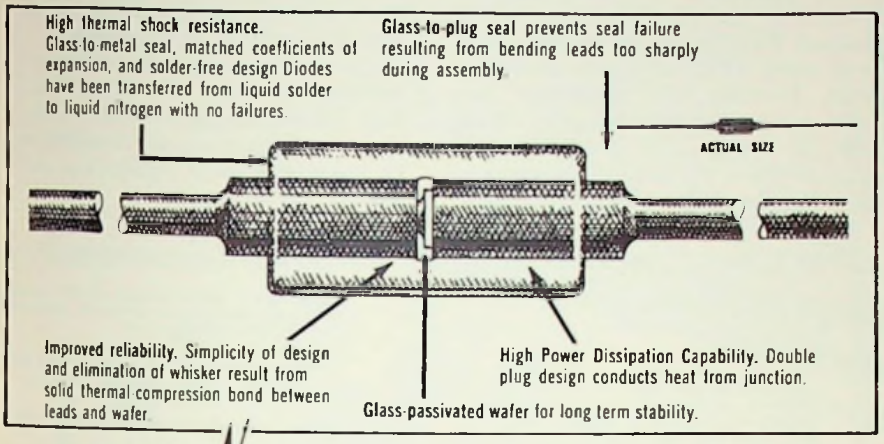
### 13/3 ELECTRON BEAM MANUFACTURING TECHNIQUES FOR INTEGRAL DEVICE INTERCONNECTIONS

D. J. GARIBOTTI
*Hamilton Standard Division*
*Broad Brook, Connecticut*

*(Continued on page 36)*

# Call us for these new TI products!

## (and see them at Texas Instruments WESCON exhibit, booths 3303-3308)



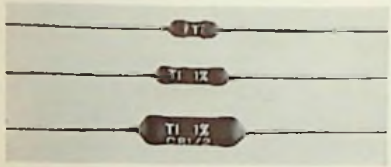

### New UNI/G* diodes feature rugged construction

Computer designers can now select from a series of TI silicon diodes which offer a new high in reliability, power-handling capacity, and long-term stability.

An entirely new concept in diode construction makes it possible for *UNI/G* diodes to meet extreme reliability requirements in military computer applications. Recently five different types of *UNI/G* diodes were tested according to the requirements of MIL-S-19500/116, /144, /188, /265A (EL). There were *no failures of any parameter of any unit tested!*

*UNI/G* diodes are presently available in the following types: 1N251; 1N659; 1N660; 1N662; 1N663; 1N914; 1N914A; 1N914B; 1N915; 1N916; 1N916A; 1N916B; 1N917; JAN 1N251; USN 1N914; USN 1N3064; U/G 625, 626, 627 (electrically identical to 1N625, 1N626, 1N627); U/G 3064 (electrically identical to the 1N3064); and TI71-75.

### epoxy.plus* carbon-film resistors meet military requirements at low cost



These new TI precision resistors are ideal for military and commercial applications calling for the most inexpensive RN55D, RN60D and RN65D package sizes.

*Epoxy-plus* resistors are coated with a new double-tough synthetic sealant by an exclusive TI process that assures extremely high moisture resistance over the entire operating temperature range.

These new TI units surpass the doubled requirements of characteristic D, MIL-R-10509 D — handling full load rating at 125°C and double-wattage rating at 70°C. *Epoxy-plus* resistors are now immediately available in a wide range of resistance values.

### Two new low-level silicon transistors announced by Texas Instruments

*Microamp switching at nanosecond speeds* is now possible using new TI 2N2693 series transistors. These devices were developed especially for use in space-borne equipment where extremely low power consumption is a necessity. They function effectively at currents 10 to 100 times lower than most other transistors.

*Spot noise figures as low as 0.8 db* are possible with new TI 2N2586 NPN diffused-planar silicon transistors. These devices are ideal for critical low-noise, low-level applications. A typical example is the input stage of amplifiers taking signals from high-impedance transducers.

### New TI high-frequency silicon transistor now available

A new silicon high-frequency transistor, the 2N2865, is now available from our stock. The new interdigitated epitaxial-planar NPN silicon device, announced at IEEE, is designed for use in VHF and UHF amplifier and oscillator applications to the kilomegacycle range.

The new 2N2865 is suitable wherever the application requires high-frequency operation under adverse environmental conditions. Typical parameters include: N.F., 3.5 db; $R_b$ '$C_c$, 8 psec; neutralized power gain, 18 db; and oscillator output, 55 mw at 500 mc.

**Trademarks of Texas Instruments Incorporated*

addition to his professorial duties he is director of the electronics research laboratory there.

In 1960 Dr. Weaver participated in the formation of Montronics, Inc., the first major electronics firm in Montana. He served as president of the company during its first year of operation and continues a close association with Montronics as a member of its board of directors.

He is a senior member of the IEEE. Among his other memberships are Tau Beta Pi, Sigma Xi, the American Society for Engineering Education, and the Montana Academy of Sciences.

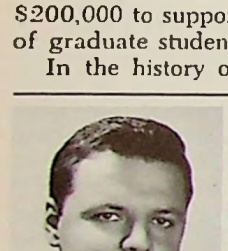
When Dr. Weaver joined the electrical engineering department of Montana State College in 1956, the graduate program in the department was practically nonexistent. Up to that time there had been so little opportunity to receive financial support for graduate studies that most students seeking postgraduate education were leaving for schools in other states.

Dr. Weaver immediately proceeded to set up within the framework of the college an organization known as the "electronics research laboratory." Touring the country, Dr. Weaver singlehandedly brought in a series of research and development contracts from Stanford Research Institute, Hughes Aircraft, USAF Rome Air Development Center, Boeing Company, National Science Foundation, and USAF Cambridge Research Center. Soon he had a backlog of nearly $200,000 to support a sizable number of graduate students.

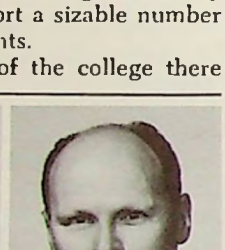
In the history of the college there had been approximately 20 M.S. degrees conferred in electrical engineering, and in 1956 there was one graduate student in the department. Since 1956 there have been 30 Master's degrees conferred, and since 1959 the department has offered a Doctorate in electrical engineering.

By 1961 the electronic research laboratory had 50 employees, nearly half of them graduate students, and was doing $300,000 worth of work a year. However, the laboratory was only postponing the day when numbers of the trained students would have to leave the state of Montana to seek employment. In anticipation of the need to provide local industrial opportunities, Dr. Weaver set into motion a plan to establish the first major electronics company in Montana. Montronics, Inc., opened its doors January 2, 1961, and was staffed by a number of people who formerly had been with the electronic research laboratory. Rather than hurting the Montana State activity, the laboratory has regained a staff of 50 employees.

Even while engaged in so many promotional activities, Dr. Weaver still kept his teaching and research activities at a high level, as witnessed by an impressive list of publications during the period.



*Seeds*



*Culshaw*

*Niblack*

*Wolf*

E. H. MILLER

*Wright-Patterson Air Force Base, Ohio*

1. One continuous and consistent trend in the history of military electronics has been in obtaining more reliable, smaller, and lighter electronic equipment. Much progress has been made in the microminiaturization of discrete electronic components as well as in the integration of active and passive elements on one chip of semiconductor material. These devices are referred to as F.E.B.'s (functional electronic blocks) or integral devices. This size reduction and associated packaging density has brought about severe heat dissipation and interconnection difficulties.

2. A solution to the above problems has been developed utilizing electron beam techniques and vacuum deposition techniques to form a multilayer interconnection system having high volumetric efficiency, good thermal dissipation characteristics, and interconnection flexibility. The development of manufacturing processes and techniques for the reliable interconnection of a wide variety of solid state functional electronic blocks is in progress.

### 13/4 INTEGRATED COMPLEMENTARY TRANSISTOR LOGIC GATES

ROBERT SEEDS

*Fairchild Semiconductor*
*Palo Alto, California*

PNP and NPN transistors can be used in a complementary emitter follower configuration to perform AND–OR logic gating functions. Such gates have a near unity linear input output voltage transfer characteristic with very high power gain. Delay times can be quite low, of the order of 2 to 5 nanoseconds for two logic levels since the transistors are always operated in the active region. Level setting inversion and threshold detection, however, must be accomplished with other types of elements having non-linear transfer characteristics. This paper describes an integrated complementary gate consisting of multiple p-n-p inputs for positive AND logic and an n-p-n output which can be paralleled for positive OR logic. These are considered in conjunction with DCTL flip flops and gates. Transfer characteristics are shown indicating the number of logic levels which can be accomplished before level setting is required. Time delay and stability are discussed under adverse operating conditions and system applications are shown where over-all performance of the DCTL family is considerably enhanced through the use of these gates.

### 13/5 SEMICONDUCTOR THIN-FILM DEVICE FOR INTEGRATED CIRCUITS

EGONS RASMANIS

*Sylvania Electronic Systems – East*
*Micro Electronic Laboratories*
*Waltham, Massachusetts*

"Silicon thin film devices for microelectronics applications" advanced thin film techniques for microcircuit applications are being developed which include both pyrolytic and vacuum deposition of thin film pn junction devices on polycrystalline ceramic substrates. Diodes with breakdown voltages up to 60 v and forward currents of 30 ma. at 1v; and transistors with current gains up to 200 have been achieved. This paper describes the deposition processes, measurements of electrical characteristics of the resulting film and the experimental device sh characteristics the pn junction structures.

## SESSION 14

## LASER TECHNIQUES

*Thursday, August 22,*
*10:00 A.M.-12:30 P.M.*
*COW PALACE – ROOM D*

Session Chairman:

WILLIAM CULSHAW

*Lockheed Missiles & Space Compan*
*Palo Alto, California*

### 14/1 POLARIZATION MODULATION AND DEMODULATION OF LIGHT

W. NIBLACK, E. H. WOLF

*Sylvania Electric Products*
*Williamsville, New York*

An optical communication system employing p larization modulation-demodulation is describe Linearly-polarized light is converted to right an left circularly-polarized light by applying a contin ously varying voltage to a Pockels cell modulat The signal is transmitted when the transmitter an receiver have been axially aligned.

A quarter-wave plate/Wollaston prism ensemb is used in the receiver to reconvert the intercepte light beams to linearly-polarized components an to achieve spatial separation between them. Th light components are detected by two photocell and processed in a difference amplifier and a de modulator stage.

The system offers significant improvements i usable transmitted power and extended range, les sened susceptibility to interference from linear ly polarized background light, and ease of transmitter receiver alignment over the performance of a com parable intensity-modulated optical communicatio system.

### 14/2 DIFFRACTION LIMITED, SINGLE MODE GLASS LASER

J. W. KANTORSKI, C. G. YOUNG

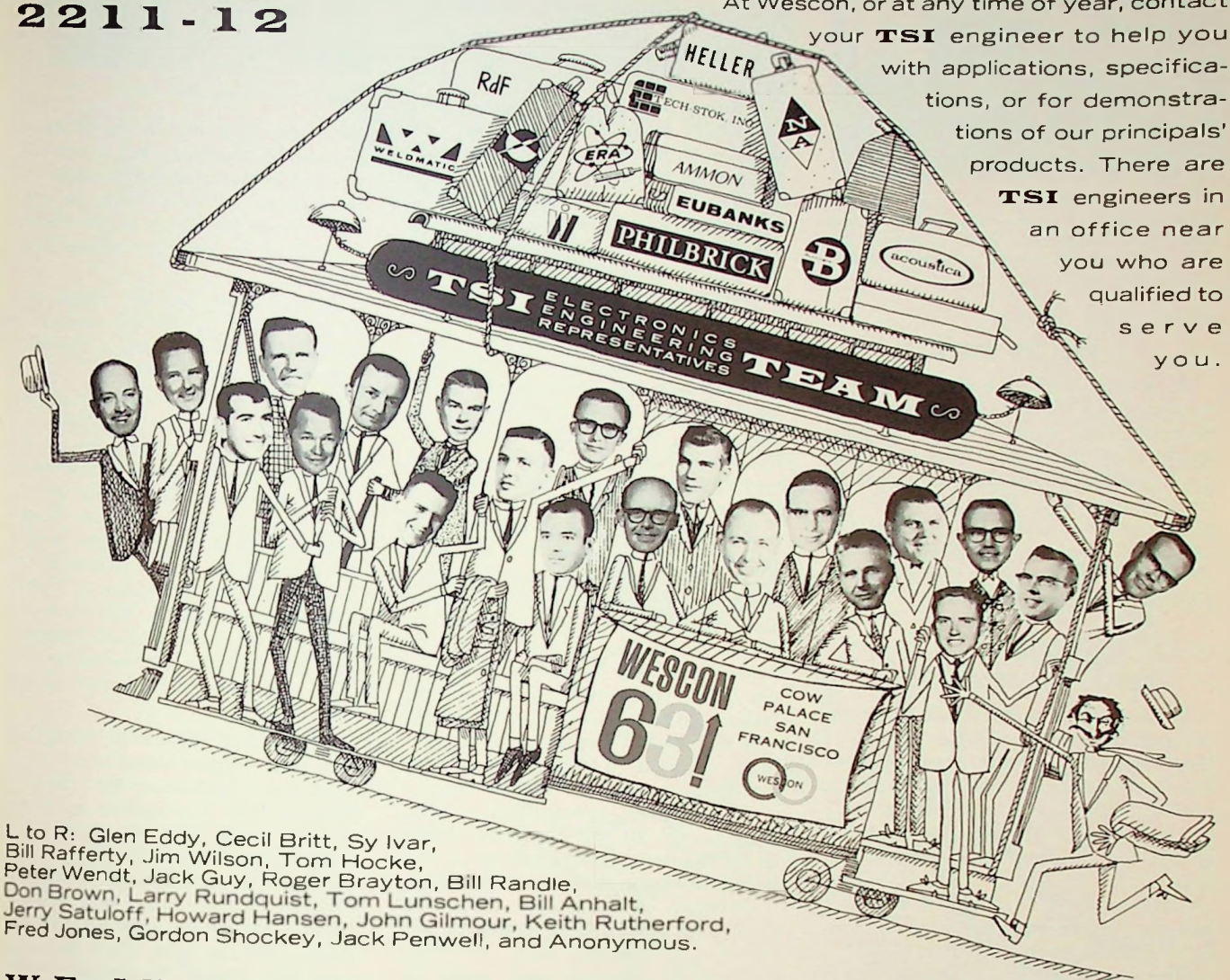
*American Optical Company*
*Southbridge, Massachusetts*

Diffraction limited performance was obtaine from a Nd doped glass laser by mode selection tech niques. Through the use of a system employing glass laser rod and plane parallel mirrors with c without a mode selection pinhole, both the lowes order transverse mode ($HE_{11}$) and the second lowe est order transverse mode ($TM_{01}\pm HE_{21}$) were obtained over an active core diameter of 3mm. The mode selection pinhole was at the common focus o two lenses inside the resonant cavity. The glass was homogeneous enough to permit a diffraction lim pinhole to be used with only a slight increase i threshold. Photographic images of the near fie pattern and beam spread measurements were ob tained. The beam spread for the lowest order mod ($HE_{11}$) was 1.44 that predicted by Fraunhofe diffraction theory and in agreement with that pre dicted for optical dielectric waveguide modes.

*(Continued on page 56)*

# WE'RE 'ALL ABOARD'
## TO DISCUSS ANY OF OUR FINE PRODUCT LINES WITH YOU AT OUR WESCON BOOTH 2211-12

At Wescon, or at any time of year, contact your **TSI** engineer to help you with applications, specifications, or for demonstrations of our principals' products. There are **TSI** engineers in an office near you who are qualified to serve you.




L to R: Glen Eddy, Cecil Britt, Sy Ivar, Bill Rafferty, Jim Wilson, Tom Hocke, Peter Wendt, Jack Guy, Roger Brayton, Bill Randle, Don Brown, Larry Rundquist, Tom Lunschen, Bill Anhalt, Jerry Satuloff, Howard Hansen, John Gilmour, Keith Rutherford, Fred Jones, Gordon Shockey, Jack Penwell, and Anonymous.

## WE INVITE YOU TO VISIT US AND OUR PRINCIPALS AT THESE IMPORTANT LOCATIONS:

| | | | |
|---|---|---|---|
| Ammon Instruments, Inc. | 2211-12 | Heller Industries, Inc. | 606 |
| Electronic Components Div., Burroughs Corp. | 3619-20 | North Atlantic Industries, Inc. | 4217-18 |
| Electronic Research Associates, Inc. | 201 | Pyrofilm Resistor Co., Inc. | 4429 |
| Eubanks Engineering Co. | 605 | Rdf Corporation | 2211-12 |
| General Ultrasonics Div., Acoustica Associates, Inc. | 602 | Tech-Stok, Inc. | 2211-12 |
| George A. Philbrick Researches, Inc. | 4739 | Weldmatic Div., Unitek Corp. | 603-4 |
| | | WEMS, Inc. | 2211-12 |

**TSI** TECH-SER, INC.
ELECTRONICS ENGINEERING REPRESENTATIVES

6061 W. 3rd St., Los Angeles 36, Calif. WE 7-0780
800 San Antonio Rd., Palo Alto, Calif. DA 6-9800
P.O. Box 6544, San Diego, Calif. AC 2-1121


*William Greathead, in charge of the Wescon advance registration trailer, visited nearly twenty Bay Area facilities during late July and early August to inaugurate a new ticket sales technique*

*national notes*

### MORE ON POWER

It is expected that the bimonthly publication, "Power Apparatus and Systems," will become a regular publication of the PTG. The transition from a division to a professional technical group will have no effect on meetings now scheduled, nor on the activities presently handled by the division as a part of the IEEE technical operating committee.

*eibg news*

### ANNUAL BUYERS LUNCHEON

During Wescon week this year, the electronic industries buyers group of the Purchasing Agents Association of Northern California, Inc., will hold its annual luncheon Thursday, August 22 at noon, in the Skyline Room of the Hilton Inn, International Airport, San Francisco.

This occasion is attended annually by purchasing agents, buyers, and management guests and is a highlight of Wescon activities. Scheduled shuttle bus service will be available from the show area to the airport for the luncheon.

Featured guest speaker will be Robert H. Leavitt, manager, procurement development, Lockheed Missiles and Space Company. He will speak on the future of the Peninsula in the missiles and space age.

The group is composed of approximately one hundred members in the electronics industry on the San Francisco Peninsula. The membership is an affiliate group of the Purchasing Agents Association of Northern California, Southbay Group.

Reservation applications will soon be in the mail, or contact directly the chairman of the EIBG, William Menzies, R S Electronics Corporation, 795 Kifer Road, Sunnyvale, to obtain information on tickets for the luncheon.

*social notes*

### HOLIDAY FOR LADIES

The week of August 19 will bring more than 35,000 men of the nation's electronics industry to the San Francisco Bay Area for Wescon – the largest annual event of its kind in the West.

For the women who will be accompanying their husbands there will be scheduled activities to engage their free time, from shopping to private social entertainment.

Planned by a group of prominent matrons whose husbands are mostly executives of Peninsula electronics firms, a "Holiday in San Francisco" theme will be carried out through two main events.

Mrs. William P. Doolittle and Mrs. Stanley F. Kaisel of Atherton, chairman and vice chairman for Wescon's women's activities, have announced a chartered Bay cruise for Wednesday, August 21, which will carry the visitors to Tiburon for luncheon and a special sidewalk art show organized by the Quay Gallery.

The Garden Court of the Sheraton Palace will be the scene of a luncheon and fashion show "with a difference" on Thursday, the 22nd. Far Eastern fashions by Norma of Dalen will be shown by Oriental models.

Miss Mai Tai Sing, San Francisco television personality, will give the fashion show commentary. A feature will be paraded costumery of a traditional Chinese wedding, to a background of music of a butterfly harp.

Beginning the opening day of Wescon, August 20, the California Room of the Fairmont Hotel will serve as a hospitality suite throughout the week.

Tuesday evening, the 20th, the ladies will join their husbands for the all-industry cocktail party for more than 2,000 persons, and again on Thursday evening, the 22nd, they will attend the annual banquet and dance to be addressed by Dr. Lee A. DuBridge, president of California Institute of Technology. Both of these events will take place in the Grand Ballroom of the Fairmont.

*attendance record*

### 46,152 IN L.A. IN '62

A total of 46,152 professional visitors registered during the 1962 Wescon in Los Angeles, a new attendance record for the show.

Previous Wescon high, also in Los Angeles, was reached in 1960, with an attendance of 40,083 during the four-day exposition. The totals eliminate wives who visit the show as well as students or youngsters who accompany their parents to Wescon.

*Mrs. Doolittle and Mrs. Kaisel*

On the final day of the Wescon—August 23—the ladies will have a continental breakfast at the Fairmont and then go to the Cow Palace by chartered buses for a tour of the exhibits conducted by past directors of Wescon.

Mrs. Doolittle and Mrs. Kaisel have been assisted by several committees in making plans to entertain the large number of visiting ladies.

Mrs. E. E. van Bronkhorst of Portola Valley and Mrs. Cortland Van Rensselaer of Los Altos Hills are co-chairmen for hospitality entertaining at the Fairmont. Their aides include Mrs. Emery Rogers and Mrs. Robert Brunner of Atherton, Mrs. Wesley Ayres and Mrs. Robert Grimm of Los Altos, Mrs. Joseph Swanson of Portola Valley, Mrs. Rankin Van Anda of Menlo Park, Mrs. Richard Reynolds and Mrs. Harold Edmondson of Palo Alto, and Mrs. Jack Melchor of Los Altos Hills.

Mrs. Robert DiLiban of Menlo Park and Mrs. William Edson of Los Altos Hills are coordinating the cruise to Tiburon with a committee composed of Mrs. Philip Rice, Mrs. John V. N. Granger, and Mrs. Edward W. Herold of Atherton; Mrs. Thomas H. Morrin, Mrs. E. H. Gavenman, Mrs. William Barnes, Mrs. Ray Cumming, Mrs. G. Kirby Dawson, Mrs. Harry Berland, and Mrs. Ernest Pappenfus of Palo Alto; Mrs. Albert J. Morris and Mrs. Lloyd A. Addleman of Los Altos Hills; Mrs. Milton Green of Menlo Park; Mrs. Dean A. Watkins of Portola Valley; and Mrs. Jefferson Wilkerson, Mrs. Romayne F. Whitmer, and Mrs. Meyer Leifer of Los Altos.

Planning for the fashion show and luncheon is headed by Mrs. Myrl Stearns of Menlo Park and Mrs. Louis ter Veen of Portola Valley. Their committee includes Mrs. Emmet Cameron of Palo Alto; Mrs. Hugh Flemming, Mrs. John Linvill, and Mrs. Frederick MacKenzie of Menlo Park; Mrs. Dean A. Watkins of Portola Valley; and Mrs. L. C. Van Atta and Mrs. Fred Salesburg of Los Altos.

Chairman for the breakfast and Cow Palace tour the final day is Mrs. T. A. Christiansen of Los Altos.


HOLIDAY
IN
SAN
FRANCISCO

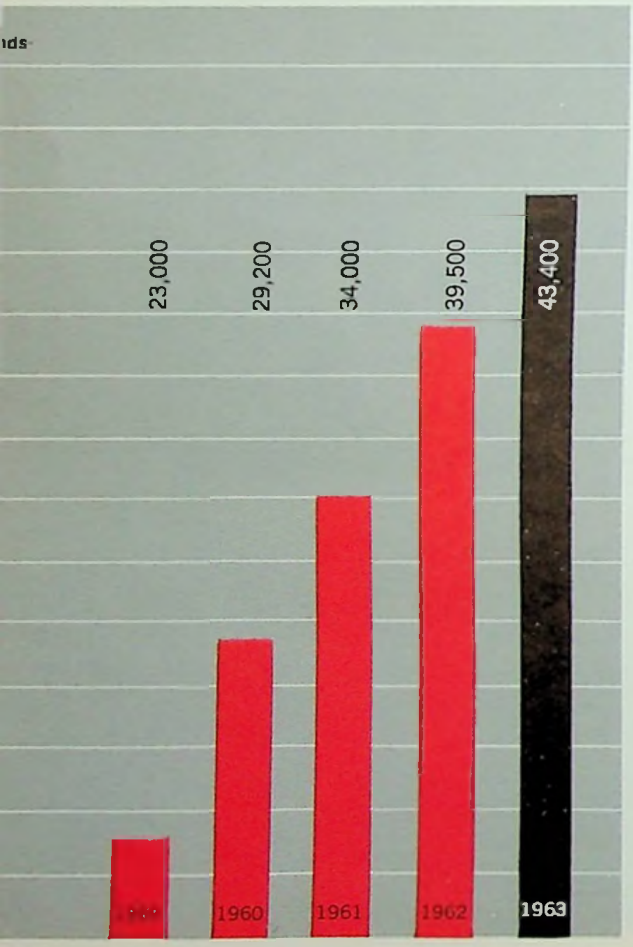
# STIMULATING!

*IN THE COOL HIGHLANDS OF SOUTHERN ARIZONA an elite technical team of government and industry specialists is at work applying automatic data processing concepts, techniques and equipment to the needs of the mobile modern Field Army. This program, now beginning its sixth year, is a vital part of the Army's Command-Control Information System Project for the 1970's—CCIS-70. TRW has been selected to continue in its role of providing technical assistance to the U.S. Army Materiel Command in support of the CCIS-70 Project at Fort Huachuca, Arizona. Challenging assignments exist in advanced areas such as digital data communications, systems integration, man-machine communications, information retrieval and display, programming techniques and languages, simulation techniques and applications, and integrated system testing under field conditions. Facilities include van-mounted computers developed by the Army for field use, associated system devices, and field communications equipment. We have immediate openings for qualified systems analysts, programmers and test engineers who desire to make a significant contribution to the nation's military capabilities in a stimulating professional environment. At Historic Fort Huachuca and neighboring Sierra Vista, civilian engineers and their families, along with hand-picked Army technical officers and their families, have created an equally stimulating intellectual and social environment. If you would like to join TRW's top-flight technical group at Sierra Vista, contact Robert W. Rogers now at 8433 Fallbrook Avenue, Canoga Park, California. Or phone him collect: Area Code 213, 346-6000. TRW is an equal opportunity employer.* **TRW** COMPUTER DIVISION

graphically tell the story of the dynamic growth ɔnics in the West over the past two decades. From g less than $100 million in sales in 1943, western cs output will come close to the four-billion-dollar 1963.

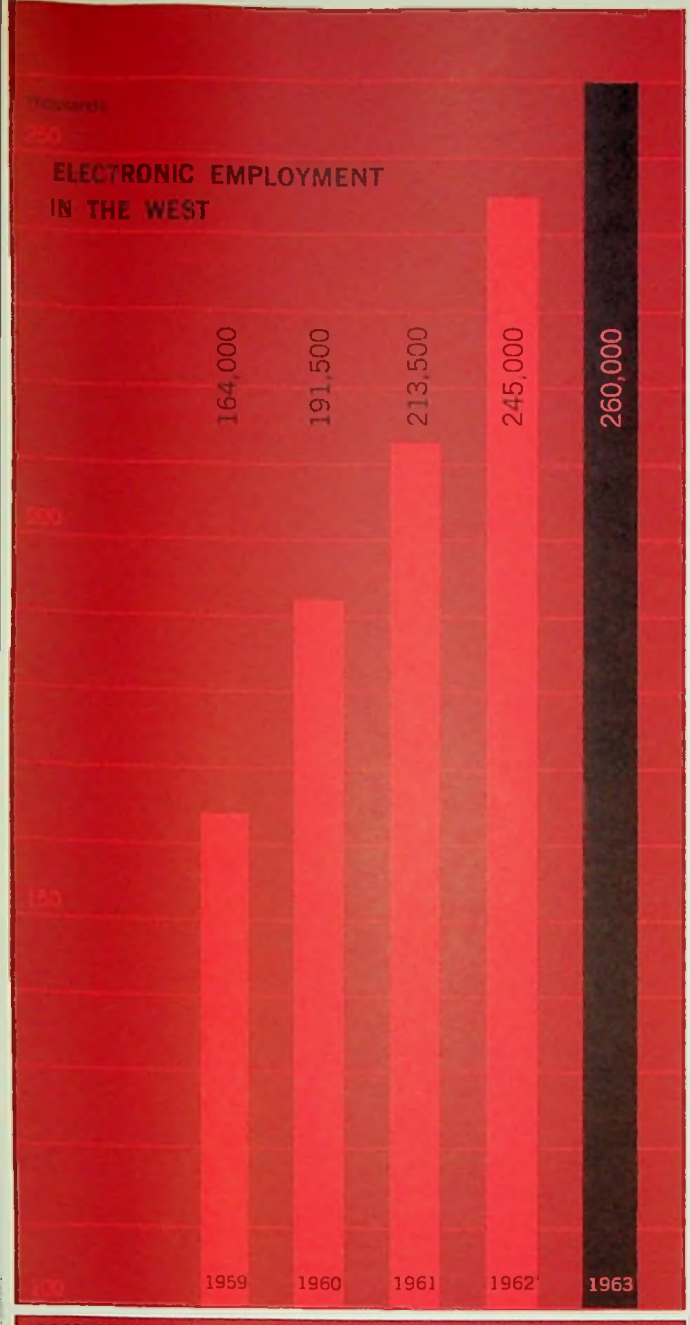
ıles are only part of the story of burgeoning western cs. As the graphs on these pages indicate, growth ı just as dramatic in employment, number of firms, nber of graduate engineers. All these factors have e West a vital force in world-wide electronics.

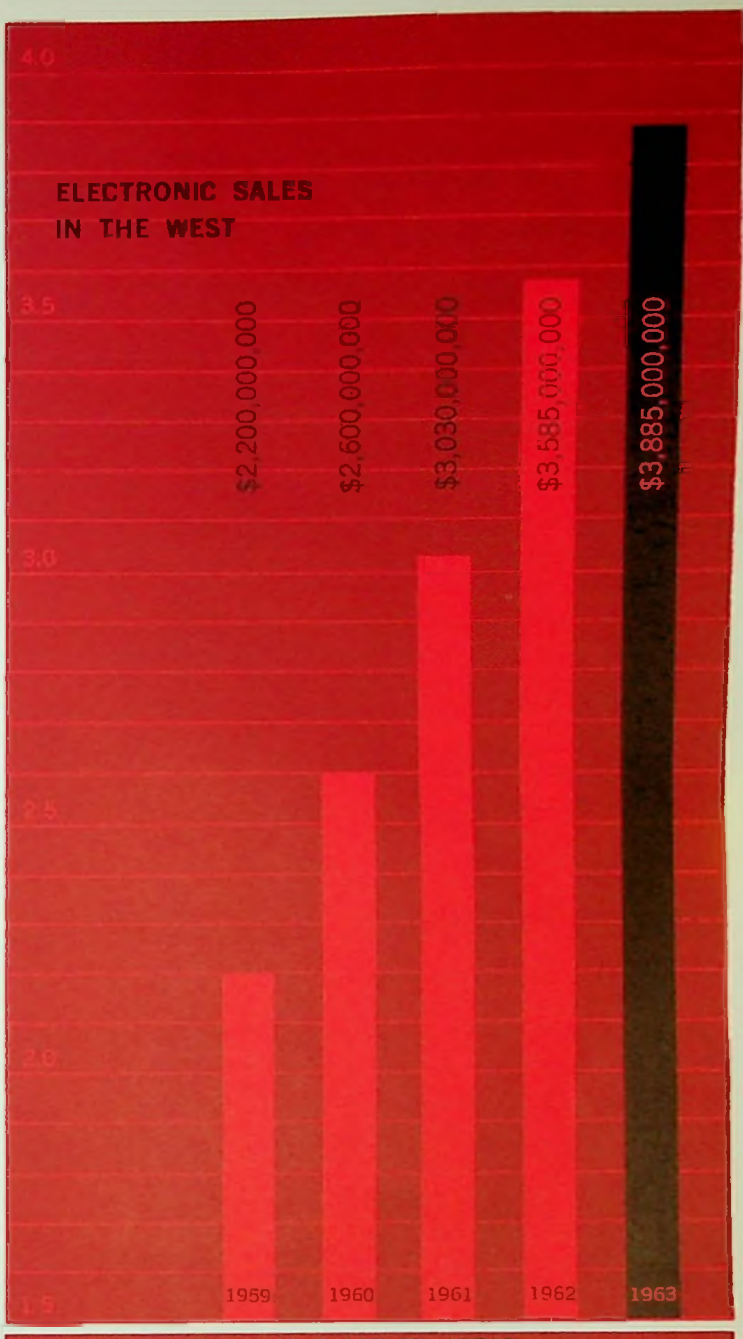
TE ENGINEERS IN ELECTRONICS IN THE WEST

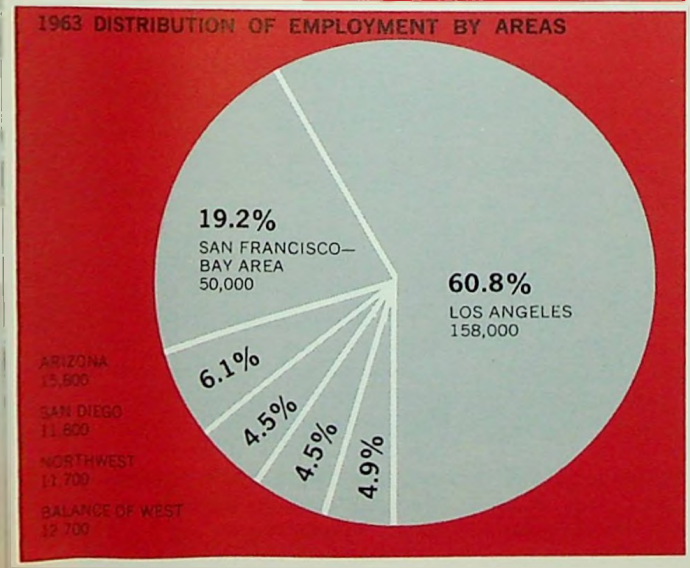


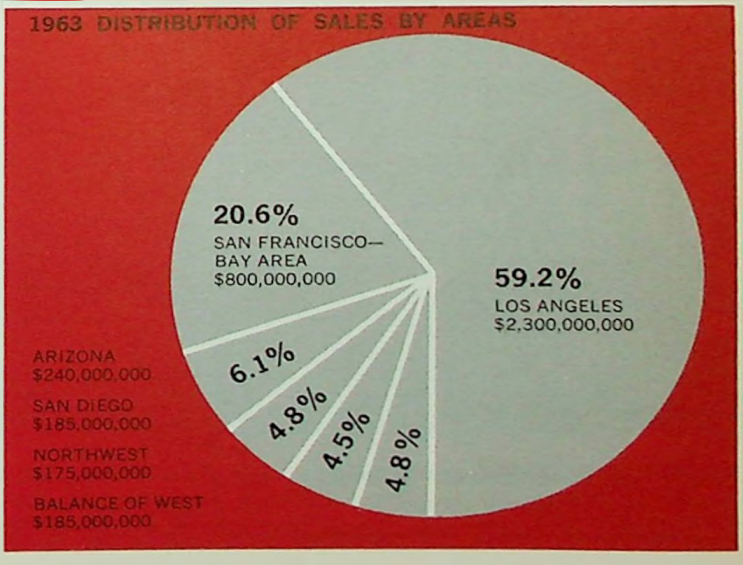

**EMPLOYMENT, FACTORY SALES AND NUMBER OF COMPANIES IN MAJOR CENTERS OF THE WEST**

| | Employment | Factory Sales | Companies |
|---|---|---|---|
| **LOS ANGELES** | | | |
| 1959 | 100,000 | $ 1,320,000,000 | 520 |
| 1960 | 115,000 | 1,512,000,000 | 550 |
| 1961 | 128,000 | 1,750,000,000 | 570 |
| 1962 | 150,000 | 2,120,000,000 | 595 |
| 1963 | 158,000 | 2,300,000,000 | 610 |
| **SAN FRANCISCO BAY AREA** | | | |
| 1959 | 35,000 | $ 485,000,000 | 244 |
| 1960 | 40,000 | 570,000,000 | 256 |
| 1961 | 43,000 | 655,000,000 | 267 |
| 1962 | 48,000 | 760,000,000 | 280 |
| 1963 | 50,000 | 800,000,000 | 290 |
| **ARIZONA** | | | |
| 1959 | 7,200 | $ 100,000,000 | 21 |
| 1960 | 10,000 | 145,000,000 | 38 |
| 1961 | 11,400 | 170,000,000 | 42 |
| 1962 | 12,500 | 190,000,000 | 45 |
| 1963 | 15,800 | 240,000,000 | 50 |
| **SAN DIEGO** | | | |
| 1959 | 7,100 | $ 97,000,000 | 38 |
| 1960 | 9,500 | 140,000,000 | 46 |
| 1961 | 10,700 | 165,000,000 | 56 |
| 1962 | 11,800 | 185,000,000 | 72 |
| 1963 | 11,800 | 185,000,000 | 75 |
| **NORTHWEST** | | | |
| 1959 | 6,200 | $ 85,000,000 | 37 |
| 1960 | 7,800 | 110,000,000 | 37 |
| 1961 | 10,000 | 145,000,000 | 50 |
| 1962 | 11,200 | 165,000,000 | 60 |
| 1963 | 11,700 | 175,000,000 | 70 |
| **BALANCE OF THE WEST** | | | |
| 1959 | 8,500 | $ 113,000,000 | 60 |
| 1960 | 9,200 | 123,000,000 | 68 |
| 1961 | 10,400 | 145,000,000 | 70 |
| 1962 | 11,500 | 165,000,000 | 88 |
| 1963 | 12,700 | 185,000,000 | 95 |
| **WESTERN TOTALS** | | | |
| 1959 | 164,000 | $ 2,200,000,000 | 920 |
| 1960 | 191,500 | 2,600,000,000 | 995 |
| 1961 | 213,500 | 3,030,000,000 | 1,055 |
| 1962 | 245,000 | 3,585,000,000 | 1,140 |
| 1963 | 260,000 | 3,885,000,000 | 1,190 |
| **U.S. TOTALS** | | | |
| 1959 | 775,000 | $ 9,800,000,000 | 4,000 |
| 1960 | 850,000 | 10,900,000,000 | 4,200 |
| 1961 | 925,000 | 12,350,000,000 | 4,350 |
| 1962 | 1,010,000 | 13,600,000,000 | 4,600 |
| 1963 | 1,070,000 | 15,200,000,000 | 4,800 |


ELECTRONIC EMPLOYMENT
IN THE WEST
164,000
191,500
213,500
245,000
260,000
1959
1960
1961
1962
1963


ELECTRONIC SALES
IN THE WEST
$2,200,000,000
$2,600,000,000
$3,030,000,000
$3,585,000,000
$3,885,000,000
1959
1960
1961
1962
1963


1963 DISTRIBUTION OF EMPLOYMENT BY AREAS
19.2%
SAN FRANCISCO—
BAY AREA
50,000
60.8%
LOS ANGELES
158,000
6.1%
4.5%
4.5%
4.9%
ARIZONA
15,500
SAN DIEGO
11,600
NORTHWEST
11,700
BALANCE OF WEST
12,700


1963 DISTRIBUTION OF SALES BY AREAS
20.6%
SAN FRANCISCO—
BAY AREA
$800,000,000
59.2%
LOS ANGELES
$2,300,000,000
6.1%
4.8%
4.5%
4.8%
ARIZONA
$240,000,000
SAN DIEGO
$185,000,000
NORTHWEST
$175,000,000
BALANCE OF WEST
$185,000,000

*western industry*

## GROWTH OF ELECTRONICS

The West now accounts for around one-fourth of the total electronic sales and employment in the U.S. According to figures recently compiled by WEMA, at the start of 1963 there were 1,190 electronic firms in the West employing more than 260,000 people and with factory sales in the order of $3,885,000,000 annually.

There are about 4,800 electronic companies in the U.S., employment is in the neighborhood of 1,070,000 people, and factory sales are estimated at $15,200,000,000.

Five years ago, in 1958, there were 920 Western companies employing 164,000 people, and sales were roughly $2,200,000,000. In 1958 the nation had approximately 4,000 companies employing 775,000 people, and sales were around $9,800,000,000.

The greatest concentration of industry activity is centered upon the Los Angeles area, which at the start of 1963 had 610 companies employing 158,000 people and with factory sales in excess of $2.3 billion. Five years ago there were 520 companies employing around 100,000 people, and sales were in the order of $1,320,000,000.

The San Francisco Bay Area, with the larger part on the Peninsula, is the next largest center of electronics activity in the West. At the start of this year there were 290 companies employing upwards of 50,000 people, and sales were above $800,000,000. Within the past five years this area gained 46 companies, employment rose by 15,000, and sales increased by roughly $315 million.

Although it ranks fifth in number of companies (50), Arizona is third-ranking with employment at 15,800 and sales at $240 million. Five years ago Arizona had 21 companies, 7,200 working in the industry, and sales were at $100 million. Therefore Arizona has better than doubled its overall activity during the past five years.

San Diego has also had a fast growth rate—37 new companies in five years, 4,700 additional employment, $88 million more in sales. The San Diego area now has 75 companies, employment is at 11,800, and sales are running at an annual rate of $185 million.

The Northwest has just about doubled in size in the past five years: 70 companies now, compared to 37 in 1958 at the same time; 11,700 employment, compared to 6,200; $175 million sales, compared to $85 million.

The balance of the West has 95 companies at the present, 12,700 workers in the industry, and sales of around $185 million. In 1958 the companies numbered 60, employment was 8,500, and sales were $113 million.

The Western Electronic Manufacturers Association, WEMA, was organized 20 years ago to focus national attention on the production potential of Western electronics. In the intervening years its membership has grown from a founding membership of 25 companies to more than 300 ranging from the Canadian and Mexican borders inland throughout the Western states.

Many of the problems and opportunities of the industry are common throughout the West, but others are related to local or state conditions. For this reason WEMA is organized into five "councils"—Los Angeles, San Francisco, San Diego, Pacific Northwest, and Arizona—to facilitate the scheduling of programs and activities tailored to the particular needs and interests of each of those areas.

The policies and programs of the association are guided by elected directors who reflect the diversity in company size and interest found among the member companies. The result is a desirable balance of geographical representation, along with a reflection of the variety of enterprise within the industry.

Current president of WEMA is Emmet G. Cameron, executive vice president of Varian Associates, Palo Alto. Chairman of the San Francisco council is William H. Heflin, executive vice president of Beckman & Whitley, San Carlos.

Executive vice president of WEMA is E. E. Ferrey, a former resident of the Bay Area. WEMA headquarters are at 3600 Wilshire Boulevard, Los Angeles. A northern California office in Palo Alto is shared with Wescon and the San Francisco Section of the IEEE at 701 Welch Road.

*western industry*

## CHANGE OF EMPHASIS

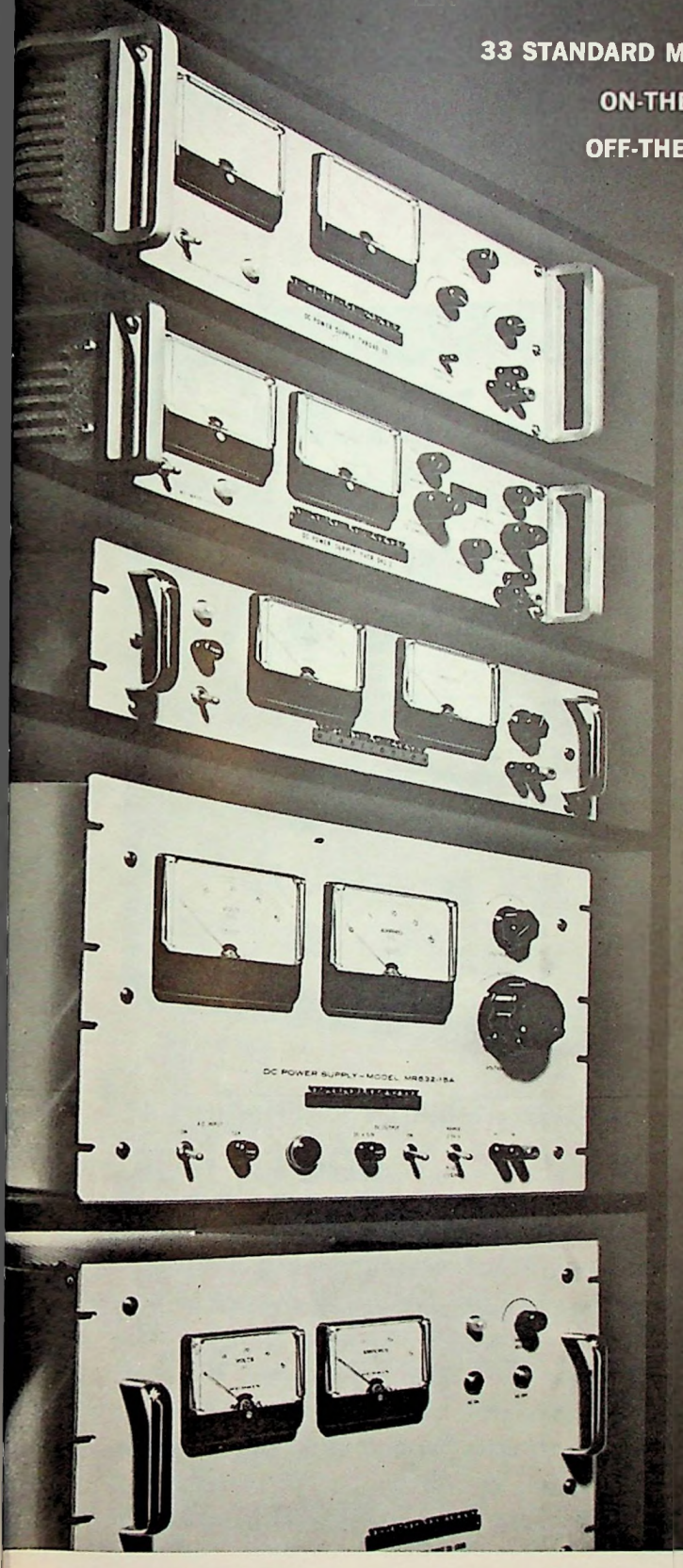
The electronic industry in the West has grown slightly more than twenty-fold during the past twenty years, according to Jules Greenblatt, publisher of the Western States Electronics Directory, which lists more than 2,200 manufacturers and laboratories in the 11 Western states.

Twenty years ago the emphasis was on transmitters, receivers, and their components and accessories, according to the North Hollywood publisher. Ten years ago it was resistors and capacitors. Today Western companies are among the leaders in the most advanced phases of electronic research and development.

# Highest Performance . . . Now at New Low Prices!

33 STANDARD MODELS . . .
ON-THE-SHELF FOR
OFF-THE-SHELF DELIVERY!

# PERKIN POWER SUPPLIES



TOP TO BOTTOM

## TVR SERIES: TRANSISTORIZED VOLTAGE REGULATED

0-40 and 60 volt ranges. Current ratings from 1 to 100 amperes. Voltage regulated; remote voltage programmable; current limiting; series and parallel operation; remote sensing; short-circuit proof; transient free. Rack mounting adapters. Guaranteed 6 full years. Seven models.

PRICED FROM **$175**

## TRANSISTORIZED VOLTAGE AND CURRENT REGULATED

TVCR Series. 0-40 volt range. Current ratings from 0.5 to 30 amperes. Current and voltage regulated; remote voltage and current programmable; voltage and current limiting; series and parallel operation; remote sensing; short-circuit proof; transient free; all solid-state circuits—no tubes. Rack mounting adapters. Five Models.

PRICED FROM **$239**

## MTR SERIES: MAGNETIC/TRANSISTOR REGULATED

24-32 volt range. Current ratings of 5 and 10 amperes. Voltage regulated; transient free; short-circuit proof; no turn-on or turn-off transients; transistorized all solid-state circuits—no tubes. Static regulation (line or load) ±0.1%. 19" rack mounting. Two model units.

PRICED FROM **$425**

## MAGNETIC AMPLIFIER REGULATED: TO 1500 AMPS

0-50 volt range. Current ratings from 5 to 1500 amperes. All solid-state circuits—no tubes. Static regulation to ±0.5% line and load. Remote sensing on most models. 19" rack mounting on units rated 50 amps and below. Convection cooling below 100 amp. Ten models.

PRICED FROM **$320**

## MRST SERIES: MAG-AMP/TRANSISTOR CONTROLLED

High current silicon rectifier power supplies. 9-32 volt range. Current ratings to 600 amps. Adjustable response time for inverter use; remote sensing; short-circuit proof; regulated for load transients; all solid-state circuits—no tubes. 19" rack mount (to 100A). Nine Models.

PRICED FROM **$1210**

For complete tech data on Perkin Standard Power Supplies, contact your nearest Perkin representative or write to the factory.

**PERKIN ELECTRONICS CORPORATION** 345 Kansas Street, El Segundo, California, SPring 2-2171

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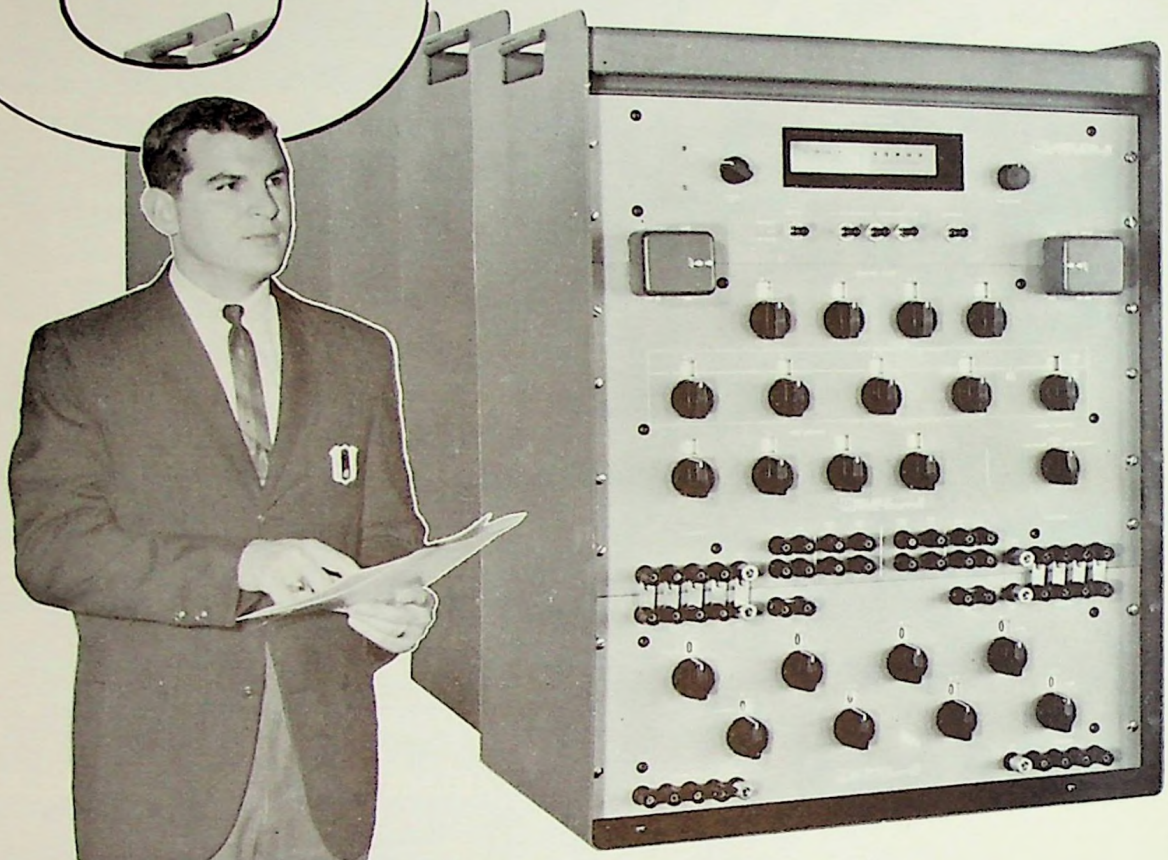
# 6 NEW esi



ALL NEW—SEE THEM IN OPERATION AT

## WESCON BOOTH NOS. 2317-2320

Six new precision measurement systems. New milliohm bridge. New unit-packaged line of precision resistors. New shielded cable connectors for all ESI systems. See them all at Wescon. Look for the men in the ESI blazers—measurements specialists demonstrating the newest in matched instrumentation from the company that pioneered the system concept.

# PRECISION MEASUREMENT SYSTEMS

1

## MODEL 791 RATIO MEASURING SYSTEM

Measures both in-phase and quadrature components of ac ratio. State-of-the-art calibration of dividers and comparison of resistors, inductors and capacitors. 7-place resolution.

2

## MODEL 121 DOUBLE-RATIO RESISTANCE COMPARISON SYSTEM

One tenth ppm resolution. Circuit eliminates lead and contact resistance. No calculations necessary. Certified correction set on separate dials before making measurements. All switch contact resistance in the bridge suppressed by a factor of 100 or more.

3

## MODEL 242 RESISTANCE MEASURING SYSTEM WITH AUTOMATIC DATA RECORDING

The Model 242 adapted to supply input to data logging systems. Records resistance measurements as typed numbers or on punched tape.

4

## MODEL 1071 AC RATIO MEASURING SYSTEM

Measures in-phase component of ac ratio and provides for quadrature balance. Highest accuracy calibration of both resistive and transformer dividers can be accomplished quickly and easily.

5

## MODEL 721 DC RATIO MEASURING SYSTEM

Compares unknown dividers to a part-per-million standard. Lead compensation and well-matched generator-detector give maximum flexibility and accuracy.

6

## MODEL 701 CAPACITANCE MEASURING SYSTEM

Continuous one ppm per dial division resolution. Separate capacitance value and deviation dials provide maximum flexibility and convenience for capacitance comparison. Continuously tunable, self tracking, line operated, wide-voltage-range generator and one microvolt detector provide more than enough sensitivity for fractional ppm comparison.

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**NEW**—Electrostatic lenses and components for customer-designed electron optical systems.

**FIRST TIME AT WESCON**—Mikros EM-20 electrostatic focusing electron microscope. Completely self-contained—automatic valving vacuum system, 10 to 40 KV accelerating voltages, automatic built-in camera, unique interchangeable lens system.

## SF MUSEUM TO SHOW WINNERS

Wider public recognition of Wescon's Industrial Design Award program is assured for the fifth annual exhibition in connection with the 1963 Wescon.

A special exhibition of outstanding entries was held at the San Francisco Museum of Art for a month preceding the start of Wescon.

Through an arrangement with the museum and its director, George D. Culler, some 20 entries chosen for Awards of Merit went on display in a main gallery of the museum in San Francisco's Civic Center, July 20 to August 19.

Fred C. Hill, IDA chairman, observed that the San Francisco Museum has exhibition policies similar to New York's Museum of Modern Art, in that architects and designers frequently enjoy recognition alongside painters, sculptors, and printmakers.

Wescon's Industrial Design exhibit will have been on public display at San Francisco Museum of Art at Civic Center for a month preceding Wescon Week. By arrangement with the museum and its director, George D. Culler, 20 entries chosen for Awards of Merit were installed in a main gallery for public viewing July 20 to August 20.

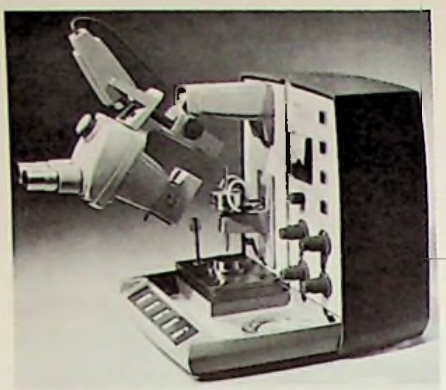
Entries to the Industrial Design competition were accompanied by 200-word descriptions of how the designer-engineer team sought to meet the principal judging criteria of "visual clarity of function, ease and safety of operation, and appropriateness of appearance," which were used to form a better impression of how better design fits with increased acceptance of electronic products on their markets.

A final judging during the museum showing will determine the five main awards to be made at the annual banquet August 22.

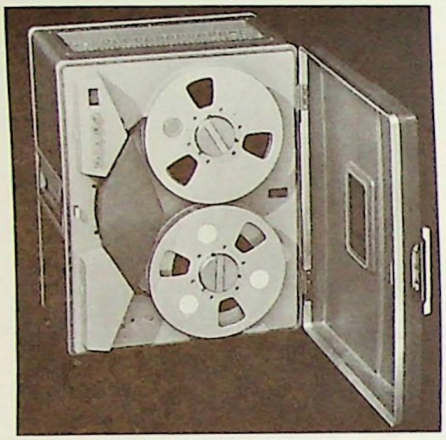
Hill said Culler and his staff had been considering formal attention to the role of industrial designers in a major segment of American industry and that the maturing of the Wescon ID program and its situation in San Francisco this year provided an ideal vehicle for a merging of interests.

As before, submissions must be components, instruments, or other electronic products which show evidence of original industrial design effort and which must have been marketed prior to June 1 this year.

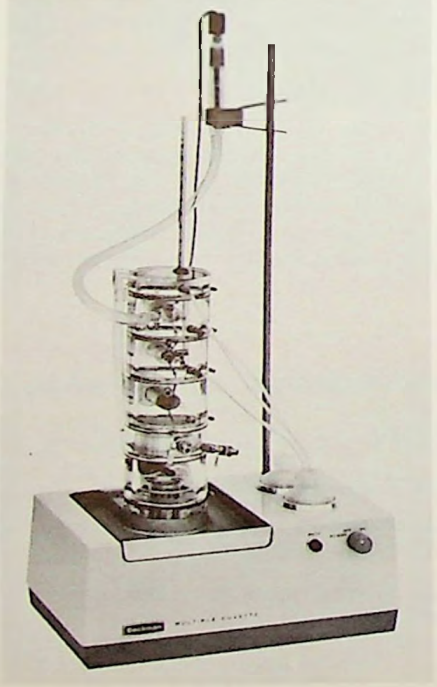
Immediately upon the close of the museum dates the exhibit will be moved to the Cow Palace and set up in the North Annex, which also will house the technical sessions, for the duration of Wescon week.



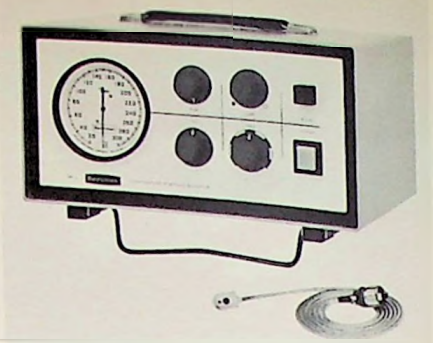
*Aerojet-General Corp. (commercial products division)—"microwelder" for welding extremely fine wires and ribbons without damage to either*



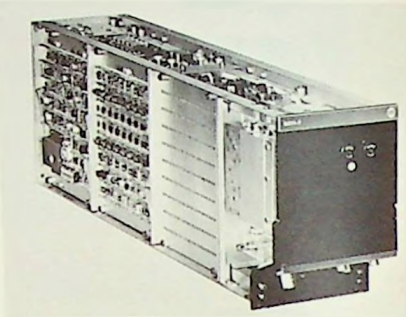
*Ampex Corp. (video/instrumentation division)—"portable recorder/reproducer" for field and laboratory applications*



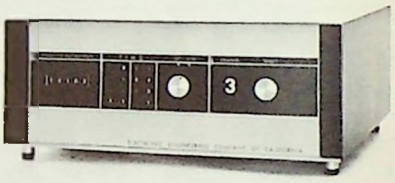
*Beckman Instruments, Inc. (Spinco division)—"multiple cuvette" to measure blood gas parameters and calibration of electrodes*



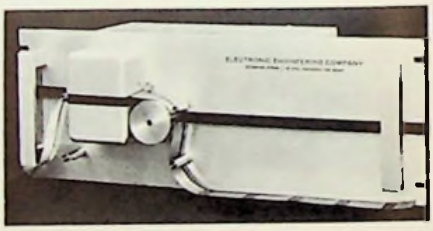
*Beckman Instruments, Inc. (Spinco division)—"continuous systolic monitor" designed to measure systolic blood pressure in humans by a pneumatic-electronic system*



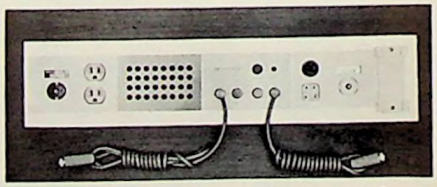
*Collins Radio Company — "Collins transponder" which provides a signal to reinforce radar replies*



*Electronic Engineering Company of California—"Datachron," a time clock for computers which reads out the time of day and records it under computer program control into a tape unit*



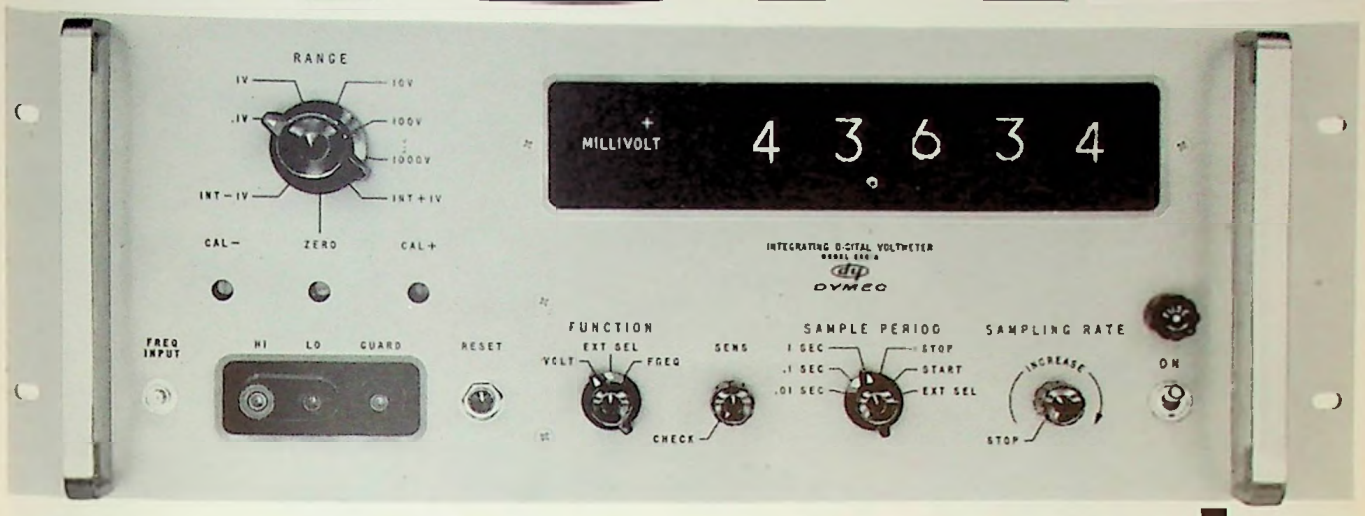
*Electronic Engineering Company of California—"photoblock tape reader" used in automatic checkout systems or in other systems using punched tape programming*



*Fisher Berkeley Corporation — "Ektacon nurse-call" for voice and light communications between nurses and patients in hospitals*

*(Continued on page 50)*

# MORE




# measurements

## LOW LEVEL DC and FREQUENCY

## with the DY-2401A Integrating Digital Voltmeter

Standard features of the DY-2401A include full scale 5 digit ranges of 1 volt and 100 millivolts with 300% overranging! Flip a switch and your DY-2401A becomes a 300 kc frequency counter, with period measurements available as a standard option. Floated and guarded input circuitry permits extreme measurement flexibility. All functions and ranges are programmable of course. These are a few of the reasons why the industry's first integrating digital voltmeter is the most useful.

The DY-2401A offers a broader measuring capability than any other digital voltmeter available today. And its guarded input and integrating operation permits measuring of the smallest signals . . . even in the presence of high common mode noise. Ten volts of common mode on the signal results in a mere one microvolt error, an unparalleled capability.

Accessory instruments include the DY-2411A Guarded Data Amplifier, which adds a 10 mv full scale range (again, with 300% overranging) while preserving the noise rejecting features. Input resistance is 10,000 megohms. The DY-2410A AC/Ohms Converter provides floated and guarded, broadband ac voltage and resistance measurements. Like the DY-2401A Integrating Digital Voltmeter, both accessory instruments are programmable by simple contact closures to ground.

Call your hp/Dymec field engineer today for complete data and for a demonstration in your plant.

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| DY-2401A | $3950 |
| DY-2410A | $2250 |
| DY-2411A | $1150 |

Data subject to change without notice. Prices f.o.b. factory.

*Don't miss seeing the Dymec Integrating Digital Voltmeter in operation at WESCON, Booths 2722-2723.*

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*A DIVISION OF HEWLETT-PACKARD COMPANY*

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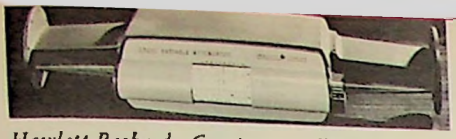
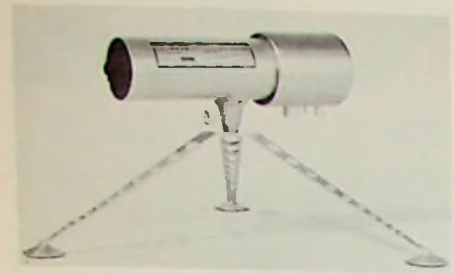


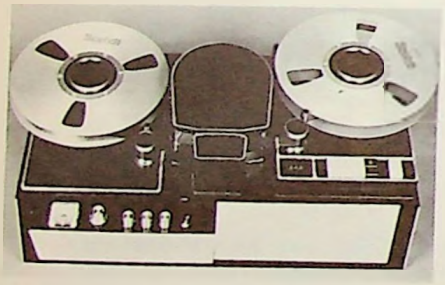
*Hewlett-Packard Company — "variable attenuator" used in precision microwave measurements*



*Hughes Aircraft Company (ground systems group)—"laser" which provides an intense source of monochromatic light for applications in welding, micromachining, photography, optical ranging, spectroscopy, and chemistry*

*International Business Machines Corp. (general products division)—"data communications system" which provides input data to processor from data source and processed output to required distant points*

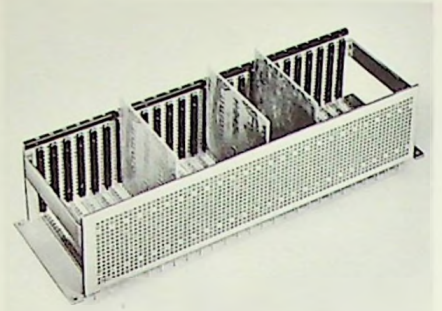
*Itek Corporation (Palo Alto division) — "single path viewer" to examine 70mm negative and positive transparent film*



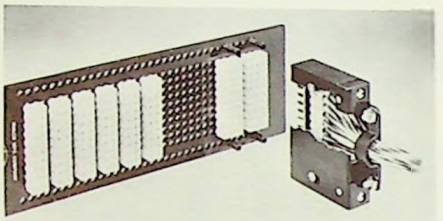
*Machtronics, Inc —"video tape recorder" to record and store audio and visual information for playback*

*Malco Manufacturing Company—"connector panel, wrapost assembly" for computer and electronic module packaging*

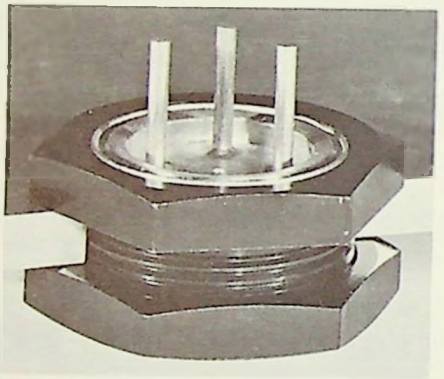
*Malco Manufacturing Company — "patchboard," a patch or jumper board for quick point-to-point program changes in system panels*



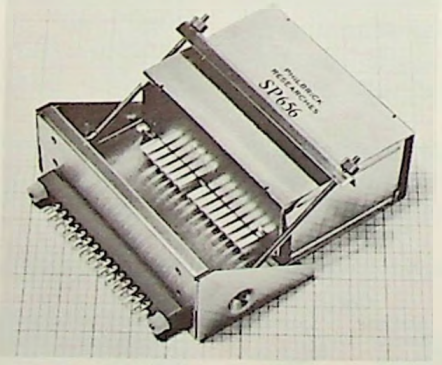
*Malco Manufacturing Company — "printed circuit card cage," a modular printed circuit card for electronic components*



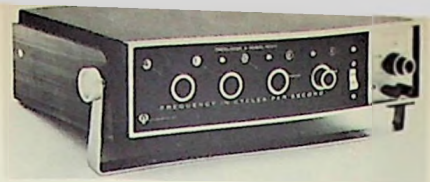
*Malco Manufacturing Company—"modular plug connectors" for interconnecting functions of electro-mechanical components*



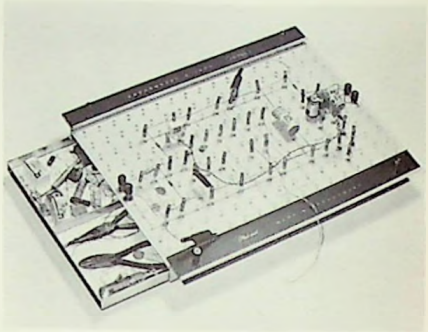
*Minneapolis-Honeywell Regulator Company (semiconductor products division)—"power transistor" for use in converters, regulators, and other high-current applications*



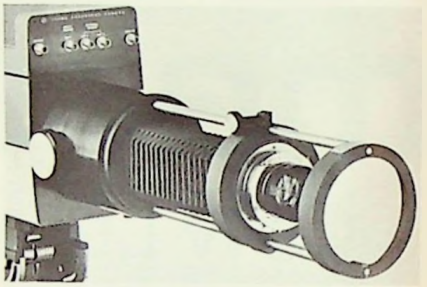

*George A. Philbrick Researches, Inc.—"universal stabilized amplifier" for applications in analog computing, measurement, control*



*Optimation, Inc.—"AF sine wave oscillator," an ultra-pure AF signal source for AC calibration, precision AC power applications, production testing, and general laboratory use*



*Phillips Control Company (Phillips-Eckardt Corp. division)—"circuit designer's 'breadboard'" which allows the electronic engineer to build and test preliminary circuits quickly and without soldering*

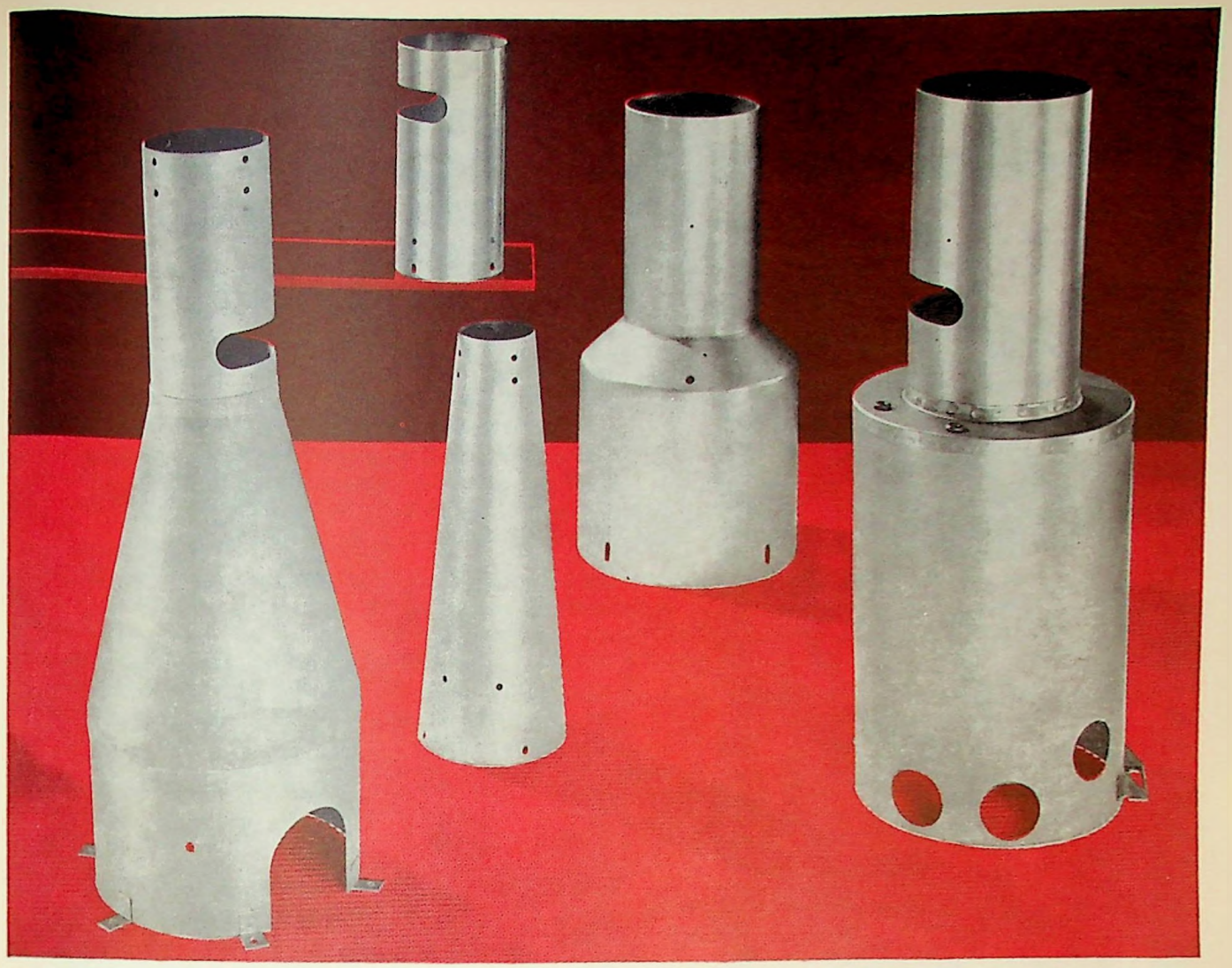


*Space Technology Laboratories (STL products division)—"STL lens extension mount" which permits the STL image converter camera to utilize special lenses with focal lengths of 10 and 15 inches*

*Space Technology Laboratories (STL products division)—"STL rubidium frequency standard," an atomic frequency standard used for laboratory calibration and systems*

*Spectra-Physics, Inc. — "gas laser" used in laboratory investigation of coherent light in communications and interferometry*

*(Continued on page 54)*



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# . . . MATERIALS, SHAPES AS REQUIRED

What material will provide the permeability required to shield cathode ray tubes or other equipment in your designs from external magnetic fields? What gauge? What shape? What drilling or other mechanical work will be required? What is the intensity of the field? Does it vary? All these and more are prime factors in the complicated science of magnetic shielding.

Arnold's Pacific Division has complete facilities for the engineering, production and heat treatment of the complex fabricated shapes required to shield vital equipment.

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Modern furnace equipment is also available to heat treat these materials in carefully controlled hydrogen atmospheres, maintained at very low dewpoint levels. Annealing cycles producing the highest possible permeability are used for each material.

● Check the Arnold Pacific Division—your only source of *quality* magnetic materials west of the Rockies—for the solutions to your magnetic shielding problems. *Let our staff help you work them out.*

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Melabs

# MICROWAVE COMPONENTS

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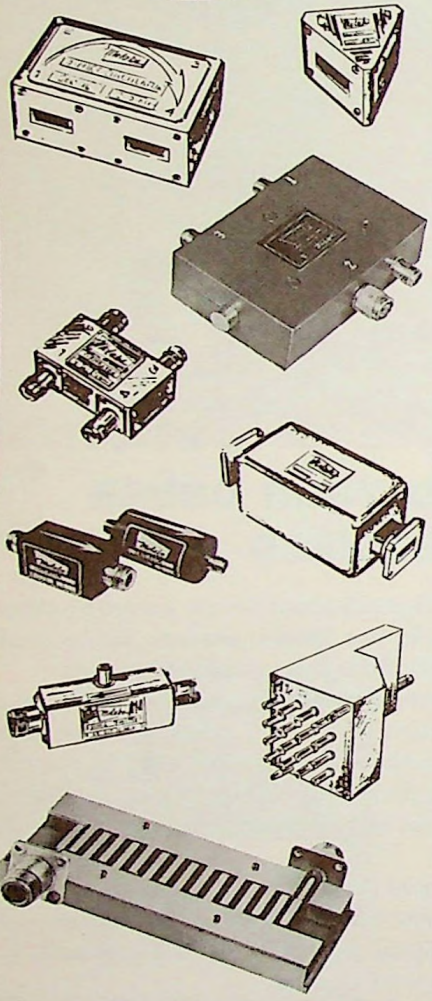

MELABS offers the dependability of wide experience, regularly produces—in **quantity**—more than 130 catalogued items encompassing over 20 different component categories! Many of these standard MELABS microwave components—ferrite circulators for parametric and tunnel diode applications and interdigital filters for example—are wholly outstanding, have performance characteristics which are pace setting in the industry.

For fast delivery on special customer requirements, MELABS can save time and engineering costs by referring to hundreds of standard designs from 50 mc to 70 Gc, each already well proved. In addition, a large stock of standard parts is maintained at all times. It is frequently possible to use this stock to advantage in speeding up delivery on production quantity orders to customers specifications.

Put MELABS high on your list of microwave component suppliers.

**FERRITE** CIRCULATORS - - - ISOLATORS - - - SWITCHES - - - MODULATORS - - - PHASE SHIFTERS - - - MULTIPLEXERS

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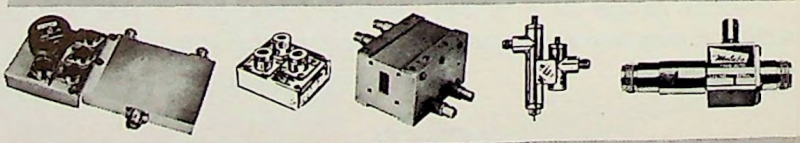
**SQUARE WAVER,** AMPLITUDE MODULATOR

**COAXIAL DC BLOCKERS**

**BROADBAND COAXIAL MIXERS**



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Melabs

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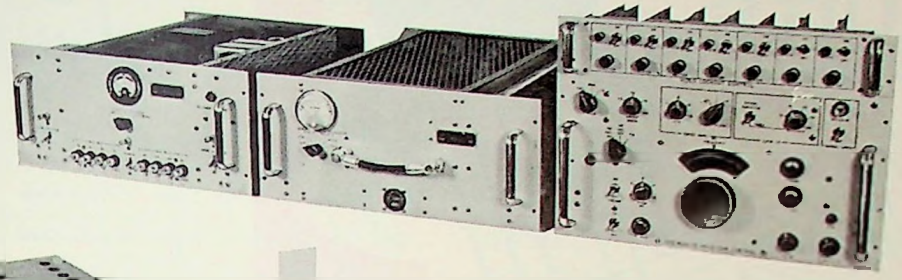
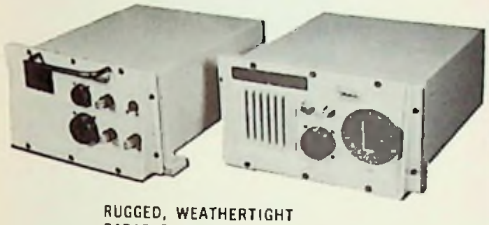
# Melabs MICROWAVE EQUIPMENT



PAN/MAN/SIG-SEEK RECEIVER

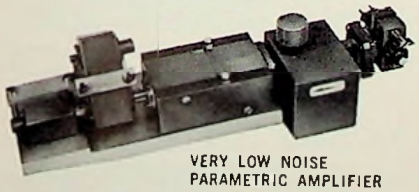
CRYSTAL VIDEO RECEIVER



RUGGED, WEATHERTIGHT RADAR PARAMETRIC AMPLIFIERS

MILLIMETER WAVE CALORIMETER

AIRBORNE TWT AMPLIFIER



VERY LOW NOISE PARAMETRIC AMPLIFIER

MELABS offers a comprehensive line of equipment for applications involving spectrum search and monitoring, microwave communications, radiometry and for general laboratory use.

Melabs **PANORAMIC/MANUAL/SIGNAL-SEEKING RECEIVERS** utilize electronic tuning and include many automatic features for spectrum search and monitoring. Models in octave and waveguide bandwidths cover 300 mc to 40 Gc.

**UHF PANORAMIC/MANUAL** RECEIVERS provide similar functions for spectrum monitoring in the 250 mc to 1 Gc range.

**LAB-CVR** new, versatile, high sensitivity receiver (packaged without L.O.) continuous coverage 0.5 to 10 Gc. Useful in monitoring, measuring, spectrum analysis and general purpose applications involving AM and FM measurements over a 100db range. Typical sensitivity, —125 dbm, 1 kc modulated signals.

**CRYSTAL VIDEO RECEIVERS** are lower priced units suitable for use where high sensitivity is not required. Octave bandwidth models cover 1 to 8 Gc.

**RADIOMETRIC RECEIVERS** can be supplied in high sensitivity models which incorporate the latest radiometry techniques. Units have been built at 1.4, 3 and 35 Gc.

**PARAMETRIC AMPLIFIERS** in ultra-low-noise designs including **wide-band** (10-20%) and **narrow band** (remotely tuned) versions. Pole mounted packaging optional. Range 1 to 6 Gc.

**TWT PREAMPLIFIERS—low noise types** in rack and pole mounting designs, 1 to 18 Gc. Optional features include Bandpass Filtering, Instantaneous AGC. Mil Spec models can be furnished.

**FALLING RASTER STORAGE DISPLAYS** **FREQUENCY METERS**

**CALORIMETERS.** Four available models cover 50-140 Gc.

LAB-CVR, LABORATORY RECEIVER

FALLING RASTER STORAGE DISPLAY

35 GC RADIOMETER

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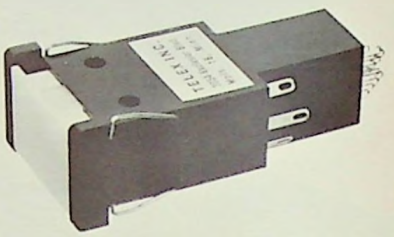
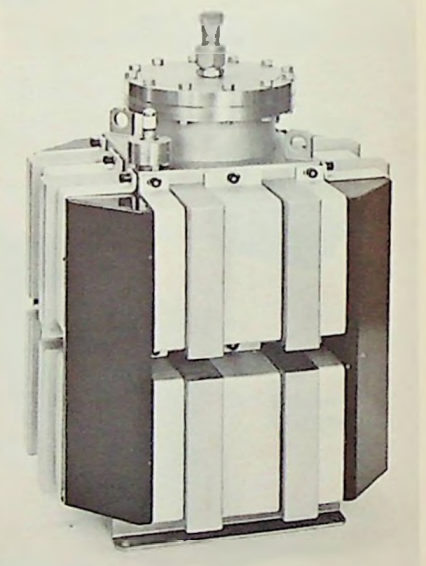
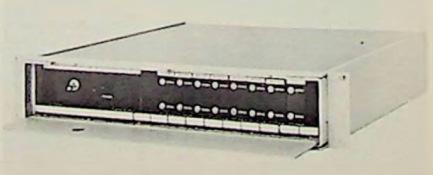
*Telex Corporation (Telex/Acoustic products division)—"amplified headset," an integral headset and amplifier for language laboratories*



*Telex Corporation (Telex/Acoustic products division)—"pushbutton display switch," an 8-pole pushbutton switch with four lights*



*Ultek Corporation—"Ultek ion pump," a vacuum pump for beam gun, space simulation, and thin-film deposition*



*Vidar Corporation — "voltage-to-frequency converter" used in various data-acquiring systems and industrial process control systems*


# WHY A NEWS MEDIUM IN A TECHNICAL FIELD?

Because it does a job that needs to be done—and nothing else can do it!

The electronics industry is noted for its multitude of technical magazines. These journals have elected to address themselves, almost exclusively, to but one face of the industry's multi-faceted interests. They offer a variety of technical dissertations and signed articles, reflecting months of preparation, complemented by an assortment of new product releases.

This is valuable editorial fare for a technical industry and frequently offers adaptable ideas and graphic aids that simplify complex engineering tasks.

But it is not, by any means, the complete answer to the industry's diverse needs.

Such an editorial approach makes no attempt to satisfy the real need for up-to-the-minute technical and business news, so vital to an industry like electronics whose technology is in a constant state of flux.

Electronic News, on the other hand, is specifically designed to do just that!

In the technical area, it renders a unique service to the engineer. By reporting technical news and developments, immediately—by briefly reporting their very existence, through what process of research and development they evolved, and for what potential applications they are destined–this news medium has spoken volumes to the experienced engineer.

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But Electronic News does not stop there. It goes on to deal with more of the informational needs of the industry. It brings news from Washington to an industry heavily involved with the biggest customer of them all, the U.S. Government. It brings news from Wall Street to an industry alive to considerations of profit and loss and competing for adequate financing. And it brings news from abroad to an industry competing with foreign firms and contemplating the effects of what may be a big competitor, the European Economic Community. News of vital interest to the people involved in that industry.

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## IT IS REPORTED:

**Brill Electronics** of Oakland, the West's largest independent electronic parts wholesaler, has announced the opening of a new Peninsula division facility in Mountain View occupying 16,000 square feet of space for warehousing and sales-service. William Wheeler, vice president - marketing will direct sales at the new location, and Frank Landefeld, veteran Brill employee and experienced industrial electronics man, will serve as manager.

**Meyer Leifer** has joined Radiation at Stanford as vice president-operations with responsibilities including the R-F systems, optical systems, products, magnetic components, and production divisions. Prior to joining the firm he was director of Sylvania's systems engineering and management organization (SEMO) in Waltham, Mass., chief engineer of Ampex's video and instrumentation division, and general manager of Sylvania's microwave device division. He is a past chairman of the San Francisco Section, a past director of Wescon, and a fellow of IEEE.

**Ostrander Associates**, Palo Alto professional and technical placement agency formerly operated by Mr. and Mrs. Montgomery Ostrander, will continue operation under the direction of Mrs. Ostrander and E. Jack Shannahan, former personnel manager of Sylvania WDL, Mountain View. Mr. Ostrander's death in June saddened the Bay Area electronic community.

*Huntley* *Oltman*

*Elspas* *Cooper*

*Mrs. Margaret Paull, left, executive secretary with the Hewlett-Packard Company, Palo Alto, is the newly elected president of the Women's Association of the Electronic Industry, a group of 105 women representing Peninsula electronic firms. Presenting Mrs. Paull with the WAEI presidential gavel is the retiring president, Mrs. Marie Cieslak of Eichorn & Melchior, Inc., San Carlos.*

### 14/3 THE POTENTIAL OF TECHNIQUES USING COHERENT LIGHT DIFFRACTION

W. H. HUNTLEY, JR.
*Stanford Electronics Laboratories*
*Stanford, California*

Constructing scale models of giant antenna arrays and "instantaneous" measurement of radar-target tangential velocity are typical problems that may be solved by using coherent light diffraction effects. While coherent light offers exciting prospects for extension of conventional microwave techniques, the new relationship between wavelength and physical object size permits entirely new approaches to electronic systems design.

Several problem areas have been investigated, and the two mentioned above have been selected to illustrate some unexpected potential of these new techniques. This paper also suggests some interesting aspects of photography as a data mechanism for coherent light measurements.

### 14/4 A 2 MM (NON)-CONFOCAL RESONATOR FOR USE AS A WAVEMETER OR FILTER ELEMENT

GEORGE OLTMAN
*Space Technology Laboratories*
*Redondo Beach, California*

A confocal resonator has been built following Zimmerer for the 2 mm waveguide band. The Q of the resonator is very high yielding sharp tunable resonances which are ideal for use as a wavemeter. Further, the observed resonant lengths agree to within 1/10% of the generalized confocal resonator theory developed by Boyd and Kogelnik. This eliminates the necessity of a known calibrating frequency, and allows calibration of the wavemeter directly from the physical dimensions. Formula are given for the average guide wavelength in the operation region.

When used as a filter element the resonator offers a high Q, a simple technique for coupling to adjacent resonators and a simple method of trimming frequency.

Detailed comparison has been made between theoretical and experimental values of resonant lengths and average guide wavelength of the fundamental and higher order modes. The agreement is excellent. Relatively large disagreement exists though in confocal length. The observed confocal distance is shorter by 1% than the true confocal distance. This, however, has a negligible effect on the resonant lengths of the fundamental mode (<1/20% total error) and only a small effect on the highest order mode observed. In use, these higher order modes would be eliminated by selective absorption. The field has been probed to determine the nulls of the transverse modes and compared with the theoretical nulls.

## SESSION 15

### FUTURE ENGINEERS SYMPOSIUM

*Thursday, August 22,*
*10:00 A.M.-12:30 P.M.*
*COW PALACE – ROOM E*

## SESSION 16

### DATA CODING & SWITCHING THEORY

*Friday, August 22, 10:00 A.M.-12:30 P.M.*
*COW PALACE – ROOM A*

Session Chairman:

BERNARD ELSPAS
*Stanford Research Institute*
*Menlo Park, California*

### 16/1 PERFORMANCE OF ORTHOGONAL AND BI-ORTHOGONAL CODES UTILIZING SUB-OPTIMUM DETECTION TECHNIQUES

R. MARQUEDANT, H. HODARA
*The Hallicrafters Company*
*Chicago, Illinois*

Optimum demodulation of orthogonal and bi-orthogonal codes require $2^n$ correlators at the receiver, where n is the number of bits in a word. The correlators are followed by a decision device which examines all correlator outputs and selects the word corresponding to the largest output. This type of detection, known as maximum likelihood detection, can be shown to be optimum in that the probability of error is minimized; unfortunately, as n increases the receiver complexity increases exponentially.

This paper describes a technique of sub-optimum detection based on reducing receiver complexity at the expense of error probability, the error probability still being below that of uncoded systems. This technique employs multi-leveled messages stored at the receiver which are cross-correlated with the received messages, thereby reducing the number of required correlators.

Curves of word error probability versus signal-to-noise energy ratio are determined and show the trade-off between receiver complexity and size performance.

### 16/2 A DECOMPOSITION RESULTING IN LINEARLY-SEPARABLE FUNCTIONS OF TRANSFORMED INPUT VARIABLES

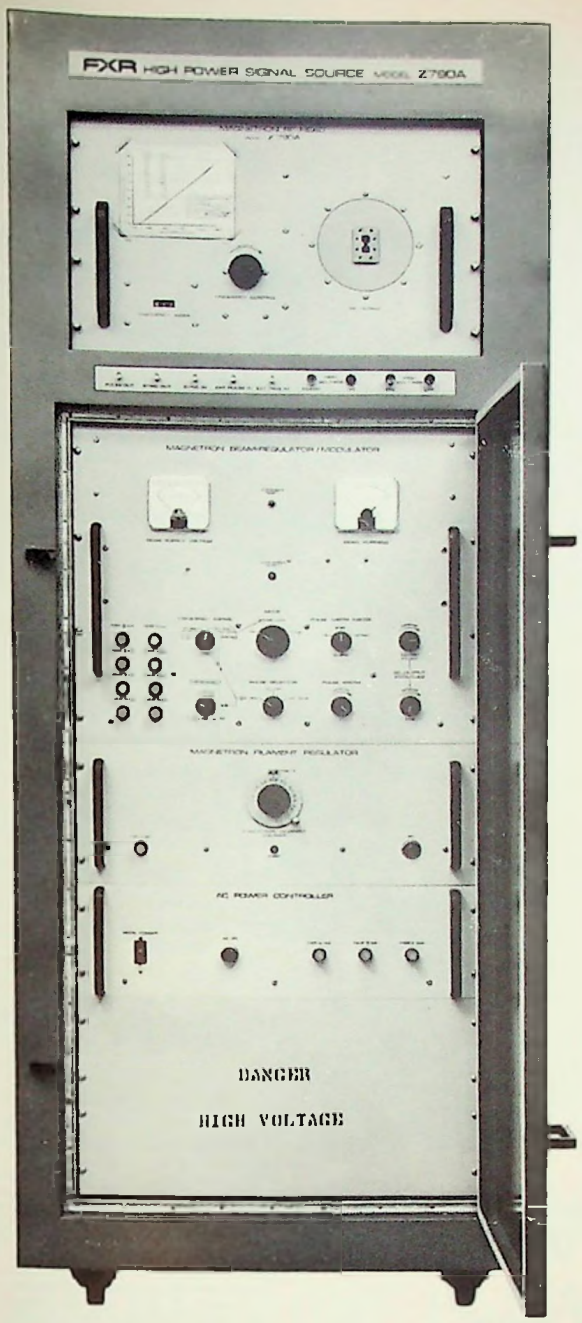
JAMES ARLIN COOPER
*Stanford University*
*Stanford, California*

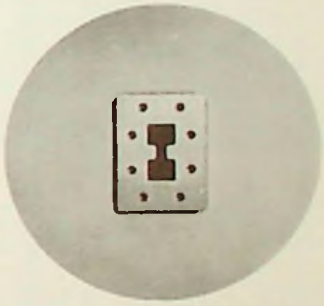
A decomposition yielding linearly-separable functions of transformed (module two) input variables is analyzed by orthogonal expansion. A design technique is given which determines the transformation required to achieve separability, and places constraints on the weights required.

The procedure can be applied to all functions whether completely specified or not. Incompletely specified functions are handled by a "partial" expansion technique which efficiently assigns values to all unspecified combinations.

It is shown that all n-variable functions can be realized as linearly-separable functions of m ≤

*(Continued on page 58)*



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FXR's new Z790A signal source is RF-tight. No stray radiation to interfere with precision measurements, thanks to full wrap-around RF shielding.

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Extras? Well there's the full-size RF-tight rear door for easy access to all components, complete interlocking and overload protection, monitoring lights and meters, modular construction and a mobile cabinet.

Ed McDonald, our product planner, will be glad to supply you with the complete specs and, if you'd like, set up a demonstration. Call him at FXR, 25-26 50th St., Woodside 77, N. Y.

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**Varian Associates'** Palo Alto tube division offers a new booklet written for engineers and technicians who operate and maintain equipment using power klystrons, "Introduction to Klystron Amplifiers."

**Jerome M. Kelley** has been named manager of advertising and public relations for the Litton Industries electron tube division, San Carlos, Calif.

**Components for Research,** Palo Alto manufacturer, has appointed White & Co., Palo Alto, as representative for the Bay Area.

*Newcomb*

*Schott*

*Liou*

*Van Trees*

formed variables ($m<2^n$), and that most functions of four variables or less can be realized as linearly-separable functions of n transformed variables.

The applications of the decomposition is designning redundant circuitry and general threshold networks are discussed.

### 16/3 PERFORMANCE OF HAMMING CODES


R. G. MARQUART, J. C. HANCOCK
*Purdue University*
*Lafayette, Indiana*


A family of formulae are developed, valid for code lengths $n=2^m-1$, m a positive integer, giving the exact error rate at the decoder output for Hamming SEC codes and, for lengths $n = 2^m$, for Hamming SEC/DED codes. For these latter codes, another family of functions are derived giving the probability that a received binit was contained in a word uncorrectably detected as in error.

A criterion of code merit is postulated, and comparisons of estimates of system values based on this merit to similar estimates derived from the word error rate are made.

Graphs of numerical values calculated from these formulae for codes up to 511/512 binits long are presented. Ranges of channel error probability over which each code length is optimum for its type are derived and tabulated.

### 16/4 ON BINARY DATA TRANSMISSION ERROR RATES DUE TO COMBINATIONS OF GAUSSIAN AND IMPULSE NOISE


LEONARD R. HALSTED
*University of Michigan*
*Ann Arbor, Michigan*


Error rates are computed for a binary data transmission system subject to both Gaussian and impulse noise. The results are plotted as graphs of the probability of error versus $\lambda T$ where T is the signal duration and $\lambda^{-1}$ is the average time between noise impulses. These graphs display, for systems subject to impulsive interference, the reduction in error rate that can be realized by the use of a signal having a large time-bandwidth product. The use of orthogonal signals to simultaneously transmit n bands is discussed. This permits the realization of large time-bandwidth products without reduction of the data rate or utilization of additional bandwidth.

Poisson distributed impulse noise and periodically recurring noise pulse clusters are considered. Error rates are computed for cases in which 2%, 5%, 10%, 30%, 50%, and 100% of the total noise power is impulse noise power, and for signal-to-noise ratios that would give error rates of $10^{-1}$, $10^{-3}$, $10^{-6}$, and $10^{-7}$ if the noise were 100% Gaussian. A linear receiver whose output is a sequence of sampled values is assumed and the variance of the output due to the impulse noise is related to the impulse noise power. The distribution of the receiver output is considered as (1) a mixture of normal distributions and (2) a mixture of normal and non-normal distributions. The basis for making these assumptions is discussed and the results are compared. Examples are given of the use of the error rate curves and of the increase in transmitted energy per band necessary to provide the same reduction in error rate as a given increase in the time-bandwidth product of the signal.

## SESSION 17

### NON-LINEAR CIRCUITS AND SYSTEMS

*Friday, August 23, 10:00 A.M.-12:30 P.M.*
*COW PALACE — ROOM B*

Session Organizer:
R. W. NEWCOMB
*Stanford University*
*Stanford, California*

Session Chairman:
GEORGE D. SHOTT
*Lockheed Missile & Space Co.*
*Sunnyvale, California*

### 17/1 NONLINEAR SYSTEMS ANALYSIS AND SYNTHESIS


MING-LEI LIOU
*Stanford University*
*Stanford, California*


The functional power series is used to describe special class of nonlinear systems which consists linear time-invariant subsystems and zero-memo nonlinear devices. The combination of these s systems and devices can be manipulated by me of system operators. The multi-dimensional Fou transform is used to synthesize nonlinear syste for arbitrary input functions. A systematic sy thesis method of nonlinear systems is presente Linear time-invariant subsystems and zero-memo nonlinear devices can be extracted alternative from both the input and output sides of the n linear system by examining specific relations among the system transforms. A table of simi nonlinear feedback systems with corresponding s of system transforms is given to facilitate the sy thesis of nonlinear systems with feedback. Ot synthesis techniques using orthonomal systems a zero-memory nonlinear devices are also presente for certain classes of input functions. The syste performance can be improved by introducing n linear compensating elements with feedback, und certain constraints. A method of solving ordina nonlinear differential equations is developed facilitate the analysis of nonlinear feedback sy tems. Examples are given throughout the paper illustrate the various aspects.

### 17/2 FUNCTIONAL TECHNIQUES FOR THE ANALYSIS OF THE NONLINEAR BEHAVIOR OF PHASE-LOCKED LOOPS


HARRY L. VAN TREES
*Massachusetts Institute of Technolo*
*Cambridge, Massachusetts*


In this paper we consider the analysis of a n linear feedback system. The purpose of the pa is twofold.

The first objective is to demonstrate the efficien of the Volterra functional expansion technique a method of analyzing nonlinear feedback syste

*(Continued on page 60)*

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*accessory notes*

## THE SQUARED TRIANGLE

IEEE membership buttons are now available for purchase from national headquarters and may be ordered on blue forms from your section headquarters.

The prices and colors are: Fellow (gold), $5.50; Senior Member (dark blue), Member (light blue), and Associate (red), all $4.40; and Student (green), $1.00.

Students elected to IEEE membership January 1, 1963, and thereafter receive a button at no charge. Students elected to membership prior to that date may purchase a button for $1.00.

*Foster*

*Linvill*

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The techniques we demonstrate are valid for a large class of nonlinear systems. Several important advantages of the functional approach are as follows:

(1) Random and deterministic inputs and disturbances are included.
(2) All input-output relationships are explicit. One does not have to solve complicated differential equations.
(3) Once one becomes facile with the properties of the expansion, the analysis of any particular nonlinear system is rapid and straightforward.

The second objective is to obtain some new and useful results for a device of practical importance. The particular nonlinear system that we will use as an example represents a phase-locked loop whose input signal is a phase-modulated sinewave which has been corrupted by additive noise. Two interesting cases of phase modulation are considered. In the first case the phase, $\theta_1(t)$, is a deterministic function. In the second case the phase, $\theta_1(t)$, is a sample function from a random process.

The results are presented as closed form analytic expressions. Several interesting cases are plotted as a function of the significant parameters.

### 17/3 FREQUENCY TRANSIENTS IN SYNCHRONIZED OSCILLATORS


T. M. WHITE, W. B. JONES

*Georgia Institute of Technology*
*Atlanta, Georgia*


Prior work on the synchronization of sinusoidal oscillators, which has considered the conditions under which synchronization can occur and the transient behavior of the oscillator as it becomes synchronized, is reviewed. These analyses of transient behavior are concerned primarily with estimates of the time required for the oscillator to become synchronized.

The work of Labin on the phase transient in a phase-lock loop is extended to describe the instantaneous frequency transient which results from the sudden application of a synchronizing signal to an oscillator. Special attention is given to the effect of the initial phase difference between the oscillator signal and the synchronizing signal. The results of the analysis are applicable to a wide variety of synchronized oscillators and phase-locked oscillators.

Experimental verification and some applications of the results of the analysis are described.

### 17/4 THE FREQUENCY RESPONSE OF A BI-STABLE OSCILLATING CONTROL SYSTEM


W. C. FOSTER

*Douglas Aircraft Company, Inc.*
*Santa Monica, California*


A graphical method for finding the frequency response of a bi-stable oscillating control system is presented. In this method, the bi-stable element is replaced by its dual input describing function (DIDF) and thereby acts as an amplitude-dependent gain term. Using the DIDF, the effect of a sinusoidal input signal upon the limit cycle amplitude and stability is discussed. The graphical procedure for finding the frequency response of the system for a sinusoidal input is then presented in a step-by-step discussion. The resulting frequency response is in the form of a family of Bode plots for various values of input signal amplitude.

To demonstrate the scheme, the frequency response of a bi-stable switching amplifier is calculated. The frequency response found by this analytical method is shown to be identical, within the accuracy of the measuring instruments, to data obtained experimentally from an actual hardware amplifier.

## SESSION 18

### SOLID-STATE ELECTRONICS

*Friday, August 23, 10:00 A.M.-12:30 P.M.*
*COW PALACE – ROOM C*

Session Chairman:

JOHN G. LINVILL
*Stanford University*
*Stanford, California*

### 18/1 ELECTROLUMINESCENT INSTRUMENT DISPLAYS


W. BROOKS

*Lockheed Missiles & Space Company*
*Palo Alto, California*


Recent developments in materials and fabrication techniques permit development of unique display systems. EL techniques permit the display to be in form producible by graphic arts techniques. Full advantage can be taken of the human factors in designing the display system.

Specific examples are given of EL displays developed with the aid of human engineering. A bar graph type meter unit will be described which can perform the functions of a moving coil instrument. Advantages of this type of display will be described which include complete control of scale factor. Instruments with linear, log, or nonlinear scales are easily produced. Any instrument may have a combination of scales desired. EL displays of sufficient brightness can be made which can be read at a distance of 20 feet under normal control room light intensity.


Work supported by IMSC Independent Research and Development Program.


### 18/2 DESIGNING TRANSISTORS FOR OPTIMUM HIGH FREQUENCY OPERATION


J. GERARD F. BOUCHARD

*Sprague Electric Company*
*Concord, New Hampshire*


Design equations to optimize the high frequency gain and noise figure of transistors are derived from physical structure and bias conditions. In this analysis are included the effects of basewidth modulation and collector time constant. It is shown that


*(Continued on page 62)*

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## OCTAVE AMPLIFIERS

Utilizing multi-pole networks to achieve maximum bandwidth, LEL provides Octave amplifiers with more power, greater dynamic range and better VSWR for such field and laboratory applications as surveillance radars, spectrum analyzers, high definition radars, multiplexing systems and broadband communications systems.

Designed for operation under the most difficult environmental conditions, the units feature hard soldered, partitioned, gold-plated chassis and are available as amplifiers only or rack mounted with low heat, solid-state regulated power supplies.

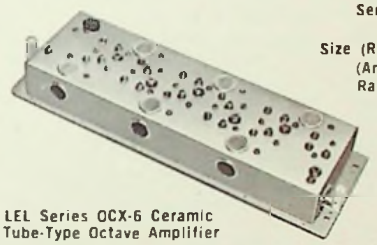
**SPECIFICATIONS**

| | |
|---|---|
| Range | from 40 Mc to 1000 Mc |
| Ripple | 1 db max. |
| VSWR, Input 1.5; Output | 2.0 |
| Noise Figure | 4 to 10.5 (dependent on $f_o$) |
| Impedance, Input and Output | 50 OHMS |
| Linear Output Typical for 100 Mc BW | 1 volt (OMX-4-100) |
| Maximum Output | 5 volt (OMX-4-100) |
| Primary Power (Rack Mounted) | 117 VAC ±10% |
| Power Requirements | |
| Series OMX | 150V ± 1%<br>6.3 ±0.2V |
| Series OCX | 200V ± 1%<br>6.3 ±0.2V |
| Size (Rack Mounted) (Amplifiers Only) | 19"L x 12"W x 5¼"H |

Range from 5¼"L x 3½"W x 1¾"H (OCX2-160) to 11¼"L x 3"W x 3⅛"H (OMX5-160)

Rack Mounted Units Designated OMP or OCP


LEL Series OMX-5 Conventional Tube-Type Octave Amplifier

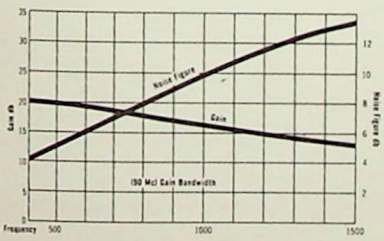

LEL Series OCX-6 Ceramic Tube-Type Octave Amplifier

## RF AMPLIFIERS

Series RC


Rack Mounted RF or Octave Amplifier with Power Supply

The LEL Series RC low noise linear RF amplifiers are rugged compact units of wide dynamic range. Broad bandwidth (100 mc) units deliver 80 mw power output for frequencies up to 1.5 Gc and narrow band units are capable of power outputs greater than 200 mw.





LEL Model RCX-3 Low Noise RF Amplifier

**SPECIFICATIONS**

| | |
|---|---|
| Frequency Range | 400—1500 Mc |
| Bandwidth (Typical) | 50 or 90 Mc |
| Noise Figure | see graph |
| Power Output | >80 MW |
| Bandpass Ripple | ± 1 db |
| Input & Output Impedance | 50 ohms |
| VSWR Input | < 2 to 1 |
| Primary Power (Rack Mounted) | 117 VAC ±10% |
| Power Req. | 200 VDC @ 45 Ma<br>6.3 ±0.2V |
| Weight Approx. | 19 oz. |
| Dimensions | 6"L x 1¾"H x 2¾"D |

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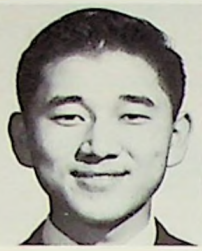
*ptgvc notes*

**PAPERS CALL**

August 15: 50-word abstracts for preliminary review for PTGVC technical session, IEEE International Convention. 500-word summaries sent by October 1. E. W. Borden, AT&T, 195 Broadway, New York 7.

*Delord*

*Hutchins*



*Kuno*

*Seeley*

*Blasi*

a given set of boundary conditions, which are dictated by the application and the fabrication technology, there is only one combination of design variables which can yield the optimum high-frequency performance. Separate analysis are presented—one for low noise, low power devices and the other for high efficiency high power devices. This paper includes p-n-p as well as n-p-n devices and it is shown that in some applications a p-n-p device will have higher gain and lower noise figure. The equations derived are compared with performance obtained with some of the best devices presently available.

### 18/3 UNIVERSAL MODEL FOR SEMICONDUCTOR DIODES SWITCHING CHARACTERIZATION

H. JOHN KUNO

*The National Cash Register Company*
*Hawthorne, California*

A new charge control model of p-n junction diode is introduced in which forward current $I_F$ and reverse current $i_R$ are related to the charge Q stored in the base region by time constants $\gamma_F$ and $\gamma_R$, respectively. Reverse switching transient is analyzed for normal switching operation where constant current phase (storage phase) and decaying current phase exist, and for overdriven switching operation where no constant current phase exists.

New switching time equations are derived. The equations are expressed in terms of measurable device parameters $\gamma_F$, $\gamma_R$, and $C_j$; external circuit variables $I_F$ and $I_R$; and external circuit parameter R. The proposed model is applicable to p-n junction diodes of any type.

Experimental results using various types of diodes are also reported. It is shown that the comparison of the experimental results with the theory are in very good agreement.

### 18/4 SOLID-STATE ELECTROMETER USING M-O-S DIODES

THOMAS B. HUTCHINS, JEAN F. DELORD

*Tektronix, Inc.*
*Beaverton, Oregon*

A diode having nearly optimum characteristics has been designed and fabricated for application in an experimental electrometer. These diodes are metal-oxide-silicon structures where silicon dioxide acts as a dielectric barrier between a metal (usually gold) and silicon. This barrier permits a high capacitance versus voltage ratio as well as very low leakage characteristics. Capacitance change rates as high as 1200 pf./volt have been built with conduction below $10^{-10}$ amperes. These diodes are designed to achieve this change rate when passing through zero bias.

An experimental electrometer using these M-O-S diodes has been designed and built. The circuit is in the form of a balanced ratio transformer bridge. This system permits thermal stability and low level, high impedance, single ended or differential voltage measurements. Some unique features of this circuit/diode combination are discussed as well as stability and noise performance.

## SESSION 19

### ANTENNA ARRAYS II

*Friday, August 23, 10:00 A.M.-12:30 P.M.*
*COW PALACE — ROOM D*

Session Chairman:

EMMANUEL A. BLASI
*Lockheed Missiles & Space Compan*
*Sunnyvale, California*

### 19/1 VLF SUPERDIRECTIVE ARRAY

E. W. SEELEY

*U. S. Naval Ordnance Laboratory*
*Corona, California*

The characteristics of a three-loop superdirecti antenna array are presented. This type of arr appears to have many desirable qualities and th usual detrimental characteristics associated wi superdirectivity, narrow bandwidth and increas losses, are minute at VLF. It is shown that th directivity is greatest (narrowest beamwidth an highest front-to-back lobe ratio) and the positio of the back lobes and nulls are most stable whe closely spaced loops are used. The bandwidth al becomes very large when closely spaced loops a employed. The proximity of the loops is limited b inequalities in signals from the individual loop which tend to obscure the nulls. In addition, th effective height is reduced for close loop spacing

### 19/2 FORESHORTENED LOG PERIODI DIPOLE ARRAY

CLAES T. ELFVING

*Sylvania Electronic Systems-West*
*Mountain View, California*

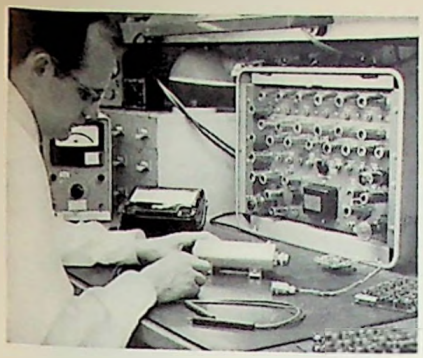
This paper describes the development of a co stant width log periodic dipole array with indu tively loaded radiating elements. A varying amou of inductive reactance is introduced to the equa length elements, resulting in elements of varyi electrical lengths on the structure for broad ban operation. When maintaining a constant elemen spacing-to-electrical length ratio and compensati for the increasing Q of the loaded element by in creasing the density of the elements, or the desig ratio, $\tau$, good experimental results have been ob tained from antenna models with element for shortenings up to two-to-one.

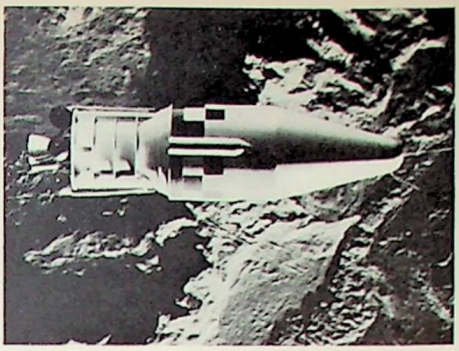
An expression for the varying design ratio, is developed, the approximate amount of induct reactance necessary for a given amount of elemen foreshortening is shown, and an experimental mod and data are described.

The log periodic dipole array, developed b D. E. Isbell, is a pseudo-frequency independe antenna. It is a linearly polarized, medium ga antenna capable of operating over a very lar frequency band with essentially constant perform ance characteristics.

Detailed descriptions of the log periodic dipo array have been published in the past and wi not be repeated in this paper. It will suffice t mention here that the frequency band of operati of the antenna is limited only by the detail of co struction at the small, high frequency end of th

*(Continued on page 64)*





Here, at Lockheed Missiles & Space Company's Space Communications Laboratory, scientists are re-investigating the possibility of using the moon to facilitate earth communications. Possibilities for the use of the moon as a relay station for earth-to-earth communications have been largely neglected because the moon's shape and rugged surface greatly distorted a return signal. But Lockheed research into the extension of communications on difficult communication channels, using techniques applicable to dispersive time variant channels, is making significant inroads into this problem.

Another area receiving intense study at Lockheed is satellite tracking of deep space probes. Since tracking accuracy depends greatly on stations being as far from each other as possible, while retaining line-of-sight communications, Lockheed is studying the use of two earth-orbiting satellite tracking stations, 8000 miles apart. Not only would great accuracy be gained by the separation, but it would be further enhanced by the positioning of the stations above the earth's atmosphere, thus eliminating atmospheric distortion.

Examples of other research projects being pursued by Lockheed in the communications area include: Random multiplexing, satellite readout techniques, scatter communications, radar mapping, submarine tracking, modulation of optical energy, communications over multipath channels, and learning systems.

***LOOK AT LOCKHEED... AS A CAREER***

Consider Lockheed's leadership in space technology. Evaluate its accomplishments—such as the Polaris missile and the Agena vehicle's superb record of space missions. Examine its outstanding advantages—location, advancement policies, creative climate, opportunity for individual recognition.

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## *LOOK AT LOCKHEED IN SPACE COMMUNICATIONS:*

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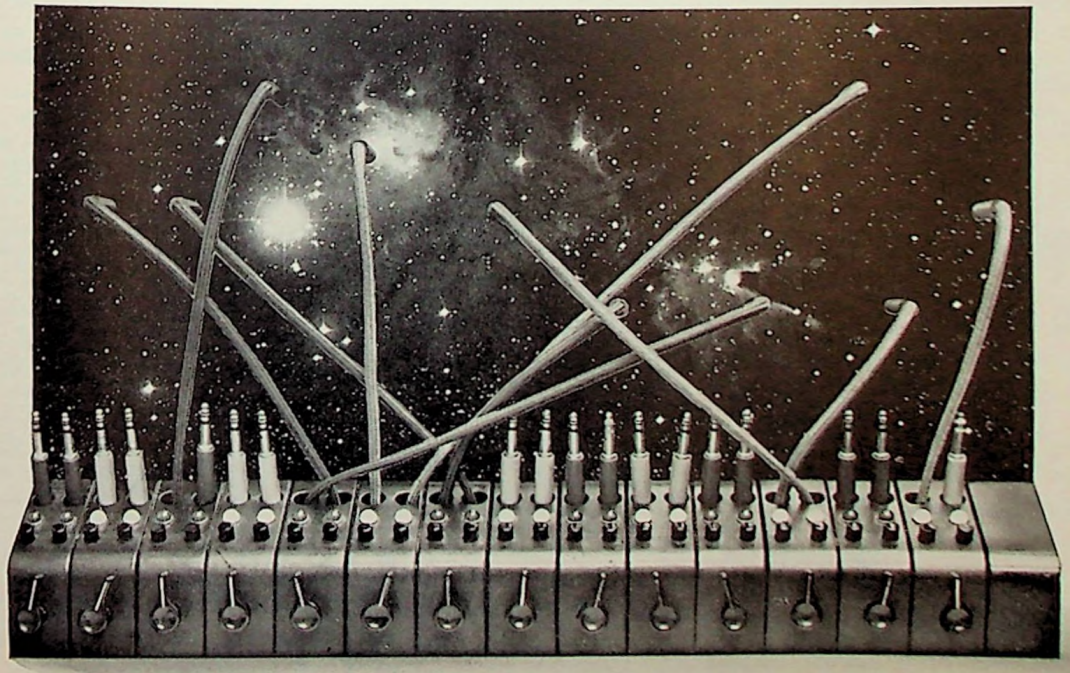

*los angeles news*

## CONTROL SYSTEM SYMPOSIUM

In mid-September the Los Angeles and Orange County chapters of PTGED and the CDC West Coast committee, both of the IEEE, will sponsor a one-day symposium on tactical command and control systems at the Southern Counties Gas Co. auditorium in Los Angeles.

Covered will be allocation of functions between the human organization and the computer in command and control; programming systems and processor organization.

The date and details will be available shortly from C. Hobbs (714) 675-1757.

*Goldfarb*

*Sewell*

*Saunders*

antenna and by the size of the largest radiating element at the low frequency end. Antennas of this type operating down to frequencies as low as 6 megacycles, with 40-foot long self-supporting elements, are now commercially available.

For applications where the space allotted for the antenna is limited, or where the frequencies are so low that the element lengths become mechanically impractical, a log periodic dipole array with inductively loaded foreshortened radiating elements was developed. The design modifications necessary for successful operation of a log periodic dipole array with foreshortened elements are discussed in this paper.

### 19/3 LOG-PERIODIC HELICAL DIPOLE ARRAYS


PAUL MAYS AND D. T. STEPHENSON
*University of Illinois*
*Urbana, Illinois*


The low-frequency cutoff of the logarithmically-periodic dipole array occurs when the longest dipole is approximately one-half wavelength long. For applications in and below the high frequency (3-30 Mc) band the antenna becomes quite large. By replacing the linear dipoles with normal-mode helical elements, the length of the dipoles can be reduced. Near field measurements show the similarity in propagation constants in arrays of linear and helical elements. Data are shown for LP helical dipole arrays with elements of length $\lambda/4$ at the lowest frequency. Frequency independent backfire patterns are maintained and maximum VSWR less than 2:1 has been achieved.

### 19/4 SMALL ANTENNA ARRAYS UTILIZING DISTRIBUTED LOADING


ROBERT A. MOORE
*Westinghouse Electric Company*
*Baltimore, Maryland*
and
ROBERT E. BEAM
*Northwestern Technological Institute*
*Evanston, Illinois*


One method of achieving directive radiation from small, high-frequency antennas involves the use of small-diameter helices as elements in yagi-type arrays. An approximate expression for the mutual impedance between helical dipoles is given. Curves giving computed and measured values of the mutual impedances are given. The design of parasitic arrays is outlined. Computed and experimental data is given for the two-element reflector array for which the radiation pattern compares well with a comparable array of linear elements. Arrays utilizing stepped-pitch helices are shown to possess characteristics which are superior to those for constant pitch helices.

### 19/5 YAGI TRANSMISSION LINES


DONALD K. REYNOLDS, ROBERT F. TIGHE, THOMAS L. BLACKNEY
*University of Washington*
*Seattle, Washington*


While it has been recognized for many y that electromagnetic waves may be guided a arrays of parallel metal rods. it has been recently that these structures have been explo as useful transmission lines. In this paper, the g ing properties of the line are briefly review experimental data are presented on the attenua for a wide range of line parameters, and it is sh that the attenuation compares favorably with o more conventional transmission lines and wa guides. Transmission around bends and curve discussed. Methods of launching and catching waves on the line are discussed, and experime data are presented on a launcher with less 0.7 db loss. Uses of the Yagi transmission line discussed, including the application to scann antennas.

## SESSION 20

## HIGH POWER MODULATORS

*Friday, August 22, 10:00 A.M.-12:30 P.*
*COW PALACE – ROOM E*

Session Chairman:

ELI M. GOLDFARB
*Radiation at Stanford*
*Palo Alto, California*

### 20/1 SPARK CHAMBER PULSE MODULATORS


QUENTIN A. KERNS
*Lawrence Radiation Laboratory*
*Berkeley, California*


Development of the triggered spark chamber a sensitive device for displaying the path of ioniz radiation has resulted in a powerful tool for study of nuclear events. Operating principles be reviewed briefly to indicate the requirement placed on the switching type modulators wi power spark chambers. The central features o modulator are the rise time of the switch and delay time of its driving circuitry.

Voltage requirements range from 2-100 KV pending upon the size of the chamber. Rise ti are of the order of 10 nanoseconds and in s cases delay must be kept below 100 nanoseco

Suitable circuits and wave form monitors be described together with recent work on wide-gap discharge chamber.

The need for minimum system delay and j has led to the concept of a thermionic switch with separated vacuum and pressure regions. design and application will be discussed with p ticular reference to cases where overall delay be kept below 10 nanoseconds.

### 20/2 COMMAND RESONANCE CHARGING SYSTEM FOR THE ASTRON ACCELERATOR


K. A. SAUNDERS, R. L. SEWELL
*Lawrence Radiation Laboratory*
*Livermore, California*


*(Continued on page 66)*

### ALAMOGORDO-HOLLOMAN

The Alamogordo-Holloman Section held seven formal meetings during the past year. Under the leadership of Horace Castillo the section drew upon its own membership to obtain distinguished speakers for its programs. The wide range of activities conducted at the White Sands Missile Range and Holloman AFB provides a fertile source of extensively interesting program material.

Two programs were presented on the activities of the aeromedical laboratory. This facility conducts physiological and psychological tests using chimpanzees and carries out acceleration experiments, using human subjects.

The Sacramento Peak observatory was host for the membership at our out-of-town meeting. The resident astronomer explained the experiments conducted at the solar observatory and showed exciting films of sunspot activity as recorded by the specialized telescopes belonging to the observatory. As a tie-in with the Sac Peak program, Mark Jones, president of Geoscience Inc., presented a program on his own work in the field of geophysics and outlined some of the techniques currently used by specialists in geophysical investigation.

Lew Taylor and Mel Lux each presented a program on specialized aspects of range instrumentation. Lew discussed ARTRAC, a sophisticated range control system that is under development at the local range. Mel presented a NASA film of the John Glenn Mercury flight and told the operation of the Corpus Christi tracking station.

The merger of the section consisted only of changing the name and going on with business as usual. With only jack rabbits and sage brush for eighty miles around, the local engineering population is held as a captive audience. Between twenty-five and fifty percent of the membership can be relied upon to attend the meetings.

New officers were announced at the April meeting. They have now assumed office and are working on section programs for the coming year. They are Melvin O. Lux, chairman; Marvin C. Green, vice chairman; Lewis M. Harris, secretary-treasurer; Myron W. Driscoll, Jr., membership chairman; Charles S. Clark, publicity chairman; Reed L. Warnock, program chairman; and O. A. Steele, awards chairman.

MELVIN O. LUX

*Holloman-Alamogordo Section chairman Horace Castillo turns over the gavel to new officers Melvin O. Lux, Marvin C. Green, and Lewis M. Harris*

*Hanna*

*Flood*

*Genova*

The astron machine AM, currently under construction at the Lawrence Radiation Laboratory in Livermore, California, is a part of Project Sherwood. This project is a nationwide effort to produce a controlled thermonuclear reaction. The astron concept will utilize the effects of a monoenergetic layer of relativistic electrons to contain and heat a plasma. The 5 MeV, 200 ampere, electron source is a magnetic induction linear accelerator.

The accelerator is a series of pulse transformers fed from 471 parallel, 36-megawatt, line-type modulators. The pulse forming networks for the modulators are parallel, RG-218/U coaxial cables, with a length of 0.4 microseconds.

The pulse forming networks are charged by four command resonance-charge, voltage regulated, power supplies. Each charging supply is capable of furnishing 35 KV ±.2%, 60 pps into a 3.3 microfarad load.

The voltage is regulated over the range of 20 to 35 KV, independent of repetition rate by a crobar circuit. Methods for reducing the affects of transients are presented.

## 20/3 180 M W SPARK-GAP LINE MODULATOR


GEORGE HANNA
*Continental Electronics Manufacturing Company*
*Dallas, Texas*


Three super high power modulators will be described. These are . . . A 180 MW spark-gap line modulator utilizing resonant charging and a pulse forming network, a 400 kilovolt floating deck modulator, and a 65 KV, 5400 ampere hard-tu modulator.

The 180 MW line modulator will be discus in detail. This modulator was designed to use existing high voltage (140 KV 8 ampere) DC s ply. Modulator features include (1) triggered m tiple spark-gaps to discharge the PFN, (2) ope tion in three separate modes up to 320 kilove (3) selective operation in the three modes with changing PFN or resonant charging reactor, backswing clipper, (5) automatic self-adjus pulse leveler, and (6) hold-off diode.

## 20/4 400 KW ELECTRONICALLY REGULATED MODULATOR


W. S. FLOOD, L. GENOVA
*Radiation at Stanford*
*Palo Alto, California*


Today's trend towards pulsed high power tra mitters having very low phase shift necessita power supplies and modulators which maint accurate tolerances in the beam voltage to t final r-f tube.

A modulator has been built which delive video pulse of 27 kv and 15 amps to a TWT. power supply consists of a variable autotr former, plate transformer, and three-phase, wave, solid-state rectifiers. The pulse modul is of the floating deck type to pulse the modu ing anode of the TWT. An electronic regulato used to hold beam voltage varintions to with 27-volt band during a 700 μsec pulse, thus p viding .1% regulation at a beam voltage of 27 The regulator has a response time of approxima 3 μsec.

*(Concluded)*

# NOW HELIAX

IN 5 SIZES
UP TO

# 5 INCHES

ANDREW HELIAX is now available in a 5 inch size, adding to the range of applications of this low loss, *flexible* coaxial cable. Produced in continuous splice-free lengths. Type H9, 5" HELIAX is ideally suited for high power installations to 826 kw peak power, frequencies to 950 Mc.

Available in 3/8", 7/8", 1 5/8", 3" and 5" sizes, there is a HELIAX RF cable system, including fittings, from one source to meet your requirements. Write or call your Andrew sales engineer for complete information.

5 easy steps for assembly of connector to Heliax Flexible Coaxial Cable

**Step 1** Cut Heliax squarely. Assemble gasket and clamping body to outer conductor.

**Step 2** Cut outer conductor with a tin snips to facilitate 90° flaring.

**Step 3** Flare outer conductor back against the clamping body.

**Step 4** Assemble inner connector to the center conductor.

**Step 5** Assemble flare ring, O ring, anchor insulator. Thread outer body onto clamping body.

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## SESSION W

*Levinthal*

*Lederberg*

*Oliver*

*Bussard*

## EXTRATERRESTRIAL LIFE, DETECTION, COMMUNICATION AND EXPLORATION

*Tuesday, August 20, 2:00 to 4:30 P.M.*

*Cow Palace — Room E*

SESSION CHAIRMAN: Elliott Levinthal
*Stanford Medical Center*
*Stanford, California*

### W/1 ORIGINS AND DIRECTIONS OF LIFE

Joshua Lederberg
*Stanford University*
*Stanford, California*

### W/2 THE DETECTION OF LIFE WITHIN OUR PLANETARY SYSTEM

Elliott Levinthal
*Stanford Medical Center*
*Stanford, California*

The Multivator, which represents a particular choice of a detection system to serve in the quest for signs of life on Mars, will be discussed. The design, or minor modifications of the design, permit many different kinds of biochemical experiments to be carried out, particularly those which can be arranged to use a photomultiplier as an output transducer. Such experiments include fluorometry, nephelometry, and scintillometry.

The possibilities of more complex instruments, requiring greater data transmission capability, for later missions will also be discussed.

### W/3 THE POSSIBILITIES OF INTERSTELLAR COMMUNICATION

B. M. Oliver
*Hewlett-Packard Company*
*Palo Alto, California*

### W/4 POSSIBILITIES FOR INTERSTELLAR FLIGHT

R. W. Bussard
*Space Technology Laboratories*
*Redondo Beach, California*

Two classes of problems require solution for the attainment of practical (short travel-time) interstellar flight. One class is concerned with the limitations of engineering technology, while the other deals with those imposed by physics. A review is given of these physical boundary conditions on the problem, and some conceptual solutions are indicated. Within the framework of these solutions, an assessment is made of the possibilities inherent in extrapolation from current engineering technology of advanced space power and propulsion systems. From this we conclude that practical intersellar flight may be achieved within a century.

## SESSION X

*Bliss*

## INFORMATION PROCESSING IN LIVING SYSTEMS

*Wednesday, August 21, 2:00 to 4:30 P.M.*

*Cow Palace — Room E*

SESSION CHAIRMAN: James C. Bliss
*Stanford Research Institute*
*Menlo Park, California*

### X/1 UNIT PROPERTIES IN NERVOUS INTEGRATION

Donald Kennedy
*Stanford University*
*Stanford, California*

This paper introduces the more specific ones which follow it by attempting a summary of the properties of neurons and their junctions which contribute to the integration process. Since the

*(Continued on page 72)*

*regional roundup*

With the merger of the Institute of Radio Engineers and the American Institute of Electrical Engineers at the start of this year, the resulting IEEE has become the world's major professional society in engineering.

As of March 31 this year, the IEEE had 134,938 higher grade (or professional) members and 27,177 student members, to a total of 162,115. The regular memberships are graded Associate, Member, Senior, and Fellow.

Prior to the merger, the IRE had 82,842 higher-grade members and 20,713 student members at the end of 1962—a total of 103,555.

As of May 1 last year, the AIEE had 57,183 higher-grade members and 10,643 student members—a total of 67,826.

The IRE was formed in 1912 and did not reach 5,000 members until 1928. There were 15,000 members at the end of World War II (1945).

The Sixth Region of the IEEE, comprising 11 Western states, is the largest. The regions embracing Philadelphia, Washington and the South (second), and New York-New Jersey (third) are next in size.

The Sixth Region has the largest number of senior members and student members in the nation and the third largest number of fellows—the most honored grade.

*regional roundup*

## ANCHORAGE SECTION

The Anchorage Section of IEEE is the result of the merger of the former Anchorage Section of IRE and the Alaska Subsection of the Seattle Section, AIEE.

Merged section boundaries encompass the entire state of Alaska, with the largest membership populations in Anchorage, Fairbanks, College (the University of Alaska area, including student members), and Clear.

Elected officers for 1963 are Gene A. West, chairman; Ted R. Young, vice chairman; Herbert D. Brazil, acting secretary; and Charles F. Wayer, Jr., treasurer.

GENE A. WEST

*regional roundup*

## SEATTLE SECTION

The Seattle Section completed its merger plans on July 1. Officers of the IEEE section are Jeremy K. Schloss, chairman; Clere S. Alger, vice chairman; John A. Tate, secretary; and Paul K. Jennings, treasurer. Members-at-large are Noble Bryan, Jr., Richard A. Daubert, Irene Carswell Peden, and Stuart P. Weiss.

E. W. EARLY

*regional roundup*

## L.A. RECOGNITION AWARDS

At the annual installation dinner-dance, June 8, the Los Angeles sections of IRE and AIEE presented six members and two companies with 1963 recognition awards for their invaluable support in 1962-63 section activities. Recipients were:

- Dr. Robert C. Hansen, for his excellent leadership and counsel in support of professional group activities.
- Gerald B. Speen, for his devoted participation in merging the joint interests of the AIEE and IRE into a student relations committee of the Los Angeles Section, IEEE, and for his sympathetic handling of student activities within the section.
- Thedore L. Golmis, for his diligent and diplomatic handling of arrangement responsibilities on behalf of the Los Angeles Section and PTGMIL.
- William X. Lamb, Jr., for his enthusiastic and effective coordination of professional group activities in the Los Angeles Section.
- Gerald M. Goldenstern, for his indefatigable support of section activities and objectives.
- Ann Wright Johnson, for her guidance and successful efforts in establishing the new IEEE auxiliary for wives of IEEE members, both at section and subsection levels.

Company recognition awards were presented to:

- Space Technology Laboratories, Redondo Beach, California, for substantial contributions of both equipment and personnel which assured the success of the 1961 and 1962 section-sponsored lecture series.
- Behlman-Invar Electronics Corporation, Santa Monica, California, for their donation of a much-needed display booth now used by the section in furthering the interests of the institute.

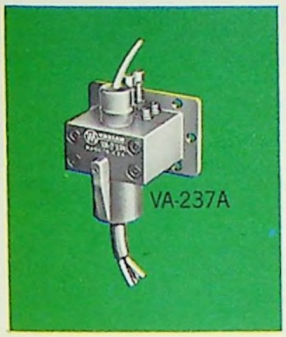
*regional roundup*

## CHINA LAKE SECTION

Newly elected officers of the China Lake Section are John M. Johnson, chairman; James C. Mitchell, vice chairman; and Phil G. Arnold, secretary-treasurer.

ROBERT G. S. SEWELL

*China Lake officers Mitchell, Johnson, and Arnold*




# 1 WATT MIN. AT 11.7-12.7 Gc* FROM VARIAN

Varian's new VA-237A reflex klystron offers exceptional performance for microwave relay applications. Conduction cooled, tube has a temperature coefficient of less than 10 kc per °C when used with a suitably designed vapor-cooled heat sink. Other features include 5000 hours life warranty; advanced design external cavity for noise-free wide range tuning; excellent modulation characteristics. The VA-237A is designed for use with WR75 waveguide. ■ For price, delivery, and technical information on these new tubes, contact the Varian Field Area Sales Office nearest you, or write Tube Division, Palo Alto. ■ *Available soon: the VA-237B, featuring the same superior characteristics, and covering 10.7-11.7 Gc.

VARIAN ASSOCIATES TUBE DIVISION Palo Alto 34, Calif.

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EUROPEAN SALES HEADQUARTERS: VARIAN A.G. ZUG, SWITZERLAND


# 106 kW CW AT X-BAND! FROM VARIAN

Varian now offers the VA-873 SBK* amplifier klystron, providing the world's highest CW power at X-band. More than 106 kilowatts was obtained from a single tube during extensive evaluation tests in the laboratory. Production tubes will be conservatively rated at 50 kW CW. *Sled-mounted Beam Supply

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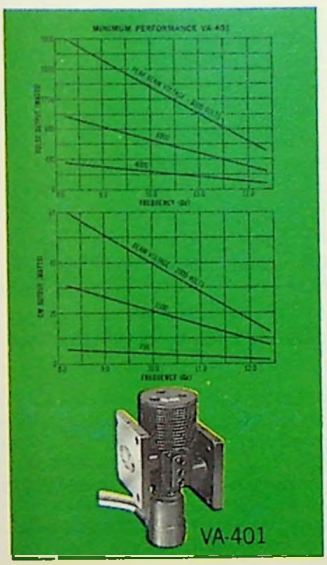
EUROPEAN SALES HEADQUARTERS: VARIAN A.G. ZUG, SWITZERLAND




# LIGHTWEIGHT X-BAND TUBE OPERATES PULSE OR CW . . . . NEW FROM VARIAN

Varian's new VA-401 klystron can operate either as a pulse or CW amplifier at any fixed frequency selected between 8.2 and 12.4 Gc. Exceptional design permits this tube to be operated at various power levels by using the appropriate beam voltage. ■ This electrostatically-focused three-cavity tube will deliver at least 500 watts in pulse service and 10 watts CW at the high-frequency end of the operating range. As shown in the graphs above, the output at the low-frequency end of the range is several times greater. This tube is an excellent choice for airborne CW radar, doppler navigation, multichannel parametric amplifier pumping, or synchrodyne systems. Typical gain, 30 db. Weight, 13 ozs. Write for more information.

VARIAN ASSOCIATES TUBE DIVISION Palo Alto 34, Calif.

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EUROPEAN SALES HEADQUARTERS: VARIAN A.G. ZUG, SWITZERLAND

# State-of-the-art microwave tubes from VARIAN

Varian introduced these tubes and many others during 1963 in *Microwave Journal*, *Microwaves*, *Electronic Design*, *Electrical Design News*, *Proceedings of the I.E.E.E.*, *Electronics*, and *Grid* magazines.

**For more state-of-the-art tubes and scientific instrumentation, see our exhibits at WESCON, Booths 1509 thru 1516.**

most important sensory systems in which central coding is studied feature considerable convergence of presynaptic upon postsynaptic neurons, the spatial distribution of endings relative to loci of spike initiation provides differential weighting for various afferent sources; in addition, such sources may be different in sign depending upon whether their endings are excitatory or inhibitory. Temporal factors are also important: certain junctions increase in efficacy (facilitate), others decrease (antifacilitate) as a function of previous stimulation. Such effects may be specific to the junctions involved (as when transmitter depletion or local receptor desensitization are the mechanism of temporal change), or may involve much of the post-synaptic cell. If, as sometimes happens, inputs of different "recovery cycles" converge upon the same cell, then their relative weights will depend upon their history of activity.

These unit properties have been useful in explaining certain operations preformed by networks of neurons, the most celebrated examples being the role of lateral inhibition in contrast-sharpening and the production of "off" responses, and that of recurrent inhibition or antifacilitation in producing temporal damping. Higher-order central neurons in sensory systems, however, show the ability to respond selectively to such dynamic stimulus parameters as velocity and direction of movement. Though such responses may be explained through complex interplays of excitatory and inhibitory input with different time-constants, it is also possible to interpret them in terms of a neuron model in which synaptic regions are separated by impulse-conducting regions. In such a situation, collision of impulses, refractoriness and after-potentials assume important integrative roles. Examples of neurons connected in this way will be given, with a discussion of their receptive-field organization and their sensitivity to moving stimuli.

*Brown*

### X/2 ROD AND CONE RECEPTOR POTENTIALS FROM MONKEY RETINAS

Kenneth T. Brown
*University of California Medical School*
*San Francisco, California*

Intraretinal recording, supplemented by recently developed techniques has made it possible to isolate and identify a receptor component from the mammalian electroretinogram (ERG). The pure cone receptor potential has been obtained from the fovea of the *Cynamolgus* monkey, and the pure rod receptor potential has been obtained from the retina of the night monkey, *Aotus trivirgatus*. Responses of both cones and rods show an initial rapid rise. Following the stimulus, the cone response decays rapidly, but the decay of the rod potential requires about 1.5 sec. This difference in decay rate seems to explain the ability of cones to follow higher flicker rates than rods, as well as certain other visual phenomena. It is also relevant for explaining nerve impulse patterns from second- and third-order neurons when these cells are controlled by rods and cones respectively.

### X/3 METHODS USED BY A SIMPLE EYE TO IMPROVE ITS SPATIAL AND TEMPORAL RESOLVING POWER

Charles F. Stevens
*University of Washington Medical School*
*Seattle, Washington*

Because of limitations of the Horseshoe Crab eye optical apparatus, the image presented to the photoreceptors of the eye is blurred. Experiments have revealed the presence of neural interactions between these photoreceptors which counteract the blurring and improve the spatial resolving power. However, the type of neural interaction used in the eye would tend to cause a distortion of stimulus patterns which are changing in time. Further experimental analysis has shown that the photoreceptors not only interact with each other, but also interact with themselves, and that this self-interaction – a type of negative feedback – counteracts the loss of high frequency response and thus decreases the distortion of time varying stimulus patterns.

### X/4 TACTILE PERCEPTION WITH ELECTRIC STIMULI

Robert H. Gibson
*Carnegie Institute of Technology*
*Pittsburgh, Pennsylvania*

Brief pulses of direct-current can reliably stimulate painfree touch over much of the body surface. Since the temporal resolving power of touch is relatively poor, the perceptual richness

*(Continued on page 76)*

*An interior view of the Nevada wing of Hoover Power Plant in the Las Vegas Section area, showing seven generating units in operation. Each generator is rated at 82,500 kilowatts, and each turbine is rated at 115,000 horsepower.*

*regional roundup*

## LAS VEGAS SECTION

During the coming year the following members will direct the section's activities:

Dolan P. Hume, chairman; Donald Thompson, vice chairman; Judd Nicholas, secretary; Charles Hunter, treasurer; Norman Snell and Rudy Legler, members-at-large.

One of the major activities for the Las Vegas Section will be coordinating and planning the hosting of the 1965 Region 6 meeting. Bruce M. Carder, past chairman of IEEE (IRE) is chairman of the conference executive committee and has selected "Power in the Space Age" as the convention theme. Don Larson from Wescon is providing help and advice in planning the convention. Another project that we shall be active in is providing technical magazines and books to the new library at Nevada Southern University.

We shall again host the electrical engineering students from the University of Nevada at Reno on tours of Hoover Dam, Nevada Test Site, Clark County Steam Plant, Southern Nevada Telephone Company, and the Edgerton, Germeshausen and Grier, Inc., facilities in Las Vegas.

The Las Vegas Section of the IEEE is composed of the former Las Vegas Section of the IRE and the Boulder City Subsection of the Los Angeles Section of the AIEE. The officers and memberships have been merged since January 1, 1963; however, the boundaries are still in a state of flux with contiguous sections. We are endeavoring to serve those areas that are more geographically and technically oriented to the Las Vegas area than to the adjacent sections. This matter should be cleared up by the first of August, so that by the first meeting of the year in September the section may ratify the constitution and bylaws for full-merged operation as a section in Region 6 of the IEEE.

DOLAN P. HUME

*Spokane will be the site of the Pacific Annual Meeting of IEEE on August 26 through 29, including technical sessions and tours, social events, and a golf tournament. For more information, write the chairman, Stephen J. Pope, P.O. Box 6217, Spokane 28, Wash.*

*regional roundup*

## SPOKANE SECTION

The highlight of the extremely successful year just completed was the chartering of the Wenatchee Section on November 16, 1962. This has been a very active subsection and will be a real asset to the society as a section.

The highlight of the current year for the Spokane Section is the Pacific Annual Meeting in Spokane, August 26-29, including the celebration of the 50th anniversary of the Spokane Section of AIEE. This will be observed Tuesday evening, August 28, with a banquet and dinner-dance.

Officers elected for the coming year are Robert E. Blasen, chairman; Dr. A. L. Betts, vice chairman; and R. W. Anderson, secretary-treasurer. Members of the executive committee are A. C. Genor, Jr., D. H. Hamilton, and Glenn W. Wimer.

R. E. BLASEN

*regional roundup*

## HAWAII SECTION

The Hawaii sections of IRE and AIEE merged effective July 1. The new officers of the IEEE section are Forrest D. Bennett, chairman; Vaughn Kelly, vice chairman; Dan Williamson, secretary; and Dr. Euyen Gott, treasurer.

Outgoing IRE officers were Gordon H. Stagner, chairman; Sayre B. MacMenamin, vice chairman; and D. Lee Grubb, secretary-treasurer.

Outgoing AIEE officers were Melvin Dean, chairman; Forrest D. Bennett, vice chairman; and Harry Johnson, secretary-treasurer.

GORDON H. STAGNER

*regional roundup*

## BIGGEST IN SOCIETY

The Los Angeles Section of the Sixth Region, with 14,700 members, is the largest in the country.

## ALBUQUERQUE SECTION

For all practical purposes, the Albuquerque–Los Alamos Section of the IRE and the Northern New Mexico Section of the AIEE merged on January 1, 1963. This successful action was the result of the efforts of IRE Section Chairman Allen Church, AIEE Section Chairman Ray Cainski, and their respective merger committees. H. H. Patterson was chairman of the IRE committee, and A. E. Rhodes was chairman of the AIEE committee. These two groups, acting in joint session, laid the groundwork for the section-level merger. Many areas were probed and, amazingly, no serious problems were found to exist.

Following this exploration by the joint merger committees, the officers of the two sections met to discuss details and make a proposal to both executive committees to consummate the merger on or before July 1, 1963. In separate actions, the executive committees of both the AIEE and the IRE approved the agreement, which became effective on January 1, 1963. The two executive committees merged, with Cainski and Church serving as co-chairmen of the Albuquerque–Los Alamos Section of the IEEE.

The Los Alamos and Santa Fe membership were combined into the Los Alamos Subsection. In order to avoid confusion, the name of the Albuquerque–Los Alamos Section was changed to the Albuquerque Section of the IEEE. The chairman of the Los Alamos Subsection is Lloyd E. Lanham.

One new professional group chapter was formed during the year. This was the PTG on Electron Devices. K. D. Hardin served as chairman.

The Albuquerque Section served as host section for the national telemetering conference that was held in Albuquerque during the week of May 20, 1963.

The section joined with the local chapter of the American Society of Quality Control in sponsoring a reliability group course at Bishop's Lodge in Santa Fe.

The annual meeting of the section was held in May, at which time the bylaws were ratified by the merged membership. The officers for the coming year were also elected. They are: Thomas L. Pace, chairman; Ray C. Cainski, vice chairman; Edward L. Amonette, secretary; and Robert F. Kinney, treasurer.

THOMAS L. PACE

# special sessions

*McCann*

*Siegman*

*Wade*

## SESSION Y

*Dacey*

*Fletcher*

## SESSION Z

*Johnson*

of multiple electric stimulation is likely to depend largely on spatial aspects of the stimulation. Painfree electric touch stimulation requires large electrodes, well spaced on the body surface, thereby apparently limiting the information processed through a given body region to less than its spatial discriminative capacity. This paper reports principles basic to information processing through a coarse electrode grid: stimulus conditions are reported for optimal arousal of apparent location and apparent movement phenomena.

**X/5 SENSORY PERCEPTION — FOCAL POINT OF INTERDISCIPLINARY RESEARCH BY BIOLOGISTS AND ENGINEERS**

G. D. McCann
*California Institute of Technology*
*Pasadena, California*

A critical summary of the known properties of biological light sensory systems. This includes the transducer properties of elementary light receptor cells, faceted eyes and the complex eyes of the vertebrates. The physiological and data processing properties of representative interneuron systems including the higher order retinas, lateral geniculates and visual cortices will be described to present the known principles of biological pattern recognition of possible interest for engineering devices. This includes temporal, form and color vision.

The necessity of integrating systems and communications theory concepts wth conventional neural biology and psychobiology in more definitive research for the more important questions yet to be answered will be discussed and illustrated by the work of the California Institute Biological Systems Laboratory. This will include a discussion of mathematical methods considered important for conceptual models of such information processing systems.

## RECENT ADVANCES IN LASERS

*Thursday, August 22, 2:00 to 4:30 P.M.*
*Cow Palace – Room E*

SESSION CHAIRMAN: Anthony Siegman
*Stanford University*
*Stanford, California*

**Y/1 RECENT ADVANCES IN INJECTION LASERS**

Glen Wade
*Raytheon Company*
*Burlington, Massachusetts*

**Y/2 WHAT, IF ANYTHING, ARE LASERS GOOD FOR?**

George Dacey
*Sandia Corporation*
*Albuquerque, New Mexico*

**Y/3 COMMUNICATIONS APPLICATIONS OF LASERS**

R. C. Fletcher
*Bell Telephone Laboratories, Inc.*
*Murray Hill, New Jersey*

**Y/4 THE LASER ROTATION RATE SENSOR**

Warren Macek
*Sperry Gyroscope Company*
*Great Neck, New York*

## ACTIVE COMMUNICATION SATELLITES

*Friday, August 23, 2:00 to 4:30 P.M.*
*Cow Palace – Room E*

SESSION CHAIRMAN: H. Richard Johnson
*Watkins-Johnson Company*
*Palo Alto, California*

*(Continued on page 78)*

## LOS ANGELES SECTION

It has not been unusual for this yearly review to mention casually that the Los Angeles Section membership had reached some new plateau—some sort of society record. With the advent of the merger, combined membership figures indicated that on January 1, 1963, more than 15,000 members resided within the territory that touches San Luis Obispo on the north, San Juan Capistrano on the south, and invades the desert cactus on the east.

The merger locally meant that there were more meetings this past 1962-63 year—about 300 subsection and professional technical group meetings. The subsections, due to their size (many with greater membership than other fully accredited sections throughout the world), should ultimately become full-fledged sections themselves.

Here is how the Los Angeles Section story unfolds, first with highlights of outstanding and unusual meetings:

Space projects, such as Telstar, Mariner 2, and Apollo, dominated the meeting scene during the fall months. For example, in September at the Los Angeles Section meeting with the Southern Subsection, Dr. Fred Adler presented his provocative talk, "Space Exploration and Baseball." The Engineers Week banquet in February attracted more than 600 guests to hear Rear Admiral Charles T. Booth preview how the Navy is going to meet the challenge of the world and the universe. At the March section meeting sponsored by the Crescent Bay Subsection, the seven newly elected fellows received their diplomas. Two subsections had a draw when it came to the best "box-office" award. San Fernando Valley's April all-industry meeting featured Major General Earle F. Cook's talk on "Industry Relationship in Electronics for the New Army Military Concepts"; Buenaventura Subsection shared honors with the Valley for their effort, which included a talk on a new concept in short antennas, a tour of Northrop Ventura, and a skydiving exhibition. The skydivers exited the planes at 15,000 feet, and performed intricate maneuvers to show the aerodynamic control of the human body in freefall. Discussion of the new 82-million-dollar atomic power plant to be constructed in southern California was a feature of the AIEE general section meeting in May.

Before the first of the year, the IEEE business office moved to its present location, the Traveler's building, finding that there was a need to

*(Continued on page 79)*

*Schreiner*

The TELSTAR satellite system consists of an active repeater in orbit and ground facilities to work with it. The presentation will cover a general description of the TELSTAR satellite and operation of the ground stations. Results of transmission and communication experiments will be given. Also, there will be a discussion of the radiation experiments carried aboard TELSTAR as well as the latest environmental measurements which have been made.

The radiation experiment consists of particle counters to measure proton and electron energy levels and special transistors and diodes to measure the cumulative effects of radiation. A large number of temperature sensors are carried aboard the satellite, and information has been obtained with regard to temperature distributions as a function of the satellite's aspect with respect to the sun.

### Z/2 RELAY

Warren Schreiner
*Radio Corporation of America*
*Hightstown, New Jersey*

Relay is a redundant microwave repeater receiving signals at 1725 mc. and retransmitting at 4170 mc. In an effort to provide "adequate" deviation in spite of a possible restriction in the bandwidth of the transmitting FM station, the deviation is tripled within the satellite before final translation and amplification. Two modes of operation are available, one for one-way television transmission and the other, for two-way "telephone" transmission. The latter is separated into two narrow bands, one for each direction of transmission.

A 20 channel redundant command system provides for the control of the communication systems, a set of 7 radiation experiments, the telemetry complex and an attitude control mechanism.

The telemetry system consists of 128 nine bit words in a PCM system. One of these words if commutated 64 times to provide low speed housekeeping information on the satellite.

Energy is received from the sun using over 8,000 silicon solar cells and is stored in 3 batteries of 20 cells each. All is housed in an 8-sided prism-like structure weighing about 170 pounds.

*Rosen*

### Z/3 SYNCHRONOUS COMMUNICATION SATELLITES

Harold A. Rosen
*Hughes Aircraft Company*
*Culver City, California*

Synchronous communication satellites require orbit and orientation control as well as active communication signal transponders. The spin stabilized configuration used in Syncom is an integrated design approach which simplifies the achievement of these functions. The requirements imposed on the control and communications systems by the characteristics of the orbit and the considerations involved in providing multiple access capability in the communications transponder will be discussed. Some of the advantages of the synchronous orbit for communications will be mentioned briefly.

*Pritchard*

### Z/4 ACTIVE COMMUNICATIONS SATELLITES

Wilbur L. Pritchard, Virgil W. Wall,
Ralph S. Wegman
*Aerospace Corporation*
*El Segundo, California*

The peculiar requirements of a military communications satellite system as distinguished from a commercial one are discussed. The effects of requiring the system to operate with transportable ground stations, to be jam resistant, and to degrade gracefully on the choice of system parameters are to be discussed.

The choice of orbit inclination altitude and eccentricity, along with choice of the number of satellites, is shown to be a function of booster payload capability, geometric coverage, and the communications power budget.

Some general comparisons between medium altitude and synchronous satellites are made, and the synchronous system is shown to be particularly well suited to very high traffic density situations whereas the medium altitude system is shown to be more economical and more within the state-of-the-art.

It is shown that the choice of a communications satellite system is critically dependent on the reliability of the booster mission, the possibility of multiple launching and the meantime to failure of the satellite.

Typical communications link calculations are shown to demonstrate the effects of key parameters on performance. A short discussion of the dependence of performance to weather, especially for very low temperature receivers, is given.

Discussion will be in general terms without reference to

*(Continued on page 80)*

be located more convenient to the freeways and needing more space for future expansion.

National IEEE Director Walter E. Peterson, representing the local IRE section, and E. Dale Barcus, the AIEE, co-chaired the joint-section merger committee. Through their efforts, experience in society operation, and foresight, many changes and innovations were introduced which ultimately met with general approval. Chairmen Ralph Lamm of the IRE and Floyd Goss of the AIEE welcomed one of the first signs of the merger with the publication of both IRE and AIEE meeting previews in one publication – the Los Angeles IEEE Bulletin. Where there previously had been two magazines, there was now one publication circulated to the entire section membership.

The student relations committee was the first committee to merge during the fall. Under the guidance of Chairman Gerald Speen, the committee sponsored an annual students day, wherein more than 400 students were hosted by 21 local firms. The students received lunch, heard talks on company technical progress, and received a plant tour. In addition, the committee prepared and manned a booth at the Los Angeles County schools career guidance center. Counselors talked to interested secondary school students on the opportunities in electronics. The final responsibility of this committee was the selection of eight young men for participation at Wescon's Future Engineers show.

The National Winter Convention on Military Electronics has become so entrenched with section affairs that the two have become almost synonymous. The Fourth National Winter Convention, held at the Ambassador Hotel last February, attracted more than 2,000 visitors. John R. Moore, Autonetics president and convention director, and Dr. Fred Adler, program chairman, arranged for the presentation of 87 high-level secret, confidential, and nonclassified papers. The usual voluminous and well-edited convention record was published. C. D. Perrine, executive vice president of General Dynamics/Pomona, will be at the helm for the Fifth National Convention, February 5-7, 1964. Chairman Perrine has selected Dr. Nicholas Begovich, vice president, Hughes Ground Systems, as program chairman.

In addition to this effort, several professional technical group chapters did creditable jobs in hosting national meetings. The vehicular communications chapter as well as the microwave theory and techniques chapter guided

their respective national symposiums into successful events. The two local chapters on electronic computers hosted a national symposium on spaceborne computers, while the AIEE computing devices committee sponsored a Pacific computers conference. The local one-day reliability of space vehicles seminar was again successfully sponsored by the PTG's on reliability, component parts, and electron devices.

Two separate section lecture series were presented in tutorial fashion during the spring and fall. Frank Craig handled the chairman's chores for both the series on "Electron Devices" and "Electronics in Space Exploration." Six talks were presented in each series, updating material eagerly sought by local engineers. Registrants in the neighborhood of 250 attended the parallel series—held on both occasions in Los Angeles, and once in Orange and in Pomona.

The thirty-six active PTG's and divisions of the section operated independently under IRE and AIEE structure and format until June 18 when, for administrative purposes, the groups declared their preferred divisional alignments.

Elected as PTG coordinator for the coming year, L. C. Hobbs will supervise the activities of six other division chieftains representing the following divisions: systems, management, communication, components, engineering profession, science, and power.

During spring, both the old IRE and AIEE sections approved the establishment of the new Vandenberg Subsection. The IRE had eight subsections and the AIEE had four subsections prior to the merger. By year's end, the combined IEEE subsections had petitioned for section status,

*Graham*

specific satellite or booster performance in order to keep the paper unclassified.

### Z/5 COMMERCIAL COMMUNICATIONS SATELLITES

Beardsley Graham
*Spindletop Research, Inc.*
*Lexington, Kentucky*

The development of commercial communications satellites, both foreign and domestic, will be traced, beginning with early technical feasibility studies and progressing through economic, political, regulatory, and legislative phases. Pertinent material on each of these phases will be discussed, and future considerations explored.

By the late 1950's technical feasibility of commercial communications satellites systems was clearly established. The joint venture approach to creating such a system through cooperative efforts of private companies was conceived early in 1959. Attention focussed on economic feasibility and on business and regulatory problems. Since sixty percent of all transoceanic communications occurs between overseas, non-U.S. entities, particular recognition was given to international aspects of the system.

Business and legal studies were completed in 1960. Results were presented to the communications industry, to Congressional committees, and to executive departments and regulatory agencies of the Federal government. A railroad release from the Department of Justice, enabled several firms to proceed with further studies refining the joint venture concept. A bill creating a communications satellite corporation, and providing that three members of its Board of Directors shall be appointed by the President, was passed by the Congress in September, 1962. Since then, creation of the business entity has been underway.

*(Concluded)*

while at the same time merging territories where previously there had been overlap.

When approved, the new sections, comprising what eventually will be called a Los Angeles District, are Foothill (Orange Belt IRE and Riverside-San Bernardino AIEE), San Gabriel Valley (Pasadena IRE), Santa Monica Bay (Crescent Bay IRE), Orange County (Santa Ana IRE and Orange County AIEE), Buenaventura, Vandenberg, South Bay Harbor (Southern IRE), San Fernando Valley, and Santa Barbara (Santa Barbara IRE and Channel Counties AIEE). Currently there is a movement for the creation of a new Metropolitan Los Angeles Section, to serve the membership of the now unincorporated areas of downtown Los Angeles and environs.

The full impact of the many man-hours devoted to facilitating the merger came to a conclusion at the June installation dinner-dance. More than 450 members, wives, and guests engaged in the festivities of the combined AIEE-IRE installation. Before Lawrence Welk warmed up his Champagne Music Makers, Region Director Daniel Noble presented awards to past subsection chairmen, recognition award winners, and installed the new IEEE Los Angeles Section chairman, Willard Fenn. Other officers elected by the membership include: William S. Moody, vice chairman; G. R. Woodman, secretary; G. M. Goldenstern, treasurer; and Bruce Angwin, Forrest C. Six, T. M. Blakeslee, and Norman Schuster, members-at-large. During the program, Mrs. Ann Wright Johnson received the accolades of the audience for her efforts as WIRE chairman (Wives of IRE) along with a section recognition award, and was reinstalled as the new IEEE auxiliary chairman.

Around 1884 when the AIEE came into existence and formed what is now our IEEE society, Los Angeles was a mere blossom of industry. Few felt that it would flourish and grow into the megalopolis that we know today. The present dictates that the Los Angeles IEEE organization must provide the engineer of southern California with adequate educational information in order to help maintain the stature that is held by the local missile, aerospace, and electronics industries.

RONALD TANSKY

---

John D. Campbell, manager of the environmental test dept. at Philco's WDL division, has been elected president of the Institute of Environmental Sciences for the year 1963-64.

*John Lavrischeff, chairman of the East Bay Subsection, San Francisco Section (right) recently presented checks for $75 and $25 to Randy Werner and Kirsten Newbury as winner and runner-up in the subsection's paper competition for prospective engineers. Second from right is Edward H. Hulse, head, electronic engineering dept., University of California Lawrence Radiation Lab, Livermore, who was speaker at the meeting.*

*regional roundup*

## EAST BAY SCHOLARSHIPS

On May 20 the East Bay Subsection of the San Francisco Section held its last meeting of the year at the Livermore High School, Livermore.

Chairman John Lavrischeff started the evening with an outline of the program and introduced Eugene A. Aas, committee chairman for student papers. Gene announced that two papers would be presented, the winner to receive $75 and the runner-up to receive $25.

Miss Kirsten Newberry, a high-school senior, spoke on "Why I Think Engineering Will Help to Make a Better World." She outlined some histories of great engineering feats, the impact of science and engineering at present, and future prospects of science and engineering.

Randy Werner, a junior, whose subject was "What Is Engineering?" discussed the definition of engineering when and where practical, the relations between engineering and science as applied to several fields, and also the challenge of the young man of tomorrow.

While judges tallied the score, Gene gave some background on the speakers' school activities, such as sports, band, etc. Chairman Lavrischeff stated the EBSS will be available for any consultation, follow-up, and help for scholarships for the winners of the student paper presentations. Lavrischeff stated that students take advantage of only approximately 60 percent of available scholarships.

Judges returned and announced the winner to be Randy Werner. Lavrischeff and Aas presented the winner with a check for $75, and the runner-up a check for $25, and wished them Godspeed in their careers.

Chairman Lavrischeff then introduced the main speaker of the evening, Edward H. Hulse, head, electronics engineering dept., UC Lawrence Radiation Laboratory, Livermore, to give some insight into the problems of "Instrumentation of Nuclear Testing." Mr. Hulse introduced

## RICHLAND SECTION

The Richland Section has completed the merger, and effective June 1, 1963, the following new officers took over:

C. M. Salina, chairman; G. L. Swezea, vice chairman; and J. C. Spanner, secretary-treasurer.

The section highlight of the past year was the successful electro-nuclear conference held in Richland, April 28–May 1, with more than 350 in attendance. The 44 papers were presented by authors from across the United States and Canada on electrical engineering subjects related to the nuclear industry, which included space technology. The next electro-nuclear conference is scheduled for June, 1965.

In the current year, plans have been made for a series of technical and general meetings plus an electrical engineer seminar, with detailed subject matter yet to be determined.

L. P. REINIG

his talk with a recently cleared, for nonclassified showing, color film entitled, "Forward Area Nevada." In this film, we saw atomic "shots" from various tower heights, balloons, and underground, showing the immense task to instrument these various-type "shots" to record all phases of the detonation.

After the finish of a most informative film, Mr. Hulse presented his talk intitled, "Instrumentation of Nuclear Testing." With the aid of slides, Hulse proceeded to outline how the successful culmination of a nuclear device explosion is preceded and followed by a number of interdisciplinary problems involving electronics engineering. The electronics equipment instrumentation required in the design and construction of the device as well as the diagnosis of the explosion is followed by other instrumentation systems for determining the results of the explosion.

The complete explosion is completed in a few microseconds, and the effects are principally manifest in the emission of energy in the form of gamma radiation and neutrons. Instruments for diagnosing what happens during the explosion require detection devices, measurement equipment, and recording equipment that function in microseconds. This process is complicated by the fact that the data has to be established in fixed form before the blast wave sweeps in and destroys the equipment which did the initial measurement.

NAMON K. "GENE" LITTLE

*San Diego officers and committee chairmen, left to right: (seated) Hively, Paull, O'Neal, Garrison; (standing) Carlson, Fiske, Miller, Wiedmann, Eggen*

*regional roundup*

## SAN DIEGO SECTION

The San Diego Section has been merged since January 1, 1963, and is recognized as the first section merged.

Officers for 1963 are Alford Paull, chairman; Kenneth R. O'Neal, vice chairman; Fred W. Garrison, secretary; and Robert R. Hively, treasurer. Junior past chairman is Edmond W. Carlson.

Committee chairmen are Paul E. Fiske, membership; Carlyle W. Miller, meetings; O. Everett Wiedmann, student relations; G. C. Eggen, publicity; and Glen A. Walters, technical operations.

G. C. EGGEN

*regional roundup*

## SACRAMENTO SECTION

Most of the section's efforts the past year were directed toward the realization of the IRE and AIEE merger, as no doubt has been the case in all sections. To all of us it was a very desirable development, and all concerned directed their very best endeavors toward this end.

The initial local planning for the merger began in August of 1962. At this time contact was by the officers of the two organizations, with the immediate result of a joint merger committee being formed. The members of this committee were: Fred E. Schrader, chairman (IRE and AIEE), Max

*Richland Section officers G. L. Swezea, C. M. Salina, and J. C. Spanner*

*Cornell* *Urseny*

Limerick (AIEE), Edward Terhaar (AIEE), William Klauer (IRE), and Charles LaPorte (IRE).

In April, the specified nominating committee selected a slate of officers. The membership voted on the slate in May, and on June 1 the newly elected officers were installed at a gala dinner-dance affair. The elected officers are: Lloyd P. Cornell, Jr., chairman; Walter G. Urseny, vice chairman; Fred S. Schrader, secretary; and Joseph J. Hicks, treasurer.

The new subsection officers selected and installed in office were: San Joaquin Subsection, Ernest J. Goldman (chairman), Michael F. Groves (secretary-treasurer); Reno Subsection, Walter J. Wiseman (chairman), Eugene V. Kasso (vice chairman and program chairman), Arthur L. Carlson (secretary-treasurer); Shasta Subsection, Edward Axtell (chairman), Wayne Turner (secretary-treasurer), and William G. Lane (program chairman).

Sacramento IEEE Section takes considerable pride in its student awards program. An outstanding student achievement (electrical) award plaque was presented to the University of Nevada. The first award was made in November, 1962, to William Stratton, whose name was engraved on the plaque. A similar plaque was presented to Chico State College in 1961 by the then IRE Section. This year the plaque was changed to reflect the IEEE Section sponsorship. Jan Hendrix (senior) received the award for the past school year at Chico State. Also in line with student activities, Thomas Norris, a senior at Encina High School, Sacramento, was chosen to represent the section at the Wescon Future Engineers show.

W. F. URSENY

*Schrader* *Hicks*

*Phoenix Section installed new officers in May, signaling completion of local merger. Emmet O'Gara, past chairman of AIEE, presents gavel to IEEE Chairman George T. Royden. At left is Dr. Arthur L. Aden, secretary, and at right, Dick T. Quisenberry, vice chairman.*

*regional roundup*

## PHOENIX SECTION

The election of George T. Royden as chairman of the Phoenix Section of IEEE signaled the end of two great organizations—the IRE and the AIEE—and the beginning of a new combined group.

Royden was a member of both organizations and a fellow in IRE. He was chairman of the Region 7 IRE convention and is retiring chairman of the awards committee. At one time, he was chairman of the San Francisco Section of IRE and has served on many local and national committees.

Malcolm M. Bridgwater, Arizona Public Service Co., was named vice chairman on the new group. A fellow of the AIEE, he has served on many committees and was elected chairman of the section in 1943-44. Bridgwater is also a member of ASME, Tau Beta Pi, and is past chairman of the state board of technical registration.

Dr. Arthur L. Aden, secretary, manager of Motorola/solid-state systems, was a senior member of IRE. He received the Ph.D. in applied physics, electrodynamics, circuit theory, and applied math from Harvard in 1950. Aden has been a member of various technical groups and a past member of the awards committee.

Dick T. Quisenberry, Westinghouse, is retiring AIEE secretary and becomes treasurer of the new group. He has been engaged in oil field exploration by means of a seismograph. Among his other elective offices were the executive committee and treasurer.

Chairman Royden has made the following committee chairman appointments:

Robert K. Peterson, program (meetings and papers); Trafford M. Morong, SRP, power and industry group; Andrew B. Jacobsen, GE/computer, computer technical group; John M. Ross, Goodyear Aircraft, electronics and communications group; John W. Hidy, Mountain States Tel. & Tel., Prescott, general meeting; Harry Wells, Arizona Public Service, membership; Dr. Sloan D. Robertson, Goodyear Aircraft, and George Groh, Arizona Public Service, awards.

Richard F. Barnes, GE/computer, publicity; Stephen M. Chalmers, SRP, and Lee Graham, Goodyear Aircraft, constitution and bylaws; George McClanathan, KPHO, nominating; and Dr. Carl Zimmer, ASU, student activities.

At its meeting on May 16, the Phoenix Section of the IEEE presented its achievement award to Dr. Arthur L. Aden.

ARIZONA ENGINEER-SCIENTIST

*regional roundup*

### FORT HUACHUCA SECTION

The Fort Huachuca Section of the IRE and the Fort Huachuca Subsection of the AIEE officially merged on July 2, 1963, to form the Fort Huachuca Section of the IEEE. Officers are Walter L. Bryant, chairman; Arthur H. Mudgett, vice chairman; Colin M. Giorgi, secretary; and Clarence S. Wilcox, treasurer.

The merged section, predominantly IRE, has a membership of 80 members; a drive to recruit eligible members, to be initiated prior to the fall session, is expected to bring the membership to 100.

COLIN M. GIORGI

*conference notes*

### WESTERN TECHNICAL CONFERENCE

The fifth IEEE western technical conference will be held November 4, 1963, at the Biltmore Hotel, Los Angeles. The conference is again jointly sponsored by the committees on domestic appliances and domestic and commercial applications.

The program is aimed at providing timely technical and professional information to engineering, sales, and management representatives from the appliance industry.

*New officers of the San Francisco Section are, left to right, William A. Edson, chairman; John C. Beckett, vice chairman; Jack L. Melchor, secretary; and Gerard K. Lewis, treasurer.*

*regional roundup*

## SAN FRANCISCO SECTION

Under the guidance of Peter Lacy, chairman, San Francisco Section, IRE, and Victor E. Kaste, chairman, San Francisco Section, AIEE, the organizations achieved merged publication readership in the Grid on March 1 and a merged section on July 1. Co-chairmen of the joint merger committee were the immediate past chairmen of the two sections, Stanley F. Kaisel and Robert E. Grady. Dean Robert Parden, electrical engineering dept., University of Santa Clara, was honorary chairman, other members of the committee being Lacy, Kaste, Albert J. Morris, Robert H. Miller, Peter Sherrill, John C. Beckett, J. E. Barkle, and James D. Warnock, ex officio. Subcommittees were appointed in the fields of bylaws, program, finances, membership, publications, public relations and publicity, student relations, awards, and nominations, all of them submitting recommendations to the committee for adoption or as charters for future action of section committees.

More than 150 technical meetings were held by the two sections during the program year, many of them jointly presented.

Elected or appointed to serve the section during 1963-64 in addition to the officers pictured above are John V. N. Granger, Section-Wescon director through November 30; Edward W. Herold, Section-Wescon director through 1965; John S. McCullough, Section-Wescon director beginning November 30, 1963; Robert H. Miller and Melvin G. Lewis, directors-at-large; Kaste and Lacy as junior past chairmen of the predecessor sections, and James D. Warnock, executive secretary and executive editor.

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All meetings of the section were merged, effective October 2, 1962.

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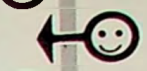

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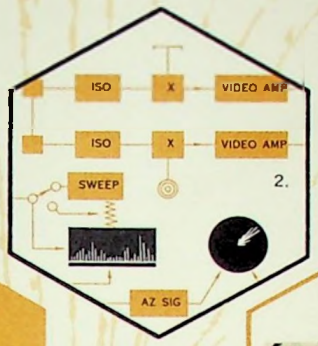

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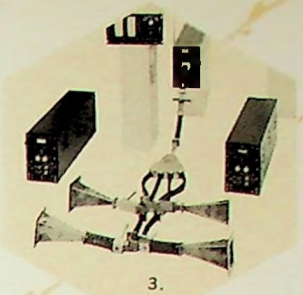
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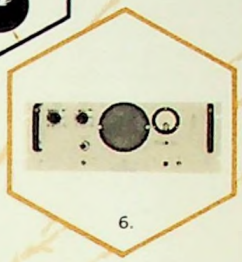
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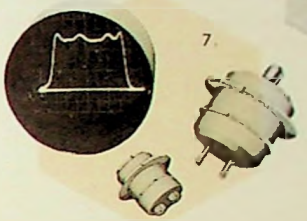
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*'64 wescon plans*

### L.A. TENT KAPUT

At a breakfast meeting with its 1963 exhibitors on the concluding day of the IEEE Show in New York, the Wescon board of directors announced plans for double show sites in Los Angeles next year, combining the Memorial Sports Arena and beautiful Hollywood Park.

Calvin K. Townsend, chairman, said the board had directed Wescon Manager Don Larson to survey all available facilities in reasonable proximity to the Sports Arena and that the choice of Hollywood Park was based on several second-site recommendations that include the Pan Pacific Auditorium (too distant) and the Shrine Convention Hall (too small).

Townsend commented, "Hollywood Park, never before used for a trade exhibition, is an especially fortuitous and appealing choice. The Wescon board is living up to a pledge made last year to eliminate tents as exhibit areas."

The luxurious building and surroundings at Hollywood Park—ten minutes from Los Angeles International Airport and 20 minutes from the Sports Arena—are expected to be a real draw in themselves, according to the Wescon planners.

It is near the heart of the largest concentration of the electronics industry in southern California. Within minutes are North American Aviation, Hughes Aircraft Co., Aerospace Corp., TRW Electronics, Space Technology Laboratory, Nortronics, Douglas, Ampex, Packard-Bell, and similar firms.

In the racing seasons, Hollywood Park has handled more than 72,000 in a single day. Parking lots have spaces for 31,000 cars.

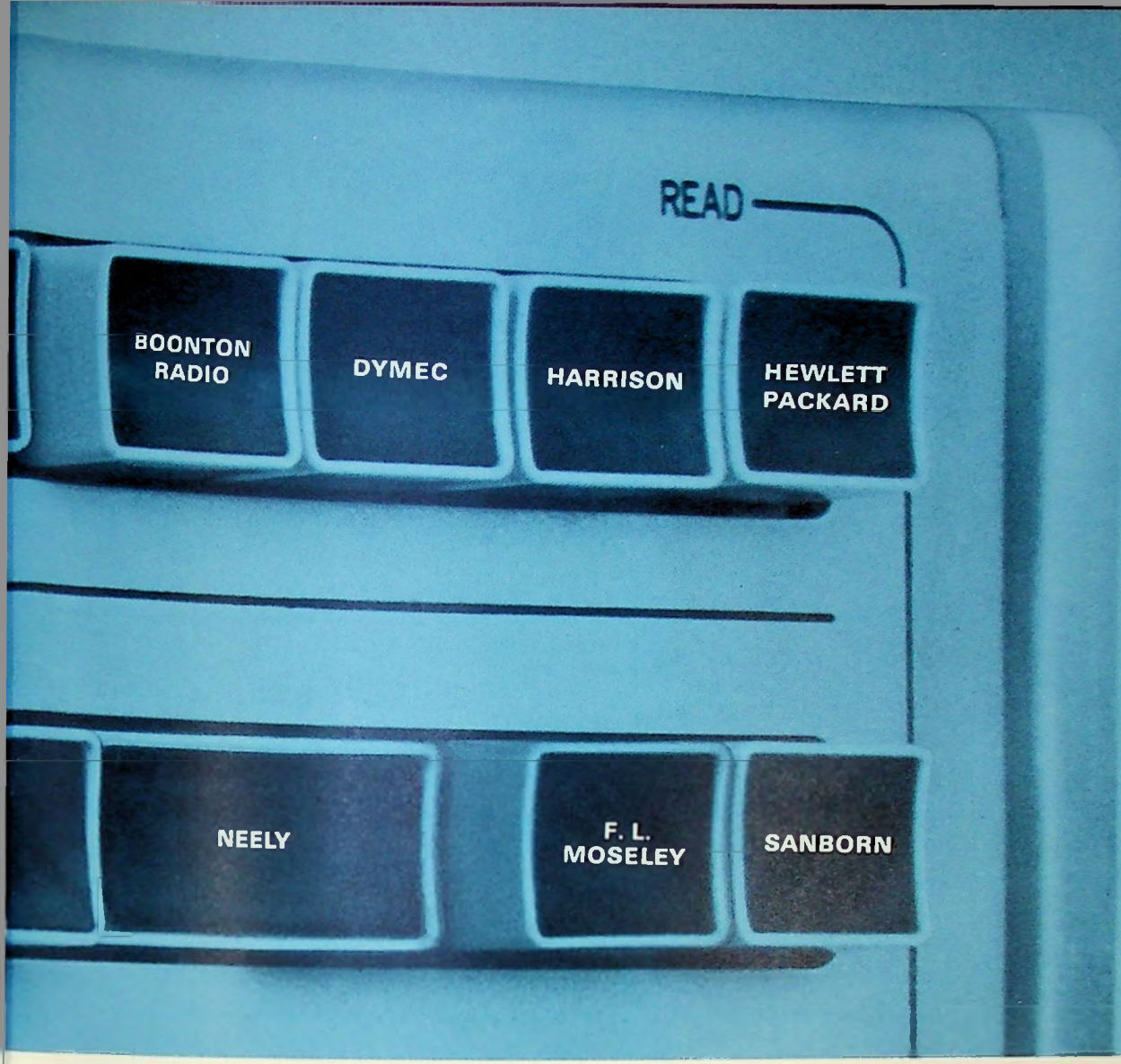
Larson estimates that almost half of the 1,250 booths to be plotted for the 1964 Wescon will be located at Hollywood Park.

The aim is for a "balanced show" between the two locations, Larson says, "with as much to see and with equal traffic at both."

Wescon will set up a rapid shuttle bus service between the Sports Arena and Hollywood Park, with departures on three-minute schedules from both exhibition halls.

Additional early planning calls for the large cocktail party traditional for the opening day of Wescon to be held in the luxurious Turf Club at Hollywood Park next year.

Local convention authorities have estimated that by the late summer of 1964 there will be 5,000 hotel-motel rooms in the vicinity of Los Angeles International Airport and Hollywood Park, which should appeal especially to air travelers and motorists.

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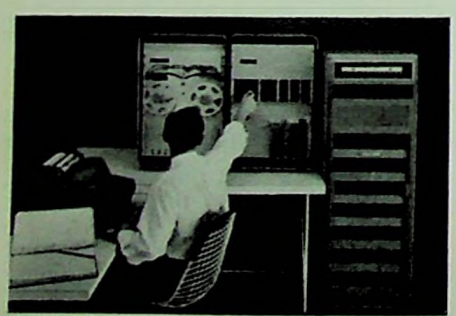

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