EDITOR’S PROFILE of this issue
from a historical perspective ...
with Paul Wesling, SF Bay Area Council GRID editor (2004-2014)

August, 1960:
Cover: The focus of the cover is to remind engineers to drive to L.A. to attend this year’s WESCON.

Page 22: A paper by Bernie Widrow and Ted Hoff is in Session 11, “Computer System Theory”, and is entitled “Adaptive Switching Circuits”. It outlines how an adaptive pattern classification machine (called Adaline, for adaptive linear) might be trained to give certain outputs when it receives certain inputs. Sounds a bit like what we do today with deep neural networks and machine learning.

Page 52: Jack Kilby of Texas Instruments (and a Nobel prize winner, for co-inventing the IC) is a panelist in Session 30, discussing micro-miniaturization. He gives a talk on “Semiconductor Networks”, proposing that all the network components can be fabricated on one semiconductor wafer.

Page 64: In a session entitled “Engineering: The Woman’s Role”, Rose Mary (Decker) Bernstein presents “A Woman Engineer?” to answer questions such as: What kind of women want to do engineering? Can they engineer? Are they accepted by their “fellow” engineers?
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<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage Range</th>
<th>Accuracy</th>
<th>Frequency Characteristic</th>
<th>Output Impedance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1300-A</td>
<td>0 to 10v</td>
<td>±2% full scale</td>
<td>Flat within ±0.25 db from 45c to 20 kc; ± 0.75 db at 20 kc; ± 1 db from 20 kc to 12 Mc</td>
<td>50Ω ± 2%</td>
</tr>
<tr>
<td>1300-B</td>
<td>0 to 10v</td>
<td>±2% full scale</td>
<td>Flat within ±0.25 db from 30c to 20 kc; ± 1 db from 20 kc to 12 Mc</td>
<td>50Ω ± 2%</td>
</tr>
<tr>
<td>1300-C</td>
<td>0 to 10v</td>
<td>±2% full scale</td>
<td>Flat within ±0.25 db from 30c to 20 kc; ± 1 db from 20 kc to 12 Mc</td>
<td>50Ω ± 2%</td>
</tr>
</tbody>
</table>

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Once again the Seventh Region of the IRE, as co-sponsor, is happy to welcome the visitors to WESCON 1960.

The principal Regional activity during WESCON is the presentation of the Electronic Achievement Award. This is awarded annually, at the All-Industry Luncheon, to an IRE member residing in the Seventh Region who has not yet received national recognition for his contribution to the art.

There have been so many words written already about the outstanding attractions to be found at WESCON.

(Continued on Page 6)

TECHNICAL TREASURES DISPLAYED

Bien venido! Aloha! Welcome, in all the languages of the old west, to the 1960 WESCON. As host and co-sponsor to this gala event, the Los Angeles Section invites you to participate to the fullest possible extent.

The growth of the Seventh Region and the Los Angeles Section of the IRE have both been spectac- (Continued on Page 6)
Radio Station Previews 1960 WESCON

Backstage preparations for WESCON will be covered via "live" radio on station KRKD Sunday, August 21, it has been announced.

Les Gideon, Hughes engineer and entrepreneur of technical broadcasts in southern California, has scheduled a direct broadcast from the Sports Arena from 1 p.m. to 1:45 that day. The show will feature interviews with WESCON and IRE executives and present a preview of the four-day show and convention.

Region Director Cont. from page 5

CON, that it would be presumptuous of the Seventh Regional Director, who comes mostly as a guest, to add more. As a prospective guest, however, I can mention a couple of items that interest me greatly. I am going to try to attend the special "Women's Session", another WESCON first, since the paper on "Debugging the Engineer", sounds extremely provocative. I am also intrigued by the paper on "The Anesthetized Individual in a Normal Environment". Will the speaker be talking about an IRE member at the WESCON Cocktail Party?

As usual, I will be torn by the conflict between the field trips and the technical sessions. The field trips are so attractive this year, however, that I suspect I will spend most of my time with the air-conditioned safaris into the wilds of the West San Fernando Valley. Where else but at WESCON 1960 can you visit so many of our new space-oriented facilities in such a short a time, so comfortably and so reasonably?

—C. Wesley Carnahan, Director, Seventh Region

Dunn Cont. from page 5

special values of a general electronics meeting of this sort is the opportunity to make contact with fields of activity different from one's own. An unusual series of survey papers and special sessions provide an up-to-date summary of the state-of-the-art in various specialized areas and I would particularly like to invite your attendance at these tutorial sessions.

Another unusual feature of WESCON is the future engineers' show. I think you will be surprised at the level of technical competence demonstrated by the participants in this show. Their exhibits are the prize-winning exhibits from dozens of high school science fairs throughout the western U.S. If you haven't been to such an exhibit for a while, I can strongly recommend a visit to this part of the WESCON show.

The San Francisco Section of the IRE congratulates the Los Angeles Section of the IRE, WEMA, and the WESCON staff and board on another strong and imaginative WESCON show and convention.

—Donald A. Dunn, Chairman, San Francisco Section

WEMA's President Speaks

Maximum Idea Exchange

We've grown in the past year to more than 300 industrial and research members and it is our privilege, as a co-sponsoring host of WESCON, to welcome you to the 1960 WESCON.

We feel, that, together with IRE, it is our responsibility to you, our guests and to the electronic exhibitors from throughout the nation, to provide the maximum opportunity for the exchange of ideas, close examination of the creative genius of machines on display.

Events have been scheduled to allow for the renewal of old acquaintances, attending technical sessions, participating in field trips, and relaxing at social events.

We of WEMA are grateful to you for your attendance at the balanced show and technical presentations; to the volunteer staff of member companies and the IRE, for their time and effort in creating and presenting WESCON to you.

Our reward, WEMA and IRE's, is your happy and productive memories of the creative advances of products and theory that is the trademark of WESCON.

We will see you at the Los Angeles Sports Arena; at exhibitors booths, in technical sessions and on the field trips.

We will meet at the 1960 WESCON.

S. H. Bellue,
President, WEMA
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GRID-BULLETIN. August 1960
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Convention Director

Jeanne J. Howard
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Hugh Moore
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The hermetically-sealed aluminum casing method developed exclusively for Arnold 6T tape cores is packed full of advantages for you... performance-improving and cost-saving advantages.

It is compact: you can design for minimum space/weight requirements. It's extra-rigid to protect against strains. And it gives you maximum protection against environmental hazards. Arnold 6T tape cores are guaranteed against 1000-volt breakdown... guaranteed to meet military test specs for resistance to shock and vibration... guaranteed also to meet military specs for operating temperatures. They require no additional insulation before winding, and can be vacuum-impregnated afterward.

And now a NEW Arnold service: immediate delivery on your prototype or production requirements for Deltamax 1, 2 and 4-mil Type 6T cores in the proposed EIA standard sizes (see AIEE Publication 430). A revolving stock of approximately 20,000 Deltamax cores in these sizes is ready for you on warehouse shelves. Subject to prior sale, of course, they're available for shipment the same day your order is received.

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Wescon Explores Men-Machines
Even the Engineer's Wife in 1960 Version

Human relationships — man-to-machine, man-to-instrument, man-to-man, any yes, even man-to-woman — will form major topics of technical interest in Los Angeles starting August 23, when WESCON-1960 gets underway.

WESCON's technical program, nucleus of the four-day activity in which 35,000 persons or more will participate, will investigate various aspects of man-machine systems in four regular sessions and an equal number of workshops, bioinstrumentation systems in another, "working with engineers" in still another, and the woman's role in engineering, as seen by a panel of feminine authors.

New Format

There will be 40 sessions in all, plus the workshops, with a new variety in format intended to discourage the note-reading of papers in favor of freer and more spontaneous discussions. The program outline includes debates, panels, related papers, tutorial papers, and combinations of the four.

While up to 3000 persons at a time may be involved (in air-conditioned comfort) in concurrent technical sessions, thousands of others will be touring 987 exhibit booths, branching out to 12 Southland field-trip sites, or inspecting such special displays as the second annual Industrial Design Exhibit on the Future Engineers Show.

Traditional Events

Such traditional events as the All-Industry, Cocktail Party and the All-Industry Luncheon will be staged, and women-at-WESCON (as many as 4000 of them) will be enjoying a four-day "Polynesian Holiday" while the men are involved with business and technical matters at the luxurious Sports Arena.

Included as a part of WESCON is the annual Distributor-Representative Conference, which will engage about 600 industry sales executives in an all-day program of business meetings at the Ambassador hotel on August 22, and both IRE and the Western Electric Manufacturers Association will use WESCON as a background for executive meetings of various kinds. WEMA will hold its annual meeting and luncheon on August 24 in the Statler-Hilton.

Goal Achieved

Throughout all this activity, the work of 200 volunteers who have staffed 14 working committees will be in evidence. Their goal — to make WESCON-1960 an unequaled forum for the exchange of technical information — has been pursued for more than six months.

The technical activities of WESCON-1960 have been supervised by Bruce S. Angwin, General Electric, who serves as convention director. His responsibilities have included guidance of seven committees, including the technical pro-

WESCON
TECHNICAL PROGRAM

(Note: This is the complete program as it existed at press-time. Check your official WESCON Program for last minute changes.)

SESSION 1
RELIABILITY

Tuesday, August 23
10:30 A.M. to 12:30 P.M.
Sports Arena - Room A

Type of Session: Contributed Papers
Chairman: Irvin R. Whiteeman
Project Director, General Analysis Corp.
Los Angeles, California

1. Economy Models for System Design Engineers
   By E. S. Wintlund, Consultant
   Computer Department
   General Electric Company
   Phoenix, Arizona
   In order to design systems satisfactory to industrial and military customers, with economy of design effort and production cost, it is desirable or necessary to determine achievable system reliability, as well as performance and price, and balance system performance and reliability indices with long-term users cost, to achieve optimal system design. From these aspects a design effort allocation technique is developed for situations requiring reliability improvement in the most economical manner. It utilizes theoretically achievable reliability gains to project resultant annual savings, investment, and amortization time. Illustrative examples are provided.

2. The Engineering Contribution to Product Quality
   By William C. Kraft, Manager
   Component Test Equipment Development
   Department
   Sanders Corporation
   Albuquerque, N. Mex.
   This paper outlines responsibilities of the engineering profession to produce of high quality, thoroughly reliable material. Included are identifications and explanations of several areas in which the engineer can help assure that his product will conform with expected quality standards. Some of the areas discussed are attitude, change evaluation, optimization vs standardization, inspection controls, and study of defects.

3. A Systematic Approach to Complex Electronic Equipment Maintenance
   Requirements
   By J. J. Brown, J. H. S. Chin, G. W. Jacob
   Surface Armament Division
   Sperry Gyroscope Company
   Division of Sperry Rand Corporation
   Great Neck, L. I., New York
   A complex shipboard electronic equipment utilizing modular packaging is analyzed for maintenance considerations. Test facilities are determined by calculation of predicted failure rates, spares and maintenance philosophy. A demand factor is calculated based upon failure rates, system population and operating or mission periods. Cost factors of module replacement versus module repair in relation to down time and complexity of repair facilities is discussed. Modifications of the latter approach are presented to yield an acceptable solution when a test facility and selected spare modules are used.

4. Precision Film Potentiometers
   By Herbert H. Adise
   Computer Instruments Corporation

(Continued on Page 12)
gram organizers.

Technical Program

This activity, in which 210 authors, session chairmen, panelists, and dealectors are taking part, will consist of 10 sessions daily (two each morning and afternoon), all but one to be presented in specially built rooms in the audience seating area of the Sports Arena. The session on the woman's role in engineering will be staged at the Statler-hotel, so that women attending WESCON can more conveniently join the men for this program.

Richard G. Leitner, System Development Corp., and Harper Q. Norin, Pacific Semiconductors, who set their sites on a new method of presenting technical information, are chairman and vice chairman of the technical program.

No Reading

In setting up session topics and "inviting" special papers, they designed the program to discourage reading, encourage debate and controversy, and stimulate audience participation. In the matter of paper presentation, they called on the national Professional Group on Engineering Writing and Speech, which is offering special assistance to WESCON authors across the nation in preparation of visual material, speech techniques, and the like.

Technical committees, working under Leitner and North, are: Dr. Lawrence T. Alexander, System Development Corp.; Edward E. Benham, KTTV, Inc.; V. J. Braun, System Development; Robert H. Brunner, Neely Enterprises; Alan F. Culbertson, Lenkurt Electric Co.; Dr. Malcolm R. Currie, Hughes Research Labs; Malcolm R. Davis, the RAND Corp.; George W. Downs, Applied Physics Corp.; Meyer Fishbein, System Development; Dudley E. Foster, Hadeline Research Inc. of Calif.; Howard A. Gates; Dr. Richard A. Gudmundsen, Hughes Products; John N. Hawkins, System Development; Jack Higgins, Consolidated Electro Dynamics; John K. Hilliard, Altec Lansing Corp.; Lt. Col. Raymond S. Isenson, Pacific Missile Range; Prof. Ellis F. King, UCLA; Louis A. Kurtz, Rantec; Walter Kuzmin, Packard-Bell Electronics; Frank W. Lehman, Space Electronics Corp.;

(Continued from Page 14)
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Computers that pace man's expanding mind.
Technical Program Cont, from Page 12

H. M. Swarm and D. D. McNells
University of Washington, Seattle

The propagation path between stations communicating by scattering mechanisms is found to be oriented in various "spurious" directions about a nominal (mean) path. Thus a highly directional antenna pointed in one direction is not as effective as an omnidirectional system as well as a broader antenna properly designed to these statistics. This paper considers the design of such antenna patterns as a function of various parameters.

3. Linear Cancellation Techniques for Suppressing Impulse Noise

By E. J. Baghdady
Massachusetts Institute of Technology
Cambridge, Mass.

The time-honored techniques for eliminating impulse noise are clipping and blocking. Under many circumstances these are entirely adequate, but the resulting non-linearity also introduces distortion, cross talk, loss of information, etc. Linear techniques also can be effective against impulse noise and often do not suffer the same disadvantages. This paper describes linear techniques in general and a new specific technique in particular.

SESSION 4
MANAGEMENT OF MAN-MACHINE SYSTEMS

Tuesday, August 23
10:30 AM to 12:30 PM
Sports Arena - Room D
Type of Session: Symposium
Chairman: Arnold Small, Hughes Aircraft Company, Fullerton, California

1. A Systems Management Appraisal of the Functions of Human Engineering

By T. Eason
Streamberg Carlson Co.
Rochester, N. Y.

If Hollywood would elect to do a scenario about the large electronic systems job of today, the chances are that the villain would be the Systems Manager himself. The heroes - obviously the technical specialists—the Human Engineers, the Reliability Engineers, and the Training Specialists. The object of this paper is to explore the roles of the Systems Manager and of the technical specialists with whom he works. It is hoped that this exploration of objectives can help to establish a unity of purpose among these people.

2. Human Factors Contribution to Management Control Procedures

By Dr. Stanley Deutsch
Douglas Aircraft Company
Santa Monica, Calif.

The design of a system control program requires the identification and listing of areas requiring control, variables involved in control, and relationships among elements of the control system. By virtue of the academic training and general work experience, the Human Factors Specialist is uniquely qualified to assist management in design and development of system control program procedures. The discussion in this paper is intended to highlight the areas in which the Human Factors Specialist can most effectively apply his competence.

SESSION 5
SEMICONDUCTOR DEVICES AND TUBES

Tuesday, August 23
10:30 AM to 12:30 PM
Sports Arena - Room E
Type of Session: Contributed Papers
Chairman: Norman J. Golden
Hoffman Semiconductors, Inc.
El Monte, California

1. Power Output and Efficiency of Thermionic Converters

By Ideal T. Saldi
General Electric Co.
Schenectady, N. Y.

The Power Tube Department of the General Electric Company has been actively engaged in developing and manufacturing thermionic converters. Much effort has been expended in producing close-spaced vacuum converters. The knowledge and experience gained in the development, design and manufacture of these components has been applied to the design of vapor converters.

The purpose of this paper is to present the results of efforts to increase the power output and efficiency of the close-spaced vacuum converter. Some preliminary data from a vapor converter will also be presented.

Theoretical and experimental results will be outlined which show converters output dependent on anode temperature, anode work function, electrode spacing, anode temperature, and cesium bath temperature.

Converter efficiency dependence on anode temperature, anode diameter and anode spacing mechanism will also be described.

2. High Power using Semiconductor Devices

By G. Luettgenau and M. V. Duffie
Pacific Semiconductors, Inc.
Culver City, Calif.

An optimized set of transistors and variable capacitor diodes delivering 0.75 watt at 1.0A is described. A series of optimized device-circuit combinations are described, consisting of a 100 mW transistor crystal oscillator driving a transistor delivering 1 watt at 125°C in turn driving another transistor delivering 3.2 watts at 125°C. This output drives three successive semiconductor variable capacitors, frequency doublers, with an output of 0.75 watts at 1,000 MC. Device optimization and circuit innovations necessary for the above results are considered in appropriate detail.

3. Glass Ambient Diodes

By Jack Cormen
Unin trade Transistor Products, Inc.
Colobasas, Calif.

Silicon junctions are inherently capable of withstanding thousands of volts. Present-day devices do not realize these voltages principally because of shortcomings in the ambient medium surrounding the silicon. This paper discusses silicon diodes operating in an ambient of hard glass where the surface condition and ambient cease to limit either reliability or voltage breakdown. Drift and instability caused by surface migration are not observed.

By choosing the glass and the electrode metal with the same expansivity as silicon, an unretained structure can be fabricated. Since this common coefficient of expansion is low, the device can withstand severe thermal shocks. The high-strength materials used made the device capable of usually large overloads and of storage temperatures as high as 500°C. By eliminating expansion differences the need for a cavity housing a spring of flexible conductor that disappeared, making possible rugged uniteriode construction.

4. Quality Assurance Procedures for Power Transistors

By J. S. Schaffner
Delco Radio Division
Kokomo, Indiana

Power transistors used in military and industrial applications require a high degree of reliability. Quality control procedures for the testing of such power transistors are described. These procedures involve the electrical and environmental tests in
Magnetic tapes of “Mylar”®
insure reliability of recording
and playback

Much information recorded on magnetic tapes can never be replaced because of the tremendous cost of duplicating test conditions. You can protect your investment in such valuable data with tapes of “Mylar”® polyester film. Their small additional cost is negligible compared to the cost of the data they contain. Here’s why they provide higher reliability than any other tapes:

**Less signal dropout.**
Chart 1 shows that dimensional change in “Mylar” with humidity change is negligible compared to acetate. This exceptional stability prevents tape shrinking, swelling or cupping that could result in shifting of tracks or loss of contact with the recording or playback head. Possibility of signal dropout or garbled or weak signals are minimized and reliability of recorded data is assured.

**Fewer garbled signals.**
If magnetic tape picks up or loses moisture unequally across the tape width there will be a difference in length between the edges and center. Chart 2 compares this effect for “Mylar” and cellulose acetate tapes. Because “Mylar” is virtually non-hygroscopic there is no dimensional difference between edges and center to cause poor registration of timing across adjacent tracks on the tape.

**Less tape breakage.**
Since most breaks start as edge nicks, the high initial tear strength of “Mylar” reduces chance of breakage and subsequent failure to record critical information. Chart 3 compares initial tear strength of “Mylar” and acetate. In addition, “Mylar” has the highest tensile strength of any instrumentation tape base. And “Mylar” does not lose its toughness with age, repeated playbacks or storage because it has no plasticizer to dry out.

**Du Pont’s registered trademark for its polyester film**

---

**CHART NO. 1**

**DIMENSIONAL STABILITY**
Coefficient of humidity expansion:
- Cellulose Acetate—15 x 10⁻⁶ inches/inch/% R.H.
- “Mylar”—1.1 x 10⁻⁶ inches/inch/% R.H.

---

**CHART NO. 2**

**MAXIMUM DIFFERENCE BETWEEN EDGE LENGTH AND CENTER LENGTH VS. CHANGES IN R.H.**

---

**CHART NO. 3**

**INITIAL TEAR STRENGTH (GRAVES TEST)**
per ASTM D-1004-49T

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*Du Pont’s registered trademark for its polyester film*
tripgoers will have the advantage of air-conditioned busses on several of the trips.

Sites to be visited include Cal-Tech (accelerators, synchrotron, electron microscopes) and JPL (telemetry, microinunitarization, information theory) on Tuesday, August 23; STL (data reduction and satellite tracking center) on Wednesday morning; Packard-Bell (consumer products) and Telemeter Magnetics (memory cores), Wednesday afternoon.

Wednesday evening, a trip is planned to System Development Corp. (SAGE computer); on Thursday morning, there will be a journey to Rocketdyne's rocket-engine test facility; Thursday afternoon, RCA's new Valley facilities (ground-support electronics) and Thompson Ramo Wooldridge (systems) will receive attention. A second trip on Thursday afternoon will go to the ITT Labs (communications) and to Librascope (computer production).

On WESCON's final day, Friday, a trip will go to Hughes' new Malibu research labs (electronics, infrared, solid-state physics).

Committeemen Named

Working with Curtiss and Knight in planning the big program of field trips are W. M. Anderson Sr., CBS Electronics; Donald L. Segel, Fenske-Fedrick & Miller; Dave Traitel, Electro-Optical Systems; R. G. Molokie, Westinghouse; George A. Straw, General Mills; Joseph Chernoff Sr., ITT; George Saturensky, Packard-Bell; and Charles Wacker, Ramo-Wooldridge.

### SESSION 6

**WHAT ARE THE COMMUNICATION VALUES OF THE TECHNICAL SYMPOSIUM?**

**Tuesday, August 23**

2:00 PM to 5:00 PM

**Sport Arena - Room A**

**Type of Session: Panel Discussion**

**Chairman and Moderator:**

Lorimer F. McConnell, System Development Corporation, Santa Monica, California

**Panelists:**

Irving J. Fong, Remington Rand Corporation, UNIVAC Div., St. Paul, Minn.: THE SPEAKER

E. R. Hagemann, Space Technology Laboratories, Los Angeles, Calif.: THE WRITER

Neil Horgan, The RAND Corp., Santa Monica, Calif.: THE EDITOR


**What Are the Communication Values of the Technical Symposium?**

The four members of the panel will address the subject: "What Are the Communication Values of the Technical Symposium?" from the points of view of the speaker, the writer, the editor, and the publisher.

The number of technical symposia held each year appears to be rising at a rapid rate, and attendance at such meetings represents a considerable effort. It therefore seems appropriate to take a long, hard look at the values of technical meetings and attempts to define requirements for effective communication. Presumably, a symposium is conducted for the purpose of exchanging information and with the hope that, by means of such exchange, old ideas will be modified and perhaps some new ones will emerge. If this is so, then is it really enough for people to simply assemble and address one another and provide a printed record of what transpires?

The speaker at the symposium must employ the best oral communication techniques. Simply reading to the audience has proved in most cases to be completely inadequate. The writer must recognize the particular communication values of the printed word and use them effectively. His paper might be better written after attending a symposium—after his ideas have been tried out on and modified by his colleagues. The editor is traditionally considered to be the man who polishes a piece of writing in order that it may be more palatable to a reader. It is perhaps appropriate to consider the need for an editor who can pull together the various written contributions to symposiums, draw conclusions from the various pieces of information presented, and point up the relevance of any particular session after the papers have been presented and the discussion completed. The publisher makes the final comment. His obligations, therefore, are to assure that the printed record of the symposium is not simply a souvenir piece, but that it makes a real contribution to science and technology.

### SESSION 7

**VARACTORS AND TUNNEL DIODE APPLICATIONS**

**Tuesday, August 23**

2:00 PM to 5:00 PM

**Sports Arena - Room B**

**Type of Session: Contributed Papers**

**Chairman:** George C. Messenger, Hughes Semiconductor Division Newport Beach, California

1. **A Nonlinear Capacitor Harmonic Generator Suitable for Space Vehicle Applications**

   By P. M. Fitzgerald, T. H. Lee, M. S. May, E. J. Powers and J. J. Younger


   This paper describes a harmonic generator device which was designed to be incorporated into a frequency-modulated communication system capable of operating over a wide range of frequencies. An extension of the theory associated with frequency multiplication using nonlinear capacitance is given, as well as a comparison with experimental results is described. The measurement techniques, results, and the procedures followed in the environmental testing of the harmonic generating system are presented.

2. **Parametric Radio Frequency Amplifier**

   By Alexander Szerlip

   Packard-Bell Electronic Corp., Los Angeles, Calif.

   The parametric amplifier using the varactor diode is shown to consist of four frequencies that are the signal, the pump, the sum, and the difference. The stability of this type of amplifier depends on many parameters. It is mathematically shown that an amplifier in which the sum frequency is suppressed can become unstable under certain conditions while an amplifier in which the difference frequency is suppressed is unconditionally stable.

   Low noise, large dynamic range, and low intermodulation distortion are essential characteristics of an RF amplifier for a communication receiver. The varactor diode and microwave balanced modulator, were constructed and tested.

3. **Gain and Bandwidth Inconsistencies in Low Frequency Reactance Up-Converter Parametric Amplifiers**

   By A. K. Kamol and A. J. Holub

   Millimeter Wave Research Lab, Purdue University, Lafayette, Indiana

   Parametric amplifiers achieve the maximum theoretical performance predicted by Rowe only when a matching parameter, α, is unity, a condition unlikely to exist in low frequency operation.

   The parameter α is dealt with for the case of a quasi-unity output amplifier and for the case of a low output amplifier where the non-unity value of α is shown on various performance characteristics. Method of measurement is shown, allowing a more accurate measurement of α. More accurate prediction of amplifier performance is achieved.

   Methods of overcoming the non-unity value of α are presented.

4. **A Compact Tunnel Diode Amplifier for Ultra High Frequencies**

   By Dr. Gerald Schaffner

   Motorola, Inc., Scottsdale, Arizona

   Describes a compact tunnel diode amplifier for operation between 400 and 600 megacycles. Used in conjunction with an equally compact UHF amplifier, an unusually small, low noise and stable amplifier system is achieved.

   The design of the amplifier is described, including the effects of coupling and noise figure and stability. It is shown that special attention on the biasing circuit prevents low frequency oscillations in the bias leads.

   The amplifier described has 15 db gain, a 12 mc bandwidth and a noise figure of 5.5 db across the band. With the isolator, system gain changes less

(Continued on Page 18)
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than 3 db with antenna VSWR variations of from 1.0 to 1.8.

Possible applications for the amplifier are discussed.

5. Analysis and Design of the Twin-Tunnel-Diode Logic Circuit
By C. H. Ailford
Lockheed Aircraft Corp.
Missile Systems Div.
Sunnyvale, Calif.

A pair of series tunnel diodes, supplied by a balanced source containing a triangular rather than a pulsed component, is used as the basis of analysis. Graphical analysis, using lead line technique, permits simultaneous solutions of the loop equations. The analysis then proceeds through the derivation of output characteristics, and the use of "Shmoo" diagrams to develop optimum and extreme case combinations of circuit parameters and component variations. Indices of performance are obtained which can be used to determine the applicability of the circuit as a high speed digital computer element.

SESSION 8
INSTRUMENTATION

Thursday, August 23
2:00 PM to 5:00 PM
Sports Arena - Room C
Type of Session: Contributed Papers
Chairman: Alvin Kaufman,
Litton Industries,
Beverly Hills, California

1. Widely Separated Clocks with Microsecond Synchronization and Independent Distribution Systems
By Thomas L. Davis and Robert H. Doherty,
U.S. Dept. of Commerce
Natl' Bureau of Standards
Boulder, Colorado

In a majority of timing applications, a problem exists in setting two or more clocks to agree with one another. Present techniques using WWV allow clocks to be synchronized within one millisecond. This paper describes a system which offers an improvement in synchronization of three orders of magnitude.

Microsecond synchronization is obtained by use of the National Bureau of Standards Master Clock at Boulder, Colorado, and any slave clock anywhere in the country.

The system also includes a unique method for distribution of several time code formats on a single UHF channel.

2. The Synthesis of Instrument Compensating Networks
By Robert Kearns
Wayne State University
Detroit, Mich.

Compensating computing networks, termed instrument functions, have been developed which, when placed in series with an instrument signal-generating system, result in total dynamic characteristics of unity. While application to accelerometers for inertial navigation is specifically discussed, use of an instrument function is general and can be applied whenever the dynamic characteristics of the system are known.

Other topics of discussion will be noise amplification control to alleviate limitations due to the increased high frequency noise sensitivity of the computing circuitry; obtaining acceleration, velocity and displacement response ratios with one instrument function for a square pulse of acceleration, a second for a triangular pulse of velocity and a third for a half sine wave pulse of displacement; graphical proof that usage of any of the three instrument functions results in more faithful measurement reproduction.

3. An Automatic Plotter of Bode, Nichols or Nyquist Responses
By David Rice
Republic Aviation
Farmingdale, L. I., N.Y.

This paper describes an automatic AC-DC vector mechanism response plotter. Its characteristics include a frequency range of 0.3 to 60 cpi, amplitude range of 40 db, one continuous phase range of 358 degrees and delivery of reproducible x-y plots within 12 minutes.

The plotter consists of five basic units; a generator to supply suppressed carrier information to the system under test, a cross-correlation detector to extract phase and amplitude data, a computer to process the data into two DC functions for plotting an x-y plot using 11 x 17 inch graph paper, a digital processor which determines the type of plot (Bode, Nichols or Nyquist), regulation plots to make the instrument selects the logarithmic frequency for the generator and provide manual control, reset to zero and automatic shut-off.

4. Touch Detector
By G. T. Kemp
Texas Research Associates Corporation
Austin, Texas

Touch detector is the name given to a sillon (electrochemical) pressure detector constructed in a unique manner to make it sensitive for testing very small momentary forces and displacements and yet be insensitive to vibrations.

The device employs the principle of constant flow of electrolyte through an orifice capillary in response to the presence of the closing diaphragm. This flow of electrolyte causes a change in electrical current which can be monitored externally. The current can be fed into an electronic circuit to operate counters or to trip relays for various control purposes.

The design of a particular unit controls the frequency response and the unit may be made selective to different types of stimulus.

Applications of the touch detector will be discussed with primary emphasis on its use as a very sensitive limit switch.

5. An Improved Method of Determining and Presenting Instantaneous Speed Error (Flutter) Data

By Abner Updike
Amplex Data Products Co.

The present method of reading flutter on a calibrated oscilloscope is subject to individual operator interpretation and consequent errors. The method to be discussed provides numerical control and displays the desired information on an electronic counter in numerical form with an accuracy of ±1%. This technique eliminates human error and displays the information in a convenient form for statistical evaluation.

The equipment is calibrated by inserting known sinusoidal signal levels and calibrating a gain control to null these various signal patterns of flutter. In use the gain control is consecutively set to predetermined pattern levels, the counter readouts recorded for each setting. A set of numbers is then available which represents the amount of time the flutter signal was less than various percentages.

SESSION 9
CIRCUIT THEORY

Tuesday, August 23
2:00 PM to 5:00 PM
Sports Arena - Room D
Type of Session: Tutorial Papers with Panel
Chairman: Louis Weinberg
Hughes Research Laboratories,
Malibu, California

Panelists:
Isaac M. Horowitz, Hughes Research Laboratories, Malibu, California
J. R. Burnett, Space Technology Laboratories, Los Angeles, California

1. Analysis and Design of Feedback Systems with Gain and Time Constant Variations

(Continued on Page 20)
The FXR Model X775A X-Band Sweep Signal Source, challenging comparison, is unsurpassed for the measurement of VSWR and reflection coefficient. The Model X775A utilizes a permanent magnet BWO as the rf source. A unique built-in AGC amplifier produces a flat rf level, with respect to a bolometer detector, over the entire swept frequency range. Both ends of the swept frequency range can be accurately preset on separate direct reading frequency dials.

Specifications for the FXR Model X775A:

- **FREQUENCY RANGE**: 8,200mc to 12,400mc.
- **SWEEP RATE (RESOLUTION)**: 300mc/sec to 300kmc/sec, linear with time.
- **SWEEP WIDTH**: to 4,200mc, direct reading, continuously adjustable.
- **OUTPUT TYPES**: cw, square wave modulation [internal 800cps to 1,200cps]
- **OUTPUT POWER**: 0 to 20mw minimum cw into matched load, continuously adjustable. With AGC-detected output flat to ±0.5db (when used with matched bolometers and directional couplers).
- **FREQUENCY DIAL ACCURACY**: ±1% — fixed frequency operation (at specified grid voltage).
  ±2% — sweep frequency operation.
- **OUTPUT CONNECTOR**: 1 X ½ waveguide.
- **POWER REQUIREMENTS**: 115/230V, 50/60cps, 200 watt.
- **DIMENSIONS**: 12 ¾” high X 21 ⅞” wide X 18” deep.
- **WEIGHT**: 78 lbs.

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"If a man's work be true and good...challenging comparison will be his strength."

David Charles

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conditioned busses to counter signs, and inculding thousands of dollars worth of projecting, recording, lighting, and other equipment for technical program use.

Just the transportation program for WESCON alone, calling for continuous shuttle bus service to and from the arena and hotels, and fleets of busses for field trips, the

women's program, and the future engineers' activities, has been a major enterprise in the planning.

Working with Montgomery and Wood are Tom Endo, Magnavox; R. W. Lacy, General Electric; Todd D. Cochran, Aeronutronic, Arnold T. Lloyd, Lockheed; David A. Young, Electronic Systems; Leo Arndt, Hoffman Labs; Harry Mayer, General Electric; Patrick H. Packard, Lockheed, and E. A. Randolph, also of Lockheed.

Students at WESCON

The fourth annual Future Engineers show at WESCON will be, more than ever, a "show within a show," with 36 junior engineers exhibiting their experiments, delivering papers about them, journeying forth on field trips, and attending an awards luncheon.

Electronics experiments were selected in local science fairs throughout the West and Hawaii, and outstanding students and their instructors will be the guests of WESCON and the local sections throughout WESCON in Los Angeles. This is the first year in which future engineers have had their own technical session or a field trip program. They'll visit Space Technology Laboratories for business—

By Ken Chen
Westinghouse Electric Corporation
Pittsburgh, Pa.

This paper presents a method for analyzing the transient response of systems containing elements with propagation characteristics. Several practical examples are discussed, including the open-loop instability in reactor controlled as motor drives. The method of analysis is based mainly on the relations between the corresponding transient response. Bode plots and actual transient response measurements are given for several examples. Practical design methods are presented.

2. Measures of Sensitivity for Linear Systems with Large Multiple Parameter Variations

By S. L. Hakimi and J. B. Cruz
University of Illinois
Urbana, Ill.

Two methods are discussed for characterizing the system function deviation from the design function due to large element variations. The first method involves the use of Nyquist theorem on an element basis of a Nyquist stability criterion. By this method, bounds on the deviation of the system function are obtained. These bounds are calculated while allowing the element values to deviate from the designed values less than the corresponding element tolerances. The second method makes use of the statistical properties of element values. Assuming that all of the elements of the system have certain statistical properties, the changes of the system function are studied. Numerical techniques are presented for computation of the "standard deviation" of the system function for a given distribution of the random variables.

3. Sampled Data Technique for Realizing Network Transfer Functions

By L. E. Franks and I. W. Sandberg
Bell Telephone Laboratories, Inc.
Murray Hill, New Jersey

A sampled-data network is described which consists of a parallel combination of N paths, each path containing a linear-time-invariant network and input and output sampling devices. This network can be characterized by a transfer function which is essentially periodic over a bandwidth proportional to N, the number of parallel paths. The sampled-data filter provides an attractive alternate realization technique for network functions which would normally require the use of complicated elements. Another feature of practical significance is that the system function consists of a sequence of frequency-translated versions of the transfer function of the linear-time-invariant networks in the individual paths. This property has been exploited for the realization of high frequency bandpass filtering characteristics without the use of inductors.

4. Delay Distortion Correction for Networks and Filters

By T. R. O'Meara
Hughes Research Laboratories
Malibu, Calif.

This paper discusses the group time delay functions for low-pass Butterworth filters of orders two through six. These functions are used to provide a technique for a number of delay correction techniques. A number of unusual realization techniques for the first degree network o were discussed. The first order all-pass networks are relatively simple to realize in inductively passive form.

The second order networks are realizable as convenient bridged T's, and design techniques are presented which are based on network synthesis.

5. All-Pass Filters which require a large number of network connections, a trial and error process is outlined. The process converges very rapidly and the computational work is greatly less than that required by the usual techniques.

SESSION 10

SEMICONDUCTOR DEVICES

Tuesday, August 23
2:00 PM to 5:00 PM

Technical Report Cont. from Page 18

Sports Arena - Room E

Type of Session: Contributed Papers
Chairman: T. W. Ghiswold, Continental Device Corporation, Hawthorne, California

1. A New Semiconductor Memory Element with Non-Destructive Read-Out and Electrostatic Storage

By V. H. Grinich and D. Hillibier
Fairchild Semiconductor Corporation
Mountain View, Calif.

A method of information storage is described which utilizes the stored charge in the depletion layers of a PNPN structure. Presence of a large space charge indicates a "zero," and a smaller charge a "one." In the determination of the existing state of the device advantage is taken of the fact that the point at which breakdown occurs in a PNPN device is a function of the ratio of the applied voltage. If one assumes a device with all junctions initially discharged, a voltage pulse having an amplitude less than VS, the switching voltage, and a sufficient short rise-time will cause the device to switch. If, however, the middle junction was previously charged to some state less than VS, the applied pulse would not result in a breakdown. Therefore, by selection of a properly "interrogation" pulse and monitoring the current through the device, one may readily determine the state.

Since this method is electrostatic, the only input power to the device is that which supplies the charge lost due to stray leakage. "Interrogation" does not alter the existing state; hence a non-destructive read-out is obtained. Specific device characteristics are discussed.

2. Some Device Aspects of Multiple Microwave Reflections in Semiconductors

By H. Jacobs, F. A. Brand, J. Meindl, M. Benamit
U.S. Army Signal Research & Development Lab.
Fort Monmouth, N.J.

3. Base Turn-off of PNPN Switches

By R. H. Van Uilen and D. Navon
Transistor Electronic Corp.
Wakefield, Mass.

This terminal, four layer semiconductor devices have now been used in switching applications. Switching on is done by supplying base current. The device may be turned off by withdrawing base current such as high resistivity germanium, an analysis has been made of the switching-off characteristics of the junctions within the medium. The dependence of these properties on frequency, sample length and conductivity is considerably complex and experimentally verified. Variation of the conductivity is observed in experiments, but also differences appear in samples which are not all necessarily identical.

A study of switching by base current will be presented. The switching current gain Ic/Ib will be derived in terms of composite transistor current gain. To attain high switching current gains without sacrificing other desirable device properties such as forward through-base, switching speed and packing density, important design complications involving base layer width, lifetime and doping levels must be reached.

The linearity of the switching process is normally off by withdrawing base current is limited. This is due to potential differentions at the control base layer causing the emitter junction to avalanche. Grometry design to minimize this effect will be discussed.

Switching off times are compared for base or collector off. Their dependence on base layer width, lifetimes and injection levels will be indicated.

4. Novel Adder-Subtractor Circuit Utilizing Tunnel Diodes

(Continued on Page 22)
Many exciting new projects at our ultra-modern laboratories in San Jose have created important openings for men who are qualified to assume new work in advanced areas.

**COMPUTER ENGINEER**—Ph.D. or M.S. in E.E. You should have five years' experience, including circuit logic and system design. A knowledge of information theory, statistics and probability theory is desirable. Your work will involve arithmetic, control and memory units and system organization.

**MICROWAVE ENGINEER**—Ph.D. or M.S. in E.E. You should have five years' experience in design of microwave systems. Familiarity with parametric amplifier design, klystron and traveling wave circuits is desirable. Your work will be in the area of data transmission. Transmitter and receiver design will be involved.

**SYSTEMS ENGINEER**—Ph.D. or M.S. in E.E. or M.E. You should have five years' experience in computer systems design and development, covering both the hardware and systems organization. Experience in reliability and communication-based data processing systems is desirable.

If you meet any of the above qualifications, write immediately, sending a complete resume, to:

Mr. J. P. Fernandez
IBM Corporation, Dept. 714S
Monterey & Cottle Roads
San Jose 14, California
Two binary counter configurations have been devised which fully exploit the properties of the "transistorized" diode flip-flop. A bipolar regenerative gate and a conventional flip-flop utilizing tunnel diodes are described and partially analyzed to determine the understanding of the new counters. Experimental results are given which demonstrate the feasibility and reliability of the circuits.

The counter stages described combine memory, test, and amplifier without impairing reliability. The economy inherent in this arrangement gives the designer latitude in adding regenerative amplifiers to improve reliability.

5. Transistor Scaling Theory

Sports Arena - Room A

By W. E. Roach
Pacific Semiconductors, Inc.
Culver City, Calif.

Basic principles are given for the application of scaling theory to the problem of increasing the power capability of a certain class of high-frequency transistors. Effects of the scaling interpretations are characteristic and performance are predicted on a theoretical basis. Measurements made for a range of sizes over a 5000 to 1 range are compared with the theoretical value.

It is concluded that the application of scaling principles represents a valid and useful approach to the problem of expanding the power capability of high-frequency transistors.

S E S S I O N 1 1
COMPUTER SYSTEM THEORY

Wednesday, August 24
10:00 AM to 12:30 PM

Sports Arena - Room A

Type of Session: Contributed Papers
Chairman: L. J. Craig,
The RAND Corporation
Santa Monica, California

1. Digital Control Techniques for Space

By L. J. Jones and P. Morgolin
Westinghouse Elec. Corporation
Baltimore, Md.

The considerations affecting the use of digital computer controllers in space vehicles (manosted or unmanned) are explored in the light of our expanding space program. The projected augmentation of system control capability is contrasted with the penalties (of size, weight and power) incurred, to determine under what conditions a digital computer controller can be employed to advantage. The desirability of planning for the use of a digital controller is stressed.

System control functions are analyzed to determine the corresponding digital computer requirements. The role of a digital computer as a means for upgrading the probability of mission success and of overall equipment reliability in a space environment is discussed.

Digital computer hardware techniques are surveyed in terms of size, weight and power both as regards electronic circuit techniques and packaging. A combination of a magnetic disc memory, transistor-diode circuitry, code disc input devices, permanent magnet stepping motor output devices, flexible multidimensional printed circuitry and modular electronic blocks are deemed desirable and feasible.

2. The Polymorphic Principle in Data Processing

By Harold A. Kell
Thompson Ramo Wooldridge, Inc.
Canoga Park, Calif.

Discusses the "Polymorphic" concept of data processing, a specialization of computer elements in which control, arithmetic, and other functions are allocated to separate, self-contained modules instead of being centralized in one element-module which are connected to each other through a passive switching network operating at electronic speed. Explains three main advantages of this system: adaptability, expandability, and dependability (figures are given for several designs). Describes the functions and capacities of individual modules, various sophisticated input-output devices, and the Central Executive in the switching network that is the passive, central element of the system.

3. An Adaptive Character Reader

By Paul Baran and Gerald Estrin
U.C.L.A., Los Angeles, Calif.

A pattern recognition system utilizing information derived from a machine learning operation is described. Samples of a set of characters are first identified by a human operator. From such input, a probability matrix is computed, and used to derive a set of weighted filters or weights which distinguish each character relative to the set of possible characters. When unknown characters are read, the proposed pattern recognition machine produces estimates of the confidence of the identification.

A digital simulation of the proposed technique was performed on an IBM 709 computer. A possible implementation having a rough character reading rate of up to 500 characters per second appears feasible. With low confidence estimates for unknown characters, it is possible to call upon more complex processes to aid recognition. Thus, a recognition system can be built having greater accuracy than the basic reading machine. This technique is particularly useful in dealing with distorted characters encountered in language text.

4. Adaptive Switching Circuits

By Bernard Widrow and Marcian E. Hoff
Stanford University
Palo Alto, Calif.

Adaptive or "learning" systems can automatically modify their own structure to optimize performance based on past experiences. The system designer "teaches" by showing the system examples of input signals or patterns and simultaneously what he would like the output to be for each input. The system in turn organizes itself to comply as well as possible with the goals of the designer.

An adaptive pattern classification machine (called Adaline for adaptive linear elements) has been devised to illustrate adaptive behavior and artificial learning. A statistical theory has been developed which relates the comparsion of the classifier to the amount of experience had (number of patterns "seen" in adapting). This theory leads to a basic rule of thumb: the number of patterns required to train an adaptive classifier is equal to several times the number of bits per pattern.

Solid adaptive logical elements (minimization Adalines) have been very effective in pattern recognition systems, information storage and retrieval-by-classification systems, and self-repairing logical and computing systems.

S E S S I O N 1 2
STEREO MULTIPLEX BROADCASTING

Wednesday, August 24
10:00 AM to 12:30 PM

Sports Arena - Room B

Type of Session: Papers and Panel Discussion
Chairman: J. J. Koen,
Hoeman Electronics Corporation,
Los Angeles, California

Panelists:
Carl Eilers, Zenith Radio Corporation,
Chicago, Illinois
William H. Beaubien, General Electric Co.,
Utica, N.Y.
Murray G. Crosby, Crosby-Teletronics Corp.,
Syosset, N.Y.
Harold Parker, Calbest Engineering and
Electronics, Los Angeles, Calif.
William S. Hosteed, Multiplex Development
Corporation, New York, N.Y.

(Continued on Page 24)
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GRID-BULLETIN, August 1960
Technical Program Cont. from Page 22

Speakers:
R. J. Farber, Hazeltine Research Corp., Plainview, N.Y. REQUIREMENTS FOR FM STEREOPHONIC RADIO TRANSMISSION.
A. Prose Walker, National Association of Broadcasters, Washington, D.C. PROGRESS OF FIELD TESTS FOR FM STEREOPHONIC BROADCAST SYSTEMS.

1. Technical Requirements for FM Stereo Multiplex Broadcast
By R. J. Farber
Associate Director of Research
Hazeltine Research Corp.
Secretary Panel 1, NSRC

Based on the premise that the reproduction of individual left and right original microphone signals will produce a satisfactory stereophonic effect, this paper discusses some of the technical considerations involved in FM multiplex broadcast transmission of stereophonic programs. The general considerations of FM and AM subcarrier transmissions are reviewed. Some comments are also made relating to audio bandwidth relationships, stereophonic crosstalk, and to the precedence effect.

2. The Zenith System of FM Stereophonic Broadcasting
By Carl Ellers
Zenith Radio Corporation
Chicago, Illinois

The system for FM Stereophonic Broadcasting proposed by Zenith is basically a sum and difference system. The sum (left + right) audio is used to directly frequency-modulate the main carrier, while the difference audio signal (left - right) is used to amplitude modulate a sub-carrier (39.5 Kc) using suppressed carrier techniques. The sub-carrier, along with a pilot carrier (105.5 Kc), is also used to modulate the main carrier. The pilot sub-carrier uses 10% of the allowable deviation leaving 90% for either the sum or difference amplitude modulated sub-carriers.

At the FM receiver a beam deflection tube is used to demodulate the difference sub-carrier and simultaneously matrix it with the sum audio to directly recover the left and right stereophonic channels.

3. The General Electric Stereophonic Multiplex System
By William H. Beaubien
General Electric Co.
Utica, N.Y.

The FM stereophonic broadcasting system developed by General Electric features stereophonic separation over the entire audio band and yet provides for simultaneous transmission of stereophonic music. Only a simple one tube adapter is required with an FM tuner to convert to this system for the monaural listener. The change in signal to noise ratio is less than one db. The system employs sum and difference matrixing with the sum transmitted as the main carrier and monaural modulation and the difference signal transmitted as suppressed carrier amplitude modulation of an ultrasonic subcarrier. Provision for recovery of the carrier at the receiver is made by transmission of a unique pilot signal at half frequency.

4. Sum-and-Difference FM - FM Multiplex Stereo
By Murray G. Crosby
Crosby-Teletronics Corporation
Syosset, Long Island, N.Y.

In the system to be described, it is recommended that the full multiplex bandbase be devoted to the lower channel for stereo. Sum and difference mixing of the two stereo channels is applied with the sum combination fed to the main channel for compatible monaural reception, and the difference combination to the subcarrier channel. This arrangement results in improvements in signal-to-noise ratio, and stability of separation adjustment. The problems involved when a second subcarrier channel is added, will be discussed.

5. The Calbest Stereo Multiplex System
By Harold N. Parker
Calbest Engineering & Electronics
Los Angeles, Calif.

The Calbest Stereo Multiplex System employs a narrow band subcarrier located at 29.5 Kc. Investigation, both at Calbest, and by Panel 6 of the National Stereo Radio Committee has shown that separation of audio frequencies higher than approximately 8 Kc is unnecessary for reproduction of high fidelity stereo. The Calbest System makes use of this fact to occupy a narrow spectrum with improved signal-to-noise ratio. It is thus possible to utilize one and possibly two additional subcarriers for background music and other non-broadcast applications. In contrast with other systems which have been designed with intention of providing space for background music, the Calbest System makes it possible for the broadcaster engaged in such operations to continue with no change in receiving equipment when stereo programming begins.

6. High-Fidelity Stereo and Simultaneous Subscriber Services by FM/FM Multiplex Method
By William S. Halstead
Multiplex Development Corporation
New York, N.Y.

The paper outlines the importance of broadcasting the public, of compatibility of proposed multiplex stereo systems with respect to (1) simultaneous non-interfering transmission of high-fidelity stereo programs and revenue-producing subscriber services under SCA, now granted to more than 250 FM stations; and of economic value to broadcasters, (2) satisfactory stereo reception of FM/AM simulcast, now widely used in commercial public service, and stereo reception of the same program by FM multiplex method thus providing the large audience needed to attract sponsors, and (3) satisfactory reproduction at a monophonic receiving point during stereo broadcasts.

Techniques employed, as described, permit signal-to-noise ratios of 50 db or better on FM main and subchannels, crosstalk and stereo separation of 50 db or better, and overall harmonic distortion of both main and stereo subchannels conforming to existing rules and regulations in structure for high-fidelity broadcast service. A mixed-high technique to improve S/N performance under high ambient-noise conditions, and to provide two 50-15000 cycle channels at receiving points without exceeding multiplex spectrum limitations, also is described.

SESSION 13
MICROWAVE THEORY AND TECHNIQUES - 1: PASSIVE ELEMENTS
Wednesday, August 24
10:00 AM to 12:30 PM
Sports Arena - Room C
Type of Session: Contributed Papers
Chairman: Harold Saltzman, Kearfott Company, Inc., Van Nuys, California

1. Misconceptions About Equivalent Circuits for Periodic Microwave Structures
By Robert M. Bevensee
Varian Associates
Palo Alto, Calif.

This discussion will establish a scientific procedure for determining equivalent circuits for periodic microwave structures. Several instances will be discussed of the arbitrariness of an "equivalent" circuit chosen by intuition for a structure and the different results obtainable by the utilization of different circuits of apparently equal worth.

Further discussion will include expansion of the ideas contained in a procedure which is set out in a set of means, each of which has an equivalent interpretation; use of variational or coupled-mode techniques in obtaining equations for mode amplitudes; use of the variational-coupling techniques which define the needed equivalent circuits at all.

2. A Fast Switching X-Band Circulator Utilizing Ferrite Toroids
By L. Levey and L. M. Silber
Microwave Research Institute Polytechnic Institute of Brooklyn

(Continued on Page 26)
Education
alone is not a true measure
of an engineer's ability

But without it you're on the outside looking in!

To us, while there is no substitute for education, professional engineering worth stems from a variety of things that merely start with a formal education. Throughout your engineering career there are rough edges to be smoothed. There's doing, re-doing, and doing again. There's frustration and despair. There's happiness and utter elation. There's growth and confidence and respect. There's maturity and courage of convictions. This is your ability, shaped, polished and made strong by conditions and people around you.

This evolution is by no means exclusive to us at RCA West Coast. We do, however, try to bring it out earlier and have you make more of it than most. Like to try? We have exceptional career opportunities for:


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Non-reciprocal waveguide devices have been constructed using permanently magnetized ferrite tubes. The use of ferrite material in this geometry makes possible the realization of ferrite assemblies without the need of a magnetic tuning for switching purposes as the remanent state of this ferrite material may be reversed by the application of a current pulse to a wire wound through the ferrite tube.

Utilizing this arrangement, a differential phase switching circuit has been developed which operates over the frequency range of 2 to 2.5 KMC. The loss between coupled ports is 0.5 db or less and the isolation between uncoupled ports is 25 db or greater. The circulator can be switched in less than 0.5 micro second.

Permanently magnetized ferrite toroids have also been employed in waveguide T and coaxial geometries. Preliminary results are presented.

3. Broadband Electronically-Tuned Microwave Filters

By K. K. Kotezueb
Watkins-Johnson Company
Palo Alto, Calif.

It has been suggested recently that large crystals of yttrium iron garnet (YIG) can be used in the construction of low-loss microwave bandpass filters which can be tuned by means of an applied dc magnetic field. This paper will discuss practical broadband circuits in coaxial line and waveguide for both single-tuned and multiple-tuned bandpass filters using such YIG crystals. One version has operated with electronic tuning from 2000 mc to 6500 mc. The insertion loss was 3 db at 2000 mc, 1 db at 4000 mc, and 0.7 db at 6500 mc, with bandwidths ranging from 18 mc to 40 mc. A packaged version of this filter will be described which utilizes a combination of permanent magnet and solenoids for tuning. The complete filter weighs less than 2½ lb. and can be tuned ±1000 mc from 3000 mc with a power consumption of 5 watts.

4. The Observed 50-90 KMC Attenuation of Two Inch Improved Waveguide

By A. P. King
Bell Telephone Laboratories
Red Bank, N.J.

A new measuring technique which is particularly suited to the measurement of low loss waveguide lines is described. The beam circuit of a single backward wave oscillator is modulated with a short pulse to provide both the signal and bearing oscillator frequencies.

Some measured results which employ this new technique are given for the Td0 transmission loss with 2 inch improved waveguide lines. Both the average loss and the random fluctuations in loss over the 50-90 Kmc frequency band are significantly lower. Some observed data obtained with lines about 400 feet long, one of solid copper and an all helix line, is presented.

5. A Non-Contacting Broadband Rotary Joint, and Four-Way Switch

By D. Alstartte and N. A. Dawson
Melpar, Inc.
Falls Church, Virginia

Recent advances in the development of very wide band antenna types have dictated the need for correspondingly broadband rotary joints and rotary switches capable of high speed continuous rotation with long life characteristics. This paper describes the design and development of a novel non-contacting rotary joint and four-way switch utilizing KMC or bandwidth with VSWR less than 1.5:1 over the band.

A second component described is a new four way non-contacting switch capable of continuous rotation at speeds in excess of 3000 rpm for nearly indefinite time periods. The long standing need for such devices in inventory application has made these devices so desirable that these should find numerous immediate applications for broad band rf systems.

SESSION 14
ANALYSIS OF MAN-MACHINE SYSTEMS
Wednesday, August 24
10:00 AM to 12:30 PM

(Continued on Page 28)
For fast, foolproof measurement of GAIN, LOSS, VSWR, Q, $X_L$, $X_C$, Z

Crystal Controlled Marker Generator
Model CM-10—A 10-crystal unit producing any selected fundamental and/or harmonic frequencies. Each oscillator has its own independent amplitude control. Features built-in scope pre-amplifier and VSWR filter.

Precision Sweep Generator
Model 707—The heart of the test set. Features an extremely flat RF output ($\pm 5/100$ db) and variable rate, all electronic sweep with plug-in oscillators available covering 2 to 265 mcs. Provisioned for use with an X-Y plotter.

Accurate Voltage Comparator
Model VC-12 — The unit that makes Measurement By Comparison possible. A 3-section instrument that contains regulated DC and RF voltage supplies and a wide band coaxial comparator for the simultaneous visual presentation of reference standards against which the test information is compared.

Jerrold MODEL 1707

Complete RF TEST SET employs the Measurement By Comparison technique

Interested in more than one frequency...an entire band, octave, or spectrum? Now it’s no longer necessary to employ the slow, tedious, point-by-point method of measurement when working with a spectrum of frequencies. Jerrold’s new 1707* test set will do the same measurement job Faster, more accurately, and with fool-proof results. Featuring the Measurement By Comparison technique, the model 1707 provides a continuous visual presentation and self calibration against precision standard attenuators (and/or accurate DC and RF voltage sources referenced against a standard cell). So, whatever your laboratory, production, or field needs—Jerrold’s sweep frequency MBC method will serve them better.

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WESCON BOOTHs 426-427

*Similar test sets available for other ranges

GRID-BULLETIN, August 1960
There's a festive punch-party on WESCON's opening day; the choice of a scenic homes tour or a trip to Disneyland on Wednesday; and the glamorous and authentic Tamarack Luncheon and the famed Polynesian on Thursday. Friday's activity will include a swim party at the Statler, and the first all-industry luncheon of feminine guests, complete with featured speaker.

Women guests will also attend the special session on "Engineering; The Woman's Role" on Wednesday at the hotel.

Island Magic

Creating the island magic especially for WESCON has been an active committee working under chairmanship of Mrs. Lois Montgomerie, with Mrs. Bea Larson as vice chairman. Members include Mssedames A. N. Curtiss, Gerry

There's a festive punch-party on WESCON's opening day; the choice of a scenic homes tour or a trip to Disneyland on Wednesday; and the glamorous and authentic Tamarack Luncheon and the famed Polynesian on Thursday. Friday's activity will include a swim party at the Statler, and the first all-industry luncheon of feminine guests, complete with featured speaker.

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We have stereotypes, generic statements and even veiled illusions. Therefore, we cannot say that all engineers love sports cars. We can say, however, (with some degree of safety) that some do. As a matter of fact, we have one at Rantec that’s a nut, with wire wheels and knock off hubs yet. Much has been claimed for this seeming predilection on the part of the engineer. That there is a definite comparison with his own professional art and the whine of an engine at 6000 rpm is, to us, a rather weak argument. This engineer and/or nut is a pleasant enough fellow, quiet, talented (in the extreme, we might add), and a family man with a large second mortgage.

At first glance, his demeanor is, well, the Pontiac class. But if one is possessed of a little insight, one sees deep within this gentleman’s eyes a romance — cornering at 65 mph, Weber carbs and overhead cams.

Although we like this man and respect him, we think all of this is a trifle sad. The modern sports car is truly fine technical machinery, but its popularity in Southern California and Westport, Connecticut, makes them suspect. A love affair between an engineer and a Stutz Bearcat, Mercer Racenbout (with T-head) or a Hispano-Suiza Boulogne we could understand. These cars were great not because of their purities (one gentleman installed a cigarette lighter in his Porsche Super 90 and was drummed out of the Alcoona Sports Car Club), but, essentially, because of their impurities. Take the Auburn 13 Boattail, for instance. Now there was a car. Twelve cylinders in line, six miles to the gallon and a lacquered planked wood body that bore a greater resemblance to Columbus’ Santa Maria than anything automotive. Yet, at the mere mention of a Deusenberg SJ, our engineer grits his teeth and says, “Can it go from zero to 60 and back to full stop in 20 seconds”? We are puzzled. This so-called advantage might be quite good for kangarooing about in downtown traffic or for burping the baby, but for going down to the grocery store for a can of salmon it seems to leave a little something lacking.

Despite it all, we are big-hearted, even though this engineer mumbles disrespectfully every time we pass him in the lunchroom. “Detroit iron!” And with such vehemence. We tell you, if it weren’t for the fact that he’s one of the smartest guys around, we’d … Any engineer with experience in ferrite devices, waveguide components, rf-telemetry devices, microwave subsystems and De Sots, please call Rantec, Calabasas, California. No Volkswagens, please. They’re the worst.

Since 1956 missile and satellite programs have depended for their success, in part, on Rantec multiplexers and filters for telemetry, unique devices which couple two, three, four or six telemetry signals to a single antenna system. A wide variety of tunable models covers the entire telemetry band. Typical specifications on recent models include Isolation between channels to 100 db with 0.5 db insertion loss VSWR — 1.3 Maximum. Rantec multiplexers, hermetically sealed and helium leak-test, for storage and long-time space use, are another example of Rantec’s proven capability in ground and airborne telemetry devices.
additional 40 ladies will serve as hostesses for the Women's program.

**Industrial Design**

Twenty-five outstanding examples of electronic package design have been selected for inclusion in the second annual WESCON Industrial Design Awards, to be presented as a part of the big Sports Arena show.

Judges for this year's event include George Walker, vice president for styling, Ford Motor Co.; Bert Gastenau, Aerojet General; Wilson Bradley, Endevco, and such outstanding designers and design instructors as George Jergenson, Frank Gianninoto, Henry Keck, Storother MacMin, and Harry Greene.

On display will be winning designs in components, instruments, products, and systems, and five of these will be awarded certificates of excellence at the show.

Kenneth J. Sloc, Librascope has been chairman, and Robert Sanders, Benson-Lehner, vice chairman of a design committee that includes Dean Johnson, Librascope; Bob Emerson, Gordon MacKay and Alan Johnson, Emerson-Johnson-MacKay; Bob Mason Industrial Design; Howard Asell, Robert Wilson, Wilson-Asell Industrial Design; Jim Craig, Beckman Instruments; Hal Zerhut, Mito Shimano and Pete Klepa, Zerhut/Vedder/Shimano; John Power, industrial designer; Melvin Best, Melvin Best & Asso-

(Continued on Page 32)

### Technical Program Cont. from Page 28

Reduces the efficiency to 2-4%.

CW saturated power output of from 2.20 watts have been obtained with the cavities synchronously tuned. The best level, synchronously tuned, gain ranges from 25-35 db. The beam voltage range is 500-1500 volts with bandwidth of 10-15 Mc. Synchronously tuned, saturated gains are about 3 db less with bandwidths of 15-20 Mc. If the tube is over-driven and stagger tuned, bandwidths of 20-25 Mc at increased saturated power output and reduced gain may be obtained.

A novel type of differential screw allows easy tunability without backlash over a tuning range of almost 100 Mc.

### SESSION 16

**COMPUTER CIRCUITS AND DEVICES**

*Wednesday, August 24*

2:00 PM to 5:00 PM

Sports Arena - Room A

**Type of Session: Contributed Papers**

**Chairman: George Eisler, Eisler Associates, Los Angeles, California**

1. Diodeless Core Logic Circuits

By S. B. Yochelson

Goodyear Aircraft Corp., Akron, Ohio

A new logic mechanization system, suitable for digital computers, is described. This system is based on the use of conventional square loop ferrite magnetic cores for all operations. It differs from the common core diode of core-transistor logic systems in that only semi-conductor and other active coupling elements are needed. It differs from other diodeless core logic systems in that there are no inherent limits to speed, logic or capabilities, or branching (fan out) capabilities.

A detailed description of the basic concept of the operation of the circuit is continued in the paper and also, descriptions of the theoretical and practical problems resulting from the non-ideal characteristics of the cores encountered in reducing the basic circuit to successful operation. An analysis is presented relating the core parameters to the limits of operation of the circuit as well as analyses of the requirements of digital logic circuits.

Circuits and photographs of a few simple working examples are included.

2. A Multi-Addressable Random Access File System

By E. A. Coil

Librascope Div., General Precision, Inc. Glendale, Calif.

This paper describes the file system developed by Librascope for the Air Traffic Control Data Processor.

This system is unique in that it allows information to be stored in randomly distributed, available locations as identified by the file itself. The data can then be retrieved from the file by addressing the information contained directly. The paper's title stems from the fact that many different criteria may be used, either singly or in combination, for the retrieval of any given record.

Program bookkeeping is thus effectively eliminated. No reference in access order is involved over a conventional, fixed address system.

3. 25-MC Clock-Rate Computer Circuits for Operation from -20°C to +100°C

By Charles R. Cook, Jr.

Texas Instruments, Inc.

Dallas, Texas

Computer circuits have been designed and built for operation at clock rates up to 25 mc and over a temperature range from -20°C to +100°C. Current-mode, inhibit and complementary circuit techniques have been used to obtain maximum speed with two types of presently available silicon transis-

(Continued on Page 32)

Page 30 GRID-BULLETIN, August 1960
WHY A MANUFACTURERS' REPRESENTATIVE

More and more engineers in the electronic industry rely on manufacturers' representatives for objective advice in the choice of electronic equipment and components. The "rep" unlike a factory salesman, is not an employee of the manufacturer he represents; his reputation depends on his independence and freedom to make the best recommendations to customers.

This confidence placed by the electronic industry in responsible manufacturers’ representatives has accelerated the growth of the industry and has provided manufacturers with more efficient engineering liaison, thus reducing the cost of sales.

The most important line carried by any manufacturers' representative is his own reputation.

THE KITTLERSON COMPANY electronic manufacturers' representatives

LOS ANGELES
416 North La Brea Avenue
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WEBster 3-7371

PALO ALTO
809 San Antonio Road
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ALAMOGORDO
2352 Apache Lane
Alamogordo, New Mexico
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GRID-BULLETIN, August 1960
A full adder circuit has been built (to operate at 100°C) that will give a SUM or CARRY with less than 20 micro sec delay, when used in a serial application. With parallel organization, the CARRY propagation time is less than 1.5 micro sec per stage at 100°C.

The shift register and pulse generator used as a clock pulse generator are designed to realize the full adder speed. The clock generator consists of a complementary delay-line oscillator and amplifier which has only 4 percent change in frequency over the temperature range.

4. A Dynamic Logic Technique for
Sixteen Megacycle Clock Rate

By T. P. Bothwell, J. Declue, H. H. Hill, and J. R. Longland

Computer Control Company, Inc.
Framingham, Massachusetts

This paper describes a Family of very high speed dynamic logic packages which perform logic functions at a 16 MC clock rate. Functional equivalence to static logic is achieved with a clocked, conventional static logic element, active and passive delay lines. The paper reviews briefly the background of dynamic logic and discusses the "marriage" of static and dynamic techniques as exhibited in the basic logic element. Discursions include performance, packaging, and typical logical structures.

Generation and distribution of clock signals are considered. Attention is given to the problems and solutions of signal transmission associated with 16 MC synchronous logic.

SESSION 17
MAGNETIC DATA RECORDING

Wednesday, August 24
2:00 PM to 5:00 PM

Sports Arena - Room B

Type of Session: Tutorial
Chairman: Warren R. Isom,
Radio Corporation of America,
Camden, New Jersey

1. Extending the Bandwidth of a Conventional Instrumentation Recording System

By Al M. Wilson
Precision Instrument Co.
San Carlos, Calif.

A development program is described in which an investigation was made of two recording systems which differed only in regard to bandwidth capabilities. The paper is divided into two major sections: (1) the results of extended bandwidth in conventional instrumentation tape recording systems; and (2) the technical design improvements necessary to make extended bandwidth practical for use in such systems. The first section discusses the increase in FM noise and the increase (or decrease) in desired noise. The second section discusses many aspects of required technical design improvements: (1) head requirements; (2) amplifier response; (3) bias frequency; (4) dynamic range; (5) tape selection.

2. The Sensitivity of Reproducing Heads in High-Frequency Magnetic Recording Systems

By W. T. Frost
Ampex Data Products Co.
Redwood City, Calif.

The sensitivity of a reproducing head in high-frequency magnetic recording systems is defined in terms of the frequency losses in the head core. A calculation is made of the variation in sensitivity with frequency. In a high frequency reproducing head and a method of measuring the sensitivity is presented. A measuring method has led to the development of reproducing heads with increased sensitivity.

3. Comparison of Wideband FM and Carrier Erase Techniques for Recording Data from DC to 10 KC

By George Work and David Lewis
Leach Corp.
Compton, Calif.

Instrumentation engineers responsible for recording data are often concerned with a wide range of frequencies from DC to several thousand cycles, with a variety of input instruments. This paper compares two types of recording systems, one employing wideband FM and the other a carrier erase technique. Design problems and performance characteristics are discussed for both systems together with an analysis of typical experiences in data acquisition by use of these techniques.

4. A Wideband Magnetic Recording System

By M. E. Anderson and J. A. Granath
Armour Research Foundation
Chicago, III.

This paper describes a video magnetic recording and reproducing system designed for airborne and mobile use and particularly suited for satellite applications. Extension of the frequency range of the system is achieved by the use of multichannel common-mode head for non-mechanical scanning. High frequency recording capability with low tape speed, low power drain through use of all solid-state circuitry, and density of information stored on tape and potential for very compact size and low weight. Essentially, the entire video spectrum is recorded on a number of low-definition tracks whose outputs can be recombined on playback to produce the original signal.

5. Mechanical Design of the CM-100 Instrumentation Tape Recorder

By John T. Mollin
Mincom Div.
Minnesota Mining & Manufacturing Co.
Los Angeles, Calif.

A new series of ground-based instrumentation tape recorders has been developed forseven-track, 14-inch reel operation with one track capable of one megacycle performance at a speed of 120 inches per second. The tape transport is designed for mechanical simplicity with a high degree of reliability, compactness, and light weight. Principle design features include modular construction wherever possible, and a new packaging approach has been employed. Two frequency response characteristics for playback are provided: one for flat response from 400 cycles to 10 megacycle and another for optimum range of pulse waveforms. Equalizers are provided for each of the 8 tape speeds from 7-1/2 ips to 120 ips.

6. Electrical Design and Performance of the CM-100 Instrumentation Tape Recorder

By George Nils Johnson
Mincom Div.
Minnesota Mining & Manufacturing Co.
Los Angeles, Calif.

This paper describes the electrical characteristics of the instrumentation recorder discussed in the previous paper. In the electronic design, tape-transport circuits have been designed wherever feasible and a new packaging approach has been employed. Two frequency response characteristics for playback are provided: one for flat response from 400 cycles to 10 megacycle and another for optimum range of pulse waveforms. Equalizers are provided for each of the 8 tape speeds from 7-1/2 ips to 120 ips.

SESSION 8
MICROWAVE THEORY AND TECHNIQUES: ACTIVE ELEMENTS

Wednesday, August 24
2:00 PM to 5:00 PM

GRID-BULLETIN, August 1960
ESAKI DIODE
(TUNNEL DIODE)
INVENTED BY
Dr. ESAKI OF
SONY
Now Available

Characteristics:
- Ip: 2mA ±10%
- Vp: 65 mV mean V
- Vv: 350 mV mean V
- Ip/Iv: 5 min
- Vs: 450–500 mV

Features
- Germanium Alloy Junction Type Diode.
- Low level high speed switching.
- Digital pulse circuits, memory matrices.
- Negative resistance Amplifiers.
- Frequency capability is a few Gigacycles.
- Good temperature stability.
- Rugged construction.

Equivalent circuit
- Typical self-resonant frequency = 3 GC
- Switching speed
- a few mµs.

SONY CORPORATION
TOKYO, JAPAN

For further information: SONY CORP. OF AMERICA : 514 BROADWAY, NEW YORK 12.
Technical Report Cont. from Page 32

Sports Arena - Room C
Type of Session: Contributed Papers
Chairman: Richard Jamison, Hughes Aircraft Company
Culver City, California

1. Masers for System Applications
By H. R. Sent
Hughes Research Laboratories
Malibu, Calif.

This paper presents a survey of results of applied research on masers. It is intended to provide general information pertinent to the application of masers to advanced system problems.

Noise temperatures of 10^4 Kelvin or less are available between about 300 MHz and 12 GHz with gains between 20 and 60 db. Typical bandwidths for reflection-cavity masers are about 7.5% of the center frequency. Travel-wave masers show promise for achieving bandwidths of up to about 5%. The development of maser materials suitable for use in the frequency range between 10 GHz and 100 GHz is progressing. The results of a preliminary study for the design of a wide band traveling-wave maser at 35 GHz are presented.

2. Design and Operation of an S-Band Traveling-Wave Diode Parametric Amplifier
By Clinton G. Shafer
Raytheon Co.
Waltham, Mass.

The first part of this design program was to ascertain the necessary conditions for successfully operating a traveling-wave amplifier which utilizes diode. The theoretical approach used "coupled-mode" theory rather than the more complex fiber theory. The device was treated in terms of differential equations rather than difference equations and quantitative answers were obtained without laborious numerical calculations. The same approach has been used successfully in traveling-wave beam-tube work. It not only gave design criteria for obtaining the desired gain and bandwidth but also led to the theoretical expression of the noise figure.

3. The Noise Figure of Iterative Traveling-Wave Parametric Amplifiers
By C. V. Bell
Walla Walla College
Walla Walla, Wash.
and
Glen Wade

The main reason for interest in parametric amplifiers is their inherent low-noise behavior. The gain mechanism involves a reactive element and hence does not produce noise at the output. However, when semiconductor diodes are used to provide the reactive element, spreading conductances in the diodes and other losses in the circuit constitute sources of noise. By far the most important source of noise within the amplifiers is the thermal noise from the spreading conductances. This paper reports on a theoretical treatment of the noise figure and gives experimental data from noise-figure measurements.

Experimental data were obtained on an iterative traveling-wave parametric amplifier operating at 1.7 GHz. The measured noise figure was 1.2 db. The theoretical calculated noise figure was 1.3 db.

4. Theory of Tern Diode Switching
By R. V. Garver
Diamond Ordnance Fuse Laboratories
Washington, D.C.

Recently experimental work has been performed in diode switching in TEM-wave transmission lines with a measure of success but with a minima of theoretical investigation. In this paper theory is presented which explains: the three basic modes of diode switching, one of which is hitherto unreported; the isolation and insertion loss bandwidth; the spacing for and isolation from multiple diode switching elements; the bandwidth of the biasing lead, and the peak and average incident power that a diode can switch. It is concluded that...
Products

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Series Sixty Cabinet Racks
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Handles
Bud handles are fabricated from steel, brass or cast aluminum. Their durable, attractive finish will provide long wear. They have unlimited applications in the electronic, electrical and many other fields. Illustrated are a few typical handles.

Chassis Slides
Two types—16 styles and sizes provide the most flexible method of moving equipment of all kinds from enclosures. The new Bud line of quality ball bearing slides are designed to give the highest serviceability. "SI" line for military and industrial applications and "SC" line for commercial use.

Bud Radio, Inc.
Cleveland 3, Ohio

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Chassis Slides
Two types—16 styles and sizes provide the most flexible method of moving equipment of all kinds from enclosures. The new Bud line of quality ball bearing slides are designed to give the highest serviceability. "SI" line for military and industrial applications and "SC" line for commercial use.

Bud Radio, Inc.
Cleveland 3, Ohio
the overall Public Relations committee to oversee publicity plans and help out in other areas where public relations considerations were important.

Each of the other committees has at least one public relations representative to provide liaison. In addition, the Public Relations committee also planned WESCON's opening ceremonies, press coverage of the big show, the annual tour by security analysts, and similar events.

Willard B. Gregory, Beckman, is public relations chairman, and his vice-chairman is Richard L. Paul- lus, Electronics Investment Management Corp. Committeemen include Don Flamm, Ford Aeronutronic; Eugene A. Mathews, Jet Propulsion Lab; David B. Browne, American Electronics; Charles Francis, IBM; Leon Levitt; A. G. New-

(Continued on Page 38)

Richard L. Paullus
Vice-Chairman, Public Relations

WESCON Report Cont. from Page 34

Technical Program Cont. from Page 34

a switch can be made having a 100-to-1 bandwidth and giving isolation greater than 20 db with insertion loss less than 1 db from 40 mc to 4 gh.

5. Tunnel Diode Microwave Oscillators with Milliwatt Power Outputs

By D. E. Nelson and F. Sterzer
Radio Corporation of America
Princeton, N.J.

In tunnel diodes, the motion of the electric charges takes place at essentially the speed of light in contrast to the relatively slow motion of the minority carriers in transistors. As a consequence, tunnel diodes are unlike transistors, not limited by transit time effects, and can operate at high microwave frequencies.

This paper describes several microwave oscillators using germanium and gallium arsenide tunnel diodes. Problems connected with stability, oscillation build up, hysteresis effects, etc., have been solved by using Laplace transforms. An outline of design procedures is given.

SESSION 19
INTERACTION OF ENGINEERING AND BUSINESS OPERATIONS

Wednesday, August 24
2:00 PM to 5:00 PM
Sports Arena - Room D
Type of Session: Invited Speakers
Chairmen: Dr. Norman H. Moore, Litton Industries, San Carlos, California
Panelists:
Glen P. Bieging, Packard-Bell Electronic Corp., West Los Angeles, Calif.; MARKETING
W. R. Lane, North American Aviation, Los Angeles, Calif.; PATENT LAW
R. T. Silberman, Electronics Capital Corp., San Diego, Calif.; ACCOUNTING AND FINANCE

Panel Discussion—Interaction of Engineering and Business Operations

How versatile is the engineer? Can he formulate, promote and adhere to the non-engineering aspects of a corporate posture, or is he bound without a slide rule? Three authorities in the fields of marketing, patent law, and management, will discuss the varied roles of engineers in the electronics industry, and the day-to-day non-engineering problems which must be faced.

Customer orientation is the essence of the marketing concept, and Mr. Bieging will stress the technical requirements of marketing people to assure coordination between engineer and customer.

Mr. Lane will discuss the function of patent law in our economy, and the present corporate and government attitudes towards patents.

Mr. Silberman will compare the present and past states of the electronics industry, and advance the thesis that engineering management is essential to the development and application of new technologies for the growth of the industry. He will offer some management tools for determining product, company worth, and short and long term cash flow forecasting.

SESSION 20
VEHICULAR COMMUNICATIONS: I - RADIATING SYSTEMS

Wednesday, August 24
2:00 PM to 5:00 PM
Sports Arena - Room E
Type of Session: Contributed Papers
Chairman: D. L. MacDonald,

Pacific Telephone and Telegraph Company, Los Angeles, California

1. Theory and Performance of Vehicular Center Fed Whip Antenna

By Helmut Brueckmann
U.S. Army Signal Research & Development Laboratory
Fort Monmouth, N.J.

Theoretical design considerations and the results of extensive performance tests of a novel antenna for vehicular communications in the 30 to 76 mc frequency range are discussed.

Among the many features of this antenna are: the matching problem, for up to ten bands, is solved by providing separate fixed tuned networks in the base selected by a remote control; the antenna is centered through a coaxial cable terminated at the lower end by a lumped reactor connected to the vehicular cables. The mechanical advantages of the whip configuration are retained with no telescopic section, making PARA Whips or jibbed Paras in the antenna itself.

2. Effects of Tower and Guys on Performance of Sided-Mounted Vertical Antennas

By R. F. Yang and F. R. Willis
Andrew Corp.
Chicago, Ill.

The Omni-directional pattern of a vertical antenna when side-mounted on a mast or tower, is distorted as a function of tower diameter and separation in wavelength. The pattern is further affected by obstruction of metallic tower guy. Laboratory and field measurements of these effects are presented. Possibility of taking advantage of these effects for special coverage is suggested. Tower effect on antenna impedence is briefly discussed.

3. A Broadband 160 MC Collinear Array

By R. F. Yang and L. H. Hansen
Andrew Corp.
Chicago, Ill.

The design of broadband collinear array is presented. It has a minimum gain of 4 db over a half-wavelength dipole and VOLER less than 1.5 over the 155-162 MC band. The circuitry of its horizontal pattern is *= = 4 db. The array elements are enclosed in a Fiberglas tube and are grounded for lightning protection and reduction in static noise.

4. Foamflex Coaxial Cable for Communications

By John Arbuthnott, Jr., A. Laird McKeen, and Sidney W. Trill
Phelps Dodge Copper Products Corp.
New York, N.Y.

During many years demands for very low loss coaxial cables have been satisfied by highly efficient semi-air spaced helix designs such as styroflex and spiroflex. Interest in attenuation losses of similar order, but in a cable combining also the physical attributes of a solid insulating led to the evolution of Foamflex.

The paper discusses design characteristics, applications and future development of the Foamflex.

SESSION 21
COMPONENT AND SYSTEMS RELIABILITY

Thursday, August 25
10:00 AM to 12:30 PM
Sports Arena - Room A
Type of Session: Panel Discussion Following Presentation of Paper
Chairman: Walter R. Kusmin, Packard-Bell Electronics Corporation
Los Angeles, California
Panelists:

(Continued on Page 38)
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GRID-BULLETIN, August 1960
**S. Kukawka, Bourne Laboratory, Inc., Riverside, Calif.**

**A. Wood, Relay Division, Leach Corporation, Los Angeles, Calif.**

**Carlyl E. Bird, The Ralph M. Parsons Company, Pasadena, Calif.**

**Using Failure Data for Component Part Derating**

By I. Doshey

Aerojet-General Corporation

Azusa, Calif.

The use of failure data on previously designed equipment is suggested for application in derating component part ratings in new designs. Certain component part types have been found to exhibit tendencies to become high failure rate items. A method of segregating these items through histogram analysis is used to obtain data on normal and abnormal expectancy. A method of applying such data is explained by example.

Following the presentation of the paper, which presents failure rates of components in an airborne electronic system, a panel composed of component manufacturers listed above will comment from their points of view. The objective of this discussion is to ascertain degree of correlation between systems reliability observations of component and results of component manufacturers’ observations regarding such factors as realistic failure rate, derating, application, etc.

**SESSION 22**

**AIR TRAFFIC CONTROL SESSION I**

**Thursday, August 25**

10:00 AM to 12:30 PM

**Sports Arena - Room B**

Type of Session: Related Papers

Chairman: Vernon Welbe, General Precision, Inc., Washington, D.C.

1. **Operational Considerations in Air Traffic Control Systems Design**

By Ralph F. Link

Bureau of Research and Development

Federal Aviation Agency

Washington, D.C.

The Federal Aviation Agency’s research and development program is directed towards developing a safe, efficient air traffic control and air navigation system for the users of our airspace. To achieve this goal, new concepts and philosophies are being explored. New equipment and systems are being developed and evaluated. Experimental tools are being developed to determine to operational and technical characteristics of the common systems. The ATC system now under development is briefly described. Guiding principles of research, analysis and development proceeding from a common air traffic control system is discussed. Technical and operational problems are reviewed, with some facts and figures on how FAA is solving them.

2. **An Airline Pilot Looks at ATC**

By J. D. Smith

Air Line Pilots Association

New York, N.Y.

The paper is directed towards high-lighting current ATC problems and off-setting the ATC subject, and questioning whether satisfactory solutions are available in the near future.

3. **ATC from the Aircraft Owners Viewpoint**

By Victor J. Kayne

Aircraft Owners and Pilots Association

Washington, D.C.

The electronic industry is facing a new and powerful challenge in the task of equipping the largest fleet of aircraft in the world (U.S. general aviation) to match the electronic capabilities of the air traffic control system.

Proposals now under consideration by the Federal Aviation Agency to fully equalize the present state of the art and the capabilities of the system should make the potentialities of this challenge all the more intriguing.

It is conceivable that the FAA proposals for “approved” type electronic equipment for all IFR and controlled VFR flight may trigger off a wholesale replacement of present IFR radio equipment with new equipment designed to more exciting standards. Therein is the challenge to the electronics industry.

**SESSION 23**

**ANTENNAS, SESSION I**

**Thursday, August 25**

10:00 AM to 12:30 PM

**Sports Arena - Room C**

Type of Session: Contributed Papers

Chairman: Louis L. Ballin, Hughes Aircraft Company, Culver City, California

1. **A New Approach to Antenna Beam-Shaping—The “Coke-Bottle” Antenna**

By C. C. Phillips

Melpar, Inc.

Falls Church, Virginia

The theoretical development of a new method of vertical plane beam shaping from Wullenweber three dimensional arrays is presented along with a particular design formulated from the theoretical techniques. The method consists of expanding the desired beam shape in a Fourier full series expansion and relating the parameters in the expansion to the parameters in the Wullenweber array. Three parameters, interelement spacing, diameter of the Wullenweber at each element, and the amplitude or current distribution along the array are allowed to vary. These three variables are sufficient to define any arbitrarily shaped pattern, including a least squares approximation.

The antenna to be discussed is basically a Wullenweber array but particularly unique in that the diameter of the Wullenweber changes with height so that it has a characteristic “coke-bottle” shape with an asymmetrical, truncated cosecant-squared beam.

2. **Application of Frequency Scan to Circular Arrays**

By Paul Shelton

Aero Geo Astro Corporation

Alexandria, Virginia

The problem of obtaining focusing from a circular array and 360-degree scanning by frequency variation is considered. Whereas an eventhappened serpentine transmission line provides frequency-scan capability for a linear array, it is shown that uniform variation of the line length between elements aligned in a circular array to the extent that the required phase correction is approximated by a parabola. The radiation aperture in the direction limited to the appropriate sector of the circle by using filters in the coupling junctions between the serpentine line and the radiation elements, the relation between bandwidth and transmission-line holding factor is determined, and limitations imposed by element coupling, element spacing, and overlapping apertures at the band edges are found. The curvature of focus of a four-power function of aperture size relative to diameter and compensation with the desired reflector indicates this technique to be significantly more efficient. Aperture antenna characteristics and efficiency of coupling, and the eye and odd components resulting from the asymmetric feed system are calculated. The design of directional filters for partial coupling is described, and the effect of the transfer phase characteristic is calculated.
We promise you a reply within one week.

The complexity of modern technology...the rapid increase in the number of specializations...and the frequent shifts in technological emphasis all have combined to require a staff of alert, aggressive, creative teams of engineering specialists. Their responsibility is to assist management in the formulation of plans for future efforts.

For our purposes the teams should be staffed by graduate Electronic Engineers and Physicists who have acquired several years of experience with radar, guided missiles, computers, infrared detection, nuclear radiation equipment, micro-electronics, underwater detection, space propulsion systems or related areas. Several of the positions require the ability to present contract proposals to both technical and non-technical officials. Other positions require the ability to do preliminary systems design. There are twenty-three openings in the above areas at the present time.

All of the positions involve close associations with senior engineers. All of the salaries reflect the unusual backgrounds required.

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Supervisor, Scientific Employment
Hughes Engineering Division
Culver City, California

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Chairman, All-Industry Luncheon


WESCON Climax
Leaders of the industry will gather Friday, August 26 in the Pacific Ballroom of the Statler-Hilton hotel for the all-industry luncheon, traditionally the climactic event of WESCON.

Upwards of 850 persons will attend the affair, including officers of WESCON’s co-sponsoring organizations, IRE and WEMA.

Arrangements for the luncheon}

(COINUED ON PAGE 44)
how do you play the numbers game?

The current numbers game consists of seeing how many components you can wedge into a small space. But there's a catch to it.

Some circuit modules may seem small until you string them together and find that interconnections and supporting structure take more space than the modules themselves. That's why it's important, in evaluating miniaturization, not to consider the module size alone, but to be concerned with the over-all size, including module, interconnections, and supporting structure.

New EECO MINIWELD circuit modules are designed with over-all system size in mind. They offer optimum miniaturization not only of modules, but also of interconnections and supporting structure. Add to this the reliability of proven circuits incorporating readily available standard catalog components rather than hard-to-get specials, the superior strength of welded rather than soldered connections, and you have an unbeatable combination of advantages.

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Write, wire, or 'phone today for detailed information on the revolutionary new MINIWELD space-saving package.

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Kimberly 7-5651
This paper describes a high-speed color display unit which has been constructed for the evaluation of color in increasing the information handling rate of operator-oriented electronic readout systems. Ordinarily CRT displays for some systems, when they encounter high data rates, tend either to overload the operator or to be so selective that much of the available information is lost.

System requirements and constraints are discussed, and the evaluation equipment, using a special Chromaplex or "Laurence" tube, is described. Special problems are discussed, as well as some solutions, illustrated by color slides.

*Work presented in this paper was supported jointly by USASDL under Contract DA 36 (011) - 78296 and USAF under contract AP (616) - 6207.

**SESSION 25**

**MICROMINIATURIZATION**

**Thursday, August 25**

**10:00 AM to 12:30 PM**

**Sports Arena - Room E**

**Type of Session: Tutorial Papers**

**Chairman: T. Limatoine**

**Diamond Ordnance Fuze Laboratory, Washington, D.C.**

1. **Design and Fabrication of a Microelectronic I.F. Amplifier**

**By J. R. Block**

Motorola Corp.

Phoenix, Ariz.

The design procedure and construction processes required to manufacture an electronic functional element in thin-film form are presented. A two-stage R.C. coupled 5 mc I.F. amplifier is used as an example. Emphasis is placed on the ease of design permitted through the use of thin-film (two-dimensional) techniques. The ability to construct R and C components over a wide range of values and to close tolerances leads to design flexibility. Factors concerning reliability, flexibility of design types, cost and component or functional densities will be included.

2. **A Packaged Micromodule Laboratory for Industry**

**By Donald T. Levy**

Semiconductor & Materials Division

Radio Corporation of America

Somerville, N.J.

The Micromodule concept presents an advanced, proven method for reducing circuit mass without any loss of performance reliability. This paper describes a compact, practical package Micromodule Laboratory containing processing equipment and microelement component together with instructions for its use. The package laboratory enables an engineer to design, assemble, and test experimental Micromodules. Microelement components have been specially designed for use in this laboratory so that a minimum stock of microelements will provide a maximum range of component values. This widened range is made possible by the use of resistors and capacitors having adjustable values and by allowance for various termination possibilities. Simplified assembly and encapsulation techniques have been developed for use with the Laboratory, and a set of tools and fixtures which simplify the construction of experimental Micromodules is described.

3. **Semiconductor Packaging for High Component Density Applications**

**By George P. Walker**

Rheem Semiconductor Corp.

Mountain View, Calif.

Some packaging approaches for high component density circuits are presented. The discussion will be primarily concerned with miniaturized packaging of transistors of the medium power class and diodes of the fast switching computer types.

A functional package of the conventional, i.e., glass or metal seal, resistance welded type will be described. Performance test data will be given. Other approaches, i.e., ceramic, ceramic-metallic, etc., will be mentioned briefly, but emphasis will be on miniature packages using conventional sealing and welding techniques.

Thermal problems will be discussed and some functional design approaches for heat dissipation indicated. Other packaging considerations that become more critical as the package size is reduced will also be discussed. This will include mechanical and thermal stress problems in the seal area as a function of welding and reflowing, thermally induced stress in the semiconductor device as a function of surrounding materials and silicon device assembly techniques for some specific, small packages.

4. **Surface Passivation as Applied to Micro-Components**

**By T. C. Hall**

Pacific Semiconductors, Inc.

Culver City, Calif.

A new approach to semiconductor micro-component packaging employing surface passivation is presented. The term "passivation" is defined to mean the formation of a thermally stable bond or a coating on the semiconductor surface of a strongly-bound chemical film layer which does not adversely affect those surface electronic properties leading to acceptable device characteristics. In addition, a condition of electrical stability of the surface is provided, together with isolation from those electrical and chemical environmental influences leading to device degradation. The merits of the new approach in contrast to conventional hermetic packaging are discussed. Experimental results demonstrating the superior device performance-reliability characteristics of diode structures treated in this manner are discussed.

In addition to improved device performance and reliability, significant and critical advantages in microminiaturization and device fabrication are realized.

5. **Silicon Layer Junctions—A New Concept in Microcircuitry**

**By J. Allegretti and D. J. Shembert**

Merck, Sharp & Dohme

Rahway, N.J.

The deposition of successive layers of single crystal silicon on single crystal silicon substrates is introduced as an advance in technology for microelectronics. Alternating single crystal silicon layers are joined by impurities of different types to produce a high resistance junction. This concept is applicable to an unlimited number of functional elements directly into a structure. The functional elements that have been deposited include capacitors, resistors, rectifiers, voltage limiting elements, diode switches, and solar cells.

Each of the functional elements have been deposited and measured individually. Electrical performance and metatlographic data of these configurations will be presented. A five layer and seven layer structure have been deposited and simple prototypes made from these structures are presented.

6. **Solid State Micrologic Elements**

**By L. Kattner, J. Last, and J. Nall**

Fairchild Semiconductor Corporation

Palo Alto, Calif.

A family of low power—high speed micrologic elements is discussed. The elements, which include flip-flops, gates, inverters, shift registers, and buffers, are comparably designed to form a single interconnectable set to perform logic function requirements in a typical digital computer. In their design and use, the emphasis is placed on the logical function to be performed rather than on the circuit details of the element.

The elements, produced on single silicon substrates, are constructed using extensions of the conventional transistor fabrication techniques of solid-state diffusion, internal metal, etching, and photolithography. The elements are packaged in multiple lead TO-5 and TO-18 headers for convenience in handling and to assure high reliability.

The elements are designed for operation at a speed of 10 mc over a temperature range of -55°C to +125°C, with an average power dissipation per element of 30 mw.

Operational data, reliability considerations, and systems applications will be discussed.

**SESSION 26**

**GOVERNMENT AND INDUSTRY: ENGINEERING PROPOSALS**

**Thursday, August 25**

**2:00 PM to 5:00 PM**

(Continued on Page 44)
Eimac expands its ceramic tube line with the introduction of the 3CX10,000A3—the only 10 kilowatt air-cooled ceramic triode in the field. This advanced power tube is intended for use at maximum ratings through 110 megacycles.

An outstanding feature of this clean, efficient ceramic triode is the large reserve of grid dissipation assured by platinum-clad tungsten grid wires. Overload protection has also been built into the 3CX10,000A3 to make it ideal for use in industrial heating—dielectric and induction.

This newly developed triode is also well suited for such applications as broadcast, FM and single-sideband transmitters, ultrasonic generators and sonar pulse amplifiers. It can also be used as a class-AB2 or class-B linear amplifier in audio or r-f service.

A companion air-system socket and chimney, as shown above, is available with the 3CX10,000A3 to meet your specific requirements. Watch for a low mu version of this high-power triode in the near future.

<table>
<thead>
<tr>
<th>GENERAL CHARACTERISTICS</th>
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<tr>
<td>EIMAC 3CX10,000A3</td>
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<tr>
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<tr>
<td>Diameter</td>
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<tr>
<td>Max. Plate-Diss. Rating</td>
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EITEL-McCULLOUGH, INC.
San Carlos, California

GRID-BULLETIN, August 1960
Sports Arena - Room A
Type of Session: Panel Discussion
Moderator: Cdr. W. Ten Hagen, USN, Bureau of Weapons, Western District, El Segundo, California
Panelists:
James Tassen, Contracts Division, Bureau of Naval Weapons, Washington, D.C.
C. E. Fetihlo, U.S. Army Signal R&D Laboratory, Ft. Monmouth, N.J.
J. B. Lewis, Packard-Bell Electronics Corp., Los Angeles, Calif.
N. Klump, Western Development Laboratories, Philco Corp., Palo Alto, Calif.
Roy Noulden, Wright Air Development Div., Dayton, Ohio

Government and Industry: Engineering Proposals
The defense electronics industry is justifiably concerned with the large amount of time and effort being devoted to engineering proposals prepared in the quest for military contracts. The increase in these costs can undoubtedly be attributed to several factors, including increased competition and government requirements. The purpose of this panel discussion is to explore constructively both industry and government viewpoints on how the government can still select the most qualified bidder and yet reduce the total proposal cost to the bidder. Representatives from each prime service will explain their methods of evaluation and their needs for the requested information. Industry representatives will explore in depth the industry problem and suggest methods for streamlining the evaluation system.

Following discussion between panel members, questions from the audience will be actively solicited.

SESSION 27
AIR TRAFFIC CONTROL
SECTION II
Thursday, August 25
2:00 PM to 5:00 PM
Sports Arena - Room B
Type of Session: Related Papers
Chairman: Glen P. Bieging, Packard-Bell Electronics Corp., Los Angeles, California

1. Central Data Processor of the Air Traffic Control System
By Lane Wolman
Librascope Division
General Precision, Inc.
Glendale, Calif.
The paper discusses various features of the Central Data Processor designed for the Federal Aviation Agency. The system contains a high-speed general purpose computer, a file control system, a multi-channel magnetic drum file system, a highly multiplexed buffer system, and a switching system for rapid exchange of on-line and spare computers. Basic characteristics of the individual elements of the system are discussed, as well as special features such as the file key search, which are particularly needed for Air Traffic Control.

2. Data Processing Requirements of the FAA Air Traffic Control Data Processing Central
By Norman Pomerance
GPI Division of General Precision, Inc.
Pleasantville, N.Y.
This paper begins with a discussion of the functional requirements of the FAA Data Processing Central which is composed of a central data processor and peripheral display console. Following the initial discussion, a detailed description of the computer display and their functions is presented. The paper concludes with a description of the system and peripheral display requirements imposed on the central data processor.

3. Automation in Air Traffic Control
By Rodger E. Davis
Radio Corporation of America
Camden, N.J.
Satisfaction of the need for automatic communications for Air Traffic Control in the form of an ATC data link has been delayed due to a lack of defined operational characteristics. Many factors have contributed to this lack.

FAA AGAGE (Automatic Ground/Air/Ground Communication System) developed by RCA for the R & D Bureau, is an experimental system designed to investigate automated more effectively controlling pilot radio traffic. The concept utilizes two-way time division digital data transfer over existing communications links to provide the exchange of information required to the automation.

This equipment has been delivered to the National Aviation Facilities Experimental Center and is under test and evaluation. The status of the program will be discussed together with a reflection of FAA test results.

4. The Need for Automatic Air Traffic Control
By Howard K. Morgan
The Bendix Research Corp.
Detroit, Mich.
Inability to "see and be seen" at high speed or altitude plus growing peak air traffic densities are giving rise to increased "inter-air" reporting. Traffic control around terminals is not the answer since only part of the traffic is involved. Neither will a projected increase of Controllers from 12,000 to 48,000 over ten years, or less, be effective as a means of increased control. Rather, than solving traffic problems which private pilots dislike and the military cannot tolerate, an Automatic Air Traffic Control System is required.

The features of Process Area Control are found in using computers to control the routine task of supplying positive continuous pilot information, expeditiously solving potential delays, reducing vocal communications and eliminating calculated fix times. These play the necessary elements of a Positive Area Control Concept will be discussed.

5. Future Trends in Air Traffic Control as Influenced by Modern Data-Processing Techniques
By A. G. VanAlstine
Gillilan Bros., Inc.
Los Angeles, Calif.
The present ATC radio "postering" evolved as a consequence of the early navigational aids, and requires extensive participation of the pilot in the form of position reports. Modern navigation methods might free aircraft from the restraint of the airways if the ATC system could accept and process position reports as discrete points and times. Data-processing methods are available which could perform such an ATC separation-monitoring function, but the data-input complex would be prefigured in size and cost. It is suggested that ATC data processors should be designed, rather than be designed by using modern sophisticated radars designed especially for function with the data processors. The result by this method will be at least separate the navigation function from the traffic control function, as well as free the instruments for purposes other than air traffic control, for all classes of air space users. Such a radio-equipped small would handle ready acceptance both economically and operationally.

SESSION 28
ANTENNAS, SESSION II
Thursday, August 25
2:00 PM to 5:00 PM
Sports Arena - Room C
Type of Session: Contributed Papers
Chairman: Charles E. Dunn

Ladies to Visit Unusual Homes
Mrs. Lois Montgomery, chairman, WESCON'S Women's Events, has released details on the tour of two Southland homes.

The tour on August 24 will visit the Fred Cole and George Brubaker homes in Hollywood and Brentwood, respectively, and end with a special luncheon at the famed Santa Ynez Inn near the Pacific on Sunset Boulevard.

The home of Fred Cole (he is the original of Cole swimwear) is high atop the Hollywood Hills above the Sunset Strip. Its contemporary Tahitian architecture and decor has been featured in national magazines as one of America's finest residences.

Fire Fountain
The two-level structure features a master bedroom with massive beamed ceilings just off the upper-level entry. On the opposite side is a triangular swimming pool, at the peak of which is a fire fountain used for evening entertaining.

The lower level includes a music room and den, with a sound system, television, and motion picture equipment in its entertainment center, and Russell Holmes iron sculpture over the fireplace.

The adjoining living room has a panoramic glass wall on each side, one of which opens to the landscaped pool area, the other to a cantilevered wooden deck. Draperies are beaded bamboo, reminiscent of glistening tropical rain. The third wall of the room is a fireplace wall of fieldstone, highlighted by a decorative Japanese wedding obi.

(Continued on Page 48)
A NEW FLIP-FLOP CIRCUIT

A new and simple method for building flip-flop or multivibrator circuits is to use two (just two!) Shockley 4-layer diodes. After all, the 4-layer diode is a solid-state switch...just what's needed in a flip-flop.

Because of low cost, wide range of power handling, and high speed, 4-layer diodes can be used for many flip-flop applications—handling currents from a few milliamperes to 20 amperes...repetition rates as low as 1 cps to hundreds of kc...voltages from 20 to 200...temperature ranges from $-60^\circ$ C. to +100$^\circ$ C.

There is circuit versatility, too. It can be triggered or free running. It can be designed so positive pulses drive it to one side, negative pulses to the other; or so each pulse drives it to one side for a specified time then reverts automatically to the other side until the next pulse. Best of all—only 9 components are required...the free running flip-flop has only 7!

Our new Multivibrator Data Sheet will tell you more. Or, maybe you're interested in how the 4-layer diode can simplify and solve other circuit problems, such as pulse modulators, ring counters, alarm circuits, magnetic memory driving, d-c to a-c inverters, oscillators, detonators, or pulse amplifiers. Call your local Shockley representative or write Dept. 5-2.
HE FRONTIERS OF SPACE TECHNOLOGY IN COMMUNICATIONS

Lockheed's interest in developing the science of communications extends from the depths of the oceans to deep space. Its Missiles and Space Division research programs deal with the development and application of statistical communication and decision theory in such areas as countermeasures; telemetry multiplexing and modulation; scatter communications; multiple vehicle tracking; millimeter wave generation and utilization; sonic signal detection and processing; avoidance of multipath degradation; and interference avoidance.

Associated research and development efforts are directed toward propagation studies and advanced antenna design; low noise amplifiers; vehicle borne signal transmission and reception; solid state materials and devices.

The scope of such activities extends from advanced studies of naval communication problems on and under the oceans; the many applications to satellite vehicles; on to the specialized communication problems of deep space explorations. Latter needs are exemplified by high frequencies, low weight and power, high stability, low effective bandwidth, extreme reliability and basic simplicity requirements.

Engineers and Scientists: Investigating the entire spectrum of communications is typical of Lockheed Missiles and Space Division's broad diversification. The Division possesses complete capability in more than 40 areas of science and technology — from concept to operation. Its programs provide a fascinating challenge to creative engineers and scientists. They include: celestial mechanics; communications; computer research and development; electromagnetic wave propagation and radiation; electronics; the flight sciences; human engineering; magnetohydrodynamics; man in space; materials and processes; applied mathematics; oceanography; operations research and analysis; ionic, nuclear and plasma propulsion and exotic fuels; sonics; space medicine; space navigation; and space physics.

If you are experienced in work related to any of the above areas, you are invited to inquire into the interesting programs being conducted and planned at Lockheed. Write: Research and Development Staff, Dept. H-101, 962 W. El Camino Real, Sunnyvale, California. U.S. citizenship or existing Department of Defense industrial security clearance required.

Lockheed / MISSILES AND SPACE DIVISION

Systems Manager for the Navy POLARIS FBM; the Air Force AGENA Satellite in the DISCOVERER, MIDAS and SAMOS Programs; Air Force X-7; and Army KINGFISHER

SUNNYVALE, PALO ALTO, VAN NUYS, SANTA CRUZ, SANTA MARIA, CALIFORNIA
CAPE CANAVERAL, FLORIDA • ALAMOGORDO, NEW MEXICO • HAWAII
Enjoy Banner Year

In compiling this year’s 7th Region Roundup, the editors acknowledge with gratitude the cooperation that has been received from officers of the various sections. These busy individuals have found the time necessary to provide information and pictures in such quantities as to approach closely the editor’s dream of 100 per cent coverage.

—Frank Haylock
Grid Editor


Alamogordo-Holloman

Membership in the Alamogordo-Holloman Section has now grown to 125 and the Section is entering a period of expansion fully to realize its growth potential. Under the chairmanship of Dr. Mark Jones, the Section presented interesting meetings on such diverse subjects as Solar Flares (Dr. H. Evans), Modern Stereo (Paul W. Klipsch), Analog and Digital Computers (Major Clarence L. Johnson), Meteor Influence (Horace T. Castillo), Electronic Teaching Machines (Dr. R. F. Mager), and Amateur Radio (Capt. J. L. Reinhardt, USN).

One of the Section highlights of the year was a visit by John N. Dyer, vice president residing in North America and C. W. Carthan, director of the Seventh Region IRE. A luncheon was set up with the Section officers attending and a field trip was conducted through many of the facilities at the Air Force Missile Development Center.

The Student Papers Committee selected Charles Burmeister (from the State Science Fair held at the New Mexico State University) to represent the Section at the WESCON Future Engineers Show. His subject was “The Calculation of the Mass of an Unknown Particle in an Ionization Chamber.” Later, in statewide IRE competition, Charles won and was awarded a $500.00 scholarship to the University of New Mexico.

The annual meeting saw the following officers elected for the coming year: Major Ursel C. Nolte, chairman; Lt. Harry E. Wagner, first vice-chairman; Howard R. Velliquette, second vice-chairman; and William S. Stotts, secretary-treasurer. Due to military transfers, Major Nolte has already been forced

(Continued on Page 50)
T-SERIES Germanium Transistor Plug-in Circuit Modules
A complete family of reliable, low-cost, 250-kc transistorized digital circuits for service in compact systems and equipment. Units incorporate standardized signal levels for compatibility and discrimination against false triggering. They also feature consistently conservative electrical specifications, standard package outline, and simple power requirements (+12 volts), as well as compatibility with EECO N-Series and R-Series Minisig indicators. This family also includes core-transistor circuits that are compatible in physical packaging, frequency, signal levels, and power supplies.

Circuit designs are based on derated specifications for the components used, and the resulting circuit specifications are then further derated to give reserved reliability. Units typically designed for 50% greater frequency range than rated in guaranteed specifications.

Typical 300-kc RS Flip-Flop, unit price $26.80 to $33.15.

T-SERIES BREADBOARD EQUIPMENT
The unique EECO T-Series Breadboard and plastic circuit cards enable you to set up, change, or take down circuits without changing components quickly — without waste of time or materials. Unit contains all necessary permanent wiring to accommodate any regular T-Series circuit. All other circuit interconnections are made by patch cords or plugs, with the prewired card circuits to provide a symbolic diagram of the system when completed.

N-SERIES Transistorized DECADES
This family of miniaturized and transistorized plug-in decimal counters features high operating speed, simple power-supply requirements (typically — 12 volts only), low power consumption, and reserve reliability. Standard conservative counting rates are 0.250 kc and 0.5 megacycles, and these units will work dependably even under adverse temperature (54°F to +71°F typical) and ±10% power supply variations. Completely compatible with EECO T-Series digital circuits and R-Series Minisig indicators and may be intermixed as required.

All units are repairable without special test equipment. Models include Incandescent, NaIc, and remote In-line readout, as well as non-indicating. Most models are available in a preset version.

Typical N-120 Incandescent Readout Decade, unit price $198.00.

STANDARD-SERIES and RUGGEDIZED-SERIES
Packaged Plug-in Circuits
This family of proven core-tube plug-in circuits, for application in military and industrial electronic systems, is available in either the Standard-Series or the Ruggedized-Series packages. More than 35 different catalog circuits and more than 200 core-tube circuits have been packaged in the Standard- and Ruggedized-Series containers. More than 100.000 of these modules have been delivered to date. Both series are ruggedized and fungus-proofed for optimum performance under extreme conditions of humidity (tropicals) and life in daily use in the tropics.

In general, the Standard-Series units are designed for use in ground equipment at fixed installations. The Ruggedized-Series modules are designed for high-temperature, shock and vibration, and are suitable for service in mobile equipment. Representative circuits in the Ruggedized package have been tested against +65°C, 3034 humidity, and shock up to 375 G. Most series are compatible with the EECO System, and a complete line is available, from 150-kc to 3-megacycle frequency, for use in ground equipment as well as low-cost custom-circuit packaging. Both series plug into existing 8- or 12-pin sockets, as appropriate to the circuit.

Stadard-Series, typical 100-kc T Flip-Flop, Z-8328, unit price $8.60 to $11.50.

Ruggedized-Series, typical 100-kc T Flip-Flop, Z-92002-8339, unit price $10.80 to $14.75.

MINISIG® Sensitive Transistorized Indicators
These proven sensitive indicator devices occupy no more panel space than conventional indicators, yet operate directly from low-level signals. Many different models are available, most of which incorporate built-in high-sensitivity transistorized driver circuit to give "on-off" indication where the signal excursion is too small (2 to 3 volts) for direct operation of neon or incandescent lamps. Models include neon, filament, high-temperature, and memory (thyatron), and are packaged in miniature, subminiature, and plug-in designs. Most models have adjustable operating characteristics controlled by external bias voltage and will accommodate a wide range of input signal conditions.

Typical Neon Minisig (R-101), unit price $5.60 to $5.55.

DIODE/MATRIX Plug-in Circuit Modules
Multiple clippers, limiters, dc rectifiers, amplifiers or demodulators, relay circuits, bridge circuits, rectifiers, diode gates, or circuits built to order and enclosed in a rugged case for plug-in use. These units eliminate the need for soldering diodes during breadboarding or production. Diode plug-in units are tested to diode manufacturer's specifications after assembly. Diodes are protected from physical damage at all times and can be tested or retested in groups of 8, 12, or 16. Can be supplied with or without hold-downs.

Typical 8-diode unit, employing J67A's, from $15.00 to $25.00.

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Albuquerque-Los Alamos

The 1959-60 IRE year has been an eventful one for the Albuquerque-Los Alamos Section. The first significant event was the election of two members of the Section—Dr. Julius P. Molnar and Mr. Glenn A. Fowler to the grade of Fellow. This was the first time in history that two members of this Section have been elected to the grade of Fellow in one year and we are justifiably proud.

At the Awards Dinner was held on February 1 and Mr. Wes Carnahan, Director of Region 7, made the presentations before an audience of 218.

The next big event was the Section meeting held April 18, when we were honored to have Dr. Ronald McFarlan, international president of IRE, as speaker. Mr. Wes Carnahan introduced Dr. McFarlan to the 165 people attending.

The Annual Meeting of the Section was held on May 11. The principal speaker for the evening was the Honorable Clinton P. Anderson, United States Senator from New Mexico and also chairman of the Joint Congressional Committee on Atomic Energy, who addressed the group on "Our New Atomic Frontiers." Election of Section officers was held, and this was the first time since 1956 that a quorum of the voting membership was present for an annual meeting, thereby making it possible to elect officers without resorting to a mail ballot.

Another memorable occasion was (Continued on Page 52)

Harry E. Wagner

Regional Report Cont. from page 48

to resign as chairman and appoint Ltl. Wagner in his place.

Technical Program Cont. from page 48


View of the head table at the Annual Meeting, Albuquerque-Los Alamos Section.
SEE THESE NEW PRODUCTS

GENESYS DISC MAGNETIC MEMORIES offer higher pulse packing density in a lightweight, space-saving package...superior long life reliability. Features include a choice of bit capacities...no dropouts...only 30-60 ma. writing current. For complete specifications, write for Genesys Bulletin UMM 3, or phone UPton 0-4671.

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RUGGED, ECONOMICAL Elliott Tape Reader is the most compact high speed tape reader available today. Variable speeds up to 1000 characters per second. Stops on any selected character throughout the full speed range. Reads all punched paper tapes. Extreme reliability, maximum speed and ease of tape insertion. Bulletin ETR-1.

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EYE, TRY, BUY AT WESCOW BOOTH 536
the Annual Picnic held on June 4 in the Jemez Mountains north of Albuquerque. This meeting, attended by members and their families, was highlighted by the installation of the newly elected officers. The new officers are: Robert C. Crevelling, chairman; Thomas E. Lommasson, vice-chairman; Robert P. Nobel, secretary; and J. E. Gross, treasurer.

Another “first” for the Section was the appointment of Mrs. Edwina Gomel to the executive committee. She served as co-chairman of the social committee and was responsible for women’s activities.

Finally, the Albuquerque—Los Alamos Section is especially pleased with the attendance at Section meetings during the 1959-60 year. The total attendance was 1210—an increase of 256 per cent over that for the previous year. This should be strong evidence that the membership is taking more interest in the IRE and its activities.

—R. C. Spice

Hawaii

The Hawaii Section Annual Meeting was held June 10 at the Queen’s Surf in Waikiki with wives and guests invited. Elections were held with Daniel L. Pang becoming chairman; Eugene Piety, vice chairman; and Dr. Ralph Patridge, secretary-treasurer. Officers during the past year have been Melvin Vittum, chairman; Daniel Pang, vice chairman; and Eugene Piety, secretary-treasurer.

Section meetings are held on the second Wednesday evening of each month (except July and December) at the Hawaiian Electric Co. auditorium on Ward Street. Pre-meeting dinners are usually held at the Evergreen Restaurant on Kapiolani Blvd. Visitors to the Islands are always welcome and, in fact, the Section has been fortunate during the past year in having three papers presented by visiting mainland engineers.

No field trips were made during the year but a number of interesting papers were presented on such topics as Satellite Signals, Ionospheric Scatter, Nuclear Reactors, Radio Astronomy, and others.
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Technical Program Cont. from Page 52
Seeking a Logical Bio-Instrumentation System
Panel Discussion

The panel will discuss bio-instrumentation re-
requirements for gathering physiological data in three
areas of modern medicine: (1) Anesthesiology—the
anesthetized subject in a normal environment; (2)
Cardiology—the unhealthy conscious individual in a
normal environment; and (3) Space Physiology—the
conscious individual in an abnormal environment.

Special attention will be directed to the signif-
ificant elements in the recorded signal; and the in-
formation to be derived from direct and integrated
measurements of physiological functions. The panel,
composed of representatives from the medical and
physical sciences, have been charged to critically ex-
amine the Whys of certain accepted practices in
physiological measurements with the view of es-
tablising an environment more favorable to an inter-
disciplinary understanding of common problems.

SESSION 32
MILITARY ELECTRONICS
Friday, August 26
10:00 AM to 12:30 PM
Sports Arena - Room B
Type of Session: Contributed Papers
Chairman: Lt. Col. Raymond Ivenson,
Office Deputy Commander Army,
Pacific Missile Range,
Pt. Mugu, California

1. System Implications of Electronic Ancestor Worship
   By Bernard Baldridge
   Light Military Electronics Department
   General Electric
   Utica, New York
   Inadequate system planning has led to the evolu-
   tion of equipments which are fast polluting the
electronic environment. The problem is analogous
to the modern day contamination of our streams
with sewage. As unpolluted water becomes a more
precious natural resource, a prohibition on unpro-
tessed waste product disposal into streams is ne-
necessary.

   Similarly, the indiscriminate disposal of acoustic,
radii frequency, radio-active, and other offensive
pamphlets waste from our sacred electronic ancestors
must be prohibited. Sewage disposal will be cheap
compared to the disposal of unwashed RF; acoustic,
or radioactive waste. The problem calls for an im-
mediate re-examination of equipments specifications
to include mandatory analysis of efficiency and
operational capability factors early in design. Before
a "seal of approval" is granted to a proposed sub-
system, a two point analysis must be made. First,
the potential problems of concerned devices for
other systems must be considered. Second, the en-
vironmental problems faced by the proposed equip-
ment itself must be considered.

2. Implementation of a Modern Communication System on a National and a Global Basis
   By C. K. Choppulis
   Communication Systems Engineer
   Los Angeles, Calif.
   The problems of emergency communications for
the Department of Defense and the civil government
are quite similar. Equipment suitable for civil
government use may be available somewhat earlier
than some of those required for military use.

   Switching, data, telephone, terminal, storage, and
security equipments can be available for imple-
mentation of modern communication systems in the
1961 to 1963 period for reasonably efficient use
of the nominal 4 kc channel for most of the com-
munication requirements of men and machines.

   Careful utilization of available commercial ser-
vice combined with provision of government facil-
ities to provide system designs which will remain
acceptable capabilities for emergency service is
possible. The knowledge to combine the capabili-
ties into acceptable systems exists today. Decisions
for implementation can overcome the problems of

(Continued on Page 55)
GLADHAND, DOUBLEDRY, GIRTH AND MARKUP
IN ELECTROLAND!

3. Automatic Programming of Ground Support Equipment Using Computer Techniques
By Meyer Cook
Convair, Astronautics San Diego, Calif.
and C. Keeler
A method is described for producing Remington Rand (UNIVAC) punched cards for use with Automatic Programmed Checkout Equipment (AP Che) directly from engineering input to an IBM 704 Computer. This is contrasted with original sequence of operations in which several translations and manual checks are required. Inspection methods are discussed and reliability of finished card decks prepared by both means.

A brief description of the AP Che and its application precedes the major presentation.

4. The BMEWS Automatic Monitoring System
By E. L. Danheiser and M. Korsen
Radio Corporation of America
Moorstown, N.J.

This paper describes an automatic system which monitors and detects faults for the vast BMEWS radar system. Utilizing digital as well as analog techniques, it provides fault sensing and fault isolation routines. Key signals in every major subsystem are continuously checked against thresholds set to system tolerances. A detailed sequential check of the faulty subsystem is initiated when a continuous fault appears. Sequential checking is programmed by punched cards, each card containing all information necessary to test a particular point. Examples of standard as well as special methods of fault sensing techniques are described. A detailed explanation of some of the key circuits is given and its specific relation to the overall Automatic Monitoring system is described. Accuracies and tolerances for some of the key items are also included, and reliability factors are discussed.
1. Pulse Position Modulation

By Conrad H. Hoepner
Electronics
Melbourne, Fla.

It has been shown that pulse position modulation/amplitude modulation is a very efficient means of transmitting information and particularly time multiplexed data channels. It is quite unsurpassed in this respect when data of moderate accuracy such as encountered in aircraft and missile testing is conveyed.

Conversely to PPM from analog voltages, variable resistance transducers and strain gauges are extremely simple, reliable and accurate. Conversion of PPM to other intelligence forms such as graphic plots, analog indications and digital computer words is simple and is done more reasonably on the ground rather than in the flight vehicle.

2. Medium Accuracy PAM-FM Telemetry

By M. B. Rudin
Aeronutronic Systems, Inc.
Newport Beach, Calif.

Analytical and experimental studies of four frequency modulation systems (PAM, PCM, PM and FM) in use or advocated for missile range telemetry have been conducted. PAM-FM has been shown to require the least transmitted power and/or bandwidth where medium accuracy of the order of 2% RMS error is required. This error is composed of assumed mutually uncorrelated fluctuation, crosstalk, distortion and sampling error.

The discussion will cover such basic operating techniques and parameters as transmitted power versus RF bandwidth, RF and video bandwidth and frequency deviation versus sample rate, duty cycle, sampling error and sample rate versus information bandwidth and frame synchronization versus 100% transmit duty cycle.

3. Efficient Transmission of Information
in Telephone Communications Networks

By J. W. Halina
ITT Communications Systems, Inc.
Nutley, N.J.

The mission of the telephone communications system engineer is the provision of information transmission channels to a multiplicity of users or subscribers. In general he begins with a high capacity channel or channels, temporarily and spatially distributed in a network, and he wishes to partition, or channelize it, into "saleable parcels." In the telephone industry the universal package is the nominal 4 kHz telephone channel.

There is an inevitable penalty to packaging or channelizing bulk capacity. There is the cost of the package (channelizing equipment), per se and the loss of the bulk capacity incurred in partitioning it into small parcels.

The capacity of the bulk channel or transmission medium is defined by its power handling capability in noise and its effective overall bandwidth.

The author considers the modulation systems in current use as channelizing means namely, single sideband, double sideband suppressed carrier amplitude modulation, double sideband suppressed carrier modulation, and narrow band FM from a theoretical, equipment, and cost point of view and develops measures of efficiency for each.

4. Operating Characteristics of the
Digilock Communication System

By Roy W. Sanders
Space Electronics Corporation
Glendale, Calif.

This paper describes the Digilock Telemetry System and discusses its various operating parameters. The paper shows the extent to which this system can approach the limit of communication efficiency given by Shannon's channel capacity formula using practical hardware.

Several examples of the applicability of the Digilock technique to various communication requirements are given.

5. Digital Data on Communication
Circuits

By J. L. Hallis
Rixom Electronics
Silver Spring, Md.

(Continued on Page 57)
Voice communications circuits with nominal bandwidths of 3000 cycles are almost universally available throughout the world. In order to take advantage of this widespread availability, digital data communication systems must be designed to operate within the limitations of these facilities. It is important that for engineers and designers who plan to utilize them to have a clear understanding of the basic characteristics of common voice facilities and how they affect the transmission of digital information.

6. Telebit as a Data Transmission System

By John E. Taber
Space Technology Laboratories
Los Angeles, Calif.

Telebit was conceived and designed early in 1959 to transmit data from interplanetary probes as rapidly and as efficiently as possible. The system was intended to convey information from several scientific experiments and several infrared environment sensors to one of several earth tracking stations in a form that would permit rapid relaying to the Space Navigation Center in Los Angeles. The extreme ranges involved required equipment of large peak transmitter powers with the consequent need for a low transmission duty cycle. Even with the large transmitter power data transmission would be limited to a few bits per second and because of the duty cycle gap for accumulating data during transmitter down periods was needed. The Telebit system which emerged as the answer to these requirements was designed, constructed, checked out and flown on Explorer VI within a period of less than eight months. Another unit is currently sending data from Pioneer V over distances exceeding ten million miles.

7. Optical Communications Systems Utilizing Solar Energy

By Duane D. Erway
Electro-Optical Systems, Inc.
Pasadena, Calif.

The paper presents an introduction to optical communication using solar energy as the light source and, in addition, contains the results of some comparative performance studies with radio frequency systems. Examples of attractive applications are suggested.

After a general discussion of the requirements of the transmitter and receiver, a typical system is given. Particular attention is then given to the problem areas in solar-optical communication systems.

Performance limitations are outlined and analyzed. Emphasis here is placed upon the noise encountered and the characteristics of the sun as a light source. The signal-to-noise equations are examined and plotted for several possible links using realistic parameters.

With the above as background, the advantages and disadvantages of solar-optical communication are explained. The performance of an RF system is then compared to that of a solar-optical system for a specific link. The results are presented as the required transmitted RF power to give the same information rate as a solar-optical system. For this comparison, equivalent antenna areas are assumed for both systems.

8. Pulse Amplitude Modulation—a High Performance, Low Cost Solution to Space Telemetry Problems

By Elton N. Sherman
General Devices, Inc.
Sherman Oaks, Calif.

The InterRange Instrumentation Group standard operating procedures were designed around by today's technology, low performance vehicles. Recent advances in high performance vehicles, space station instrumentation, as well as deep space vehicles, have called for a rather rigorous expansion of herefore little-explored avenues in the telemetry realm. Pulse amplitude duration is a logical choice for many data gathering/data retrieval systems in that it requires a minimum of conversion in order to adapt to operation with some of the more recent digital data concepts. It becomes readily apparent that PAM techniques are having a renaissance in the space age.

Recent studies made by many leading organizations show that pulse amplitude modulation both in standard IRIG and also many non-standard configurations is perhaps the most flexible, most reliable, highest performance technique available today, and is not last but least, the most economical.

(Continued on Page 58)
New KAY Ligna-Sweep SKV

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- OUTPUT LEVEL: Continuously variable from 1 volt rms down to 65 db below 1 volt, ±5% over widest sweep AGC.
- IMPEDANCE: 70 ohms nominal (50 ohms on request). Audio range: 600 ohms.
- SWEEP OUTPUT and REPEAT RATES: Sawtooth for horizontal deflection of oscilloscope. Approx. 7 volts peak to peak—Output impedance 1,000 ohms nominal; fixed 60 cps, line locked; fixed 30 cps, logarithmic (for audio and video application); 3 cont. var. ranges—2-1 cps, 1.5 cps, 5-30 cps.
- MARKERS: Swept signal available for operation of Varie-Marker SKV Generator. Optional Internal Markers limited number of sharp, crystal-controlled pulse-type markers at customer specified frequencies can be provided. Please inquire before ordering.
- POWER SUPPLY: Input approx. 220 Watts, 117 v (±10%), 50-60 cps B+ electronic regulation.
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SEE US AT THE WESCON SHOW BOOTHS 2062-3
4. Human Factors in System Operations and Training

By James W. Singleton
System Development Corporation
Santa Monica, Calif.

The thesis of this paper is that in many respects, the system process begins rather than terminates at the point of implementation. System operations contain the payoff in the entire process of system development. Neglecting the significance and professional aspect of equipment in system operations does a disservice to the role and reparation of the system developers.

System operations is possibly the most neglected phase of system development. It is considered lacking in professional challenge and unworthy of serious attention. Time after time, descriptions of the system process conclude with the phase "then and the system is implemented."

The major characteristics of the system operational period is that people are an integral part of the system for the first time. Although people infuse the process of system analysis, design and management, it is only in the operational period that operators, supervisors and managers are on-line capacity in making system work.

5. Measuring Human Interactions in Man-Machine Systems

By A. M. Freed
System Development Corp.
Santa Monica, Calif.

The paper is a first step toward a research effort intended to devise instruments for measuring human interaction behavior in man-machine systems. The search for such measures is thus made out of the need for system operators as well as system trainers for a method of assessing system effectiveness and the effectiveness of training programs.

The proposition is made that there are two aspects of man-machine systems: a conceptual system, which reflects the design and administration; and the operating system, which is the dynamic act of the system.

The suggestion is made that the interactive behavior of people in an operational system be observed and evaluated in terms of achievement of goals. Such observables and discriminates become possible when the operational system is measured in operational terms.

Samples of the vast literature dealing with human interaction are presented. Implications for research and applications of prospective findings are described.

SESSION 35

VEHICULAR COMMUNICATIONS II: MOBILE RADIO AND PAGING SYSTEM

Friday, August 26
10:00 AM to 12:30 PM
Sports Arena - Room E

Type of Session: Contributed Papers and Panel

Chairman and Moderator: Kenneth T. Corner,
Comm. Dept.,
City of Los Angeles, California

1. Personal Radio Paging in the VHF Band

By John F. Mitchell
Motorola, Inc.
Chicago, Ill.

A citywide one-way personal radio paging system with a capacity of 7500 subscribers has been developed by Motorola. Complete system and equipment for compatible application in existing installations is discussed.

This system is designed to be compatible with all land mobile PM communications in the 30 and 150 ms bands. The voice message is sent after a two-tone-code is used to select the desired subscriber. The high performance miniaturized receiver (6" x 2 1/2" x 1") contains the tone selector using Reed relays.


By T. H. Yeffe
Bendix Radio Div., Bendix Corp.
Baltimore, Md.

This paper describes a VHF "personal" communication receiver-processor assembled entirely from individual circuit modules. The modules are constructed with standard, commercially available, miniature components. They are designed and modified if desired. Other receiver features include a 1 watt power output, a transistorized modulator and a DC-DC converter type of power supply with rechargeable nickel cadmium batteries. The shirt pocket receiver operates with a combined weight of less than 100 cubic inches and total less than 4 lb. weight.

3. System Performance, Compatibility, and Standards

By R. T. Buesing and N. H. Shepherd
General Electric Co.
Lyneburg, Va.

The two prime purposes of Industrial Standards, for two-way land mobile radio equipment, are to assure high standards of customer performance and system compatibility. Examples of each are discussed separately.

The necessity and logic for standards defining frequency sensitivity, receiver selectivity and performance of continuous-sweep coded systems are discussed. In addition, the proposed IEEE standard defining vehicular noise is presented as a stepping stone to the much-needed standard for receiver performance in the presence of impulse noise.

4. Police and Fire Department Communications Centers: A Systems Approach to the Control Console and Related Facilities

By G. A. Brookes
Westrex Corp.
Los Angeles, Calif.

Police Departments, Fire Departments and other similar organizations, which require communication with mobile units have similar problems. The equipment provision for a typical installation is discussed with particular emphasis on the facilities which are provided in the Communications Console. A description is given of the modular units such as amplifiers, control units, display units and signal accrued recorded which have been developed for this application.

SESSION 36

SEEKING A LOGICAL BIOINSTRUMENTATION SYSTEM

Friday, August 26
2:00 PM to 3:00 PM
Sports Arena - Room A

Type of Session: Continuation of Session No. 31 on the above subject

(Continued on Page 60)
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Session 37
Coding Methods and Telemetry
Friday, August 26
2:00 P.M. to 5:00 P.M.
Sports Arena - Room B

Type of Session: Contributed Papers
Chairman: A. V. Balakrishnan,
Space Technology Laboratories, Inc.,
Los Angeles, California

1. An Improved FM Discriminator-
Detector for Airborne Telemetry
Receivers
By G. E. Reis and C. E. Lend
Sandia Corporation
Albuquerque, N. Mex.

Recently the design of an FM receiver for air-
borne telemetering applications led to a critical
evaluation of existing discriminator-detector circuits.
Existing circuits were compared on the basis of
efficiency, complexity in both design and construc-
tion, ease of adjustment and adaptability to sub-
sequent changes in design and packaging techniques. This
study led to the invention by Mr. L. G. Snyder
of a new discriminator-detector circuit which is
superior to existing circuits when evaluated as de-
scribed above.

This paper is a description of the new circuit and a
complete analysis of the theory and operation.

2. Improved DOVAP Transponder
By Floyd M. Gardner
Gardner Research Co.
Orange, Calif.

DOVAP is a CW phase measuring system used for
tracking missiles. A transponder in the missile
frequency-doubles a ground-generated signal and re-
transmits it to the ground. Range, velocity, and ac-
tural information are derived from the phase measurements of the two signals. Any trans-
ponder-generated phase changes show up as tra-
jectory errors.

Three sources of phase change are prevalent: (1)
AGC action resulting in phase change 'drifting';
(2) temperature changes of the equipment, and
(3) carrier frequency changes due to Doppler shift.
Wide bandwidths extending beyond 400 Kc are
amplified to overcome some of these errors to some extent. The
resulting early units were simple, small and rea-
tion-insensitive; however, their phase variation
would not allow precise tracking.

Occupancy of the DOVAP frequency spectrum
(37 and 74 me) has increased substantially and
we have passed through the peak of a sunspot cycle.
This combination has resulted in interference to the
system. A narrow band has become necessary to
avoid interference.

3. Optimized Data Systems
By J. C. O'Brien
Nortronics Div., Northrop Corporation
Hawthorne, Calif.

The basic problem of data systems, which in-
clude all types of testing, sensing and surveillance
instrumentation, is to acquire, transfer and transfer
information correctly. Until recently, such systems
have not enjoyed the blessing of well integrated
fundamental analysis, and performance, such as
have been developed for communication systems.

Increasing the similarity between the transfer of
time functions of information, such as messages,
and the acquisition of meaningful data from phys-
ical situations, such as a surveillance area, has
caused the author to adapt the concepts of in-
formation theory to the specific problems of data
handling. This has been done by extending the
time functions involved in communication, to in-
clude spatial dimensions, and converting the per-
tent parameters, such as bandwidth and noise,
et, to their spatial counterparts.

4. Reliable Fail-Safe Binary
Communication

(Continued on Page 61)
Las Vegas

During the past year an effort was made to generate interest in forming a local section of the IRE in the Las Vegas area. Many people may wonder what possible interest could be found in a resort area such as Las Vegas, but as the idea grew, so did the number of prospective members. These people came from many different fields of interest such as power, sound engineering, reactor engineering, and instrumentation. Subsequently, the Las Vegas Section was formed in April, 1960 and it now has 60 members with 22 applications pending.

The Section was very fortunate to have the participation of Dr. McFarlan, the national chairman and Dr. Carnahan, the Seventh Regional director in its first meeting. The talk given by Dr. McFarlan on the “Use of Microwave Power to Support a High-Altitude Platform” was the type of sendoff needed to insure the success of the new Section.

To keep the interest alive, this meeting was closely followed by a second one in which we were again fortunate. Barney Oliver of Hewlett-Packard consented to give a talk on “Filtering and Equalization in Optics”. Because of the success of these two meetings we feel that the Las Vegas Section will grow and become a useful part of the IRE.

—E. R. Lutkehaus, secretary

Los Angeles

The Los Angeles Section undertook an ambitious year’s schedule of technical meetings, symposium,

Technical Program Cont. from page 60

By J. J. Metzler and K. C. Morgan
Research Div., New York University
New York, N. Y.

Unidirectional systems which employ coding for error correction are unsatisfactory for high reliability transmission over channels with widely varying characteristics. This problem may be solved by employing long code words, feedback, correcting very small numbers of errors, and preventing any type of disturbance in the feedback channel from harming system reliability. The resulting system yields excellent reliability, "fails safe", and operates at a relatively high per-symbol information rate. This approach is particularly effective in situations where severe burst type noise or heavy fading is encountered. Computing and storage requirements are far less than those of comparable unidirectional systems.

Analysis is pretented of error probability and information rate for various channel conditions, computing and storage requirements, and transmission delay problems. The necessary coding and decoding procedures are discussed for various classes of codes, including Elias’ sliding parity check codes and a modification thereof termed "rotational parity check codes."

5. Data Compression
By H. Schwab
Applied Development Corporation
Hawthorne, Calif.

Data compression is a data processing operation for reduction of specific information. Such compression is desired for bandwidth saving in communication and for simplification of successive data processing operations. Data compression has to be investigated in close connection to data encoding methods for overall system efficiency. Typical examples are for simple data transmission and sample rate reduction, accuracy reduction, increment monitoring, event monitoring, source analysis. Data compression is of importance in space and industrial communication, reconnaissance, and high-speed high-volume data handling.

SESSION 38
INFORMATION THEORY AND MODULATION METHODS
Friday, August 26
2:00 PM to 5:00 PM
Sports Arena - Room C
Type of Session: Continuation of Session 33 on the above subject

SESSION 39
EFFECTS OF NUCLEAR EXPLOSIONS
Friday, August 26
2:00 PM to 5:00 PM
Sports Arena - Room D
Type of Session: Contributed Papers
Chairman: Dr. Lester C. Van Atta
Department of Defense
U. S. Government
Washington 25, D.C.

1. The Effective Range of a Nuclear Explosion for Electronic Equipment
By John Crittenden
Electric Components Div.
General Electric Co.
Owensboro, Ky.

By Marc Bendick
System Development Corp.
Santa Monica, Calif.

3. Transient Effects of Nuclear Radiation on Typical Electronic Sub Systems
By John W. Clark and T. D. Hanscom
Hughes Aircraft Co.
Los Angeles, Calif.

The speakers will discuss various aspects of vulnerability of certain electronic systems and components to nuclear explosions. The session will constitute an up-to-date summary of important investigations of this subject. Much of this material, although not classified, has never been released before.

SESSION 40
VEHICULAR COMMUNICATIONS III: NEW IDEAS AND CONCEPTS FOR MOBILE TELEPHONE OPERATION
Friday, August 26
2:00 PM to 5:00 PM
Sports Arena - Room E
Type of Session: Contributed Papers and Panel
Chairman and Moderator: A. Culbertson, Lenkurt Corp., San Carlos, California
Panellists:
R. C. Crabb, Mobilfone, Los Angeles, Calif.
Charles W. Schwieger, Pacific Telephone and Telegraph Corp., San Diego, Calif.

1. Pushbutton Mobile Dial Radio-telephone an Advanced Concept in Common Carrier Mobile Service
By James R. Stewart
Motorola, Inc.
Chicago, Ill.

A push button "dial" mobile telephone using a sequential two out of four tone arrangement for the dialing tones has been developed by Motorola. The mobile tone-controlled with the use of a lighted pushbutton, one for each digit of the telephone dial controls the various tone signals to be transmitted from the mobile unit. At the dial exchange, terminal equipment sends the mobile radio system into standard telephone circuits. System concepts, equipment and operation are discussed.

2. Guarded Tone Signalling
By William B. Smith
Bendix Radio Div., Bendix Corp.
Baltimore, Md.

A novel method of tone code transmission which conveys a maximum of information in a minimum number of tone channels is described. The use of a positive space to initiate sampling, as well as a limited sampling interval, enhance the reliability. The presence of the positive space in all code signals also permits failure indication, that is the remote point in the event that partial failure occurs in either encoder or decoder. The method of decoding provides an inherent decade group call. Principles of operation will be the main topic, but application and equipment will also be covered, in particular, equipment for party line telephone selective ringing which has been on field test will be shown.

3. System Concepts for Address Communication Systems
By Donald H. Hamsher
U.S. Army Signal Corps
R & D Laboratories
Fort Monmouth, N.J.

The U.S. Army Signal Research and Development Laboratory has been investigating the concepts of address communication systems in form known as non...
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<tr>
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Technical Program Cont. from page 61

synchronous or asynchronous communication. This concept exploits the random character of speech transmission so that no two users are transmitting during the quiescent period of others. In a system many transmitters are radiating signals more or less simultaneously and the receivers must pick in each instance the signal intended for him. The approach investigated by the Laboratory has been termed "random access discrete address." Concepts for this type of communication system and variations hereof are presented and discussed.

4. The Application of Telephone Trunking Principles to Multi-Channel Mobile Service

By Edwin S. Randel

American Telephone & Telegraph Co.

New York, N.Y.

Because of the nature of the development of the service, mobile-service channels have generally been used and administered on a single-channel basis. Transmitters and receivers have been capable of operation on one channel only and therefore the channel could be given access to that channel regardless of the number of channels in operation in a given location. Thus, in forming total call carrying capacity, with a constant grade of service, one channel plus one channel merely equals two channels. However, in the provision of telephone trunks one plus one does not equal two since individual trunks are combined to operate as multi-channel groups to which a customer or operator may have access.

This paper attempts to demonstrate potential increases in call carrying capacities which might be achieved through multi-channel mobile operation with the channels now available and also with hypothetical broad bands of adjacent channels.

**Workshop I**

**Management of Man-Machine Systems**

Tuesday, August 23
2:00 PM to 5:00 PM

Location: Golden State Room
Starlet Hilton Hotel

Type of Session: Roundtable Discussion Panel

Panelists:
- R. L. Clark
  Department of Defense
  Washington, D.C.

**Workshop II**

**Analysis of Man-Machine Systems**

Wednesday, August 24
2:00 PM to 5:00 PM

Location: National Technical Schools

4000 S. Figueroa Street, Los Angeles, Calif.

Type of Session: Roundtable Discussion with Panel

Moderator: Lt. Col. Anthony Dabon

Rome Air Development Division, Rome, N.Y.

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GRID-BULLETIN, August 1960
WORKSHOP III
SYNTHESIS AND DESIGN OF MAN-MACHINE SYSTEMS
Thursday, August 25
2:00 PM to 5:00 PM
Location: National Technical Schools
(Room 313)
4000 S. Figueroa Street, Los Angeles, Calif.
Type of Session: Roundtable Discussion with Panel
Panelists:
R. K. Ausbourne, Hughes Aircraft Corp., Culver City, Calif.
V. Z. Evans, Aeronutronic Systems, Inc., Newport Beach, Calif.
L. Christie, System Development Corp., Santa Monica, Calif.
Harold Van Cott, International Business Machines Corp., Bethesda, Md.
(This is a continuation of Session No. 24)

WORKSHOP IV
OPERATION AND TRAINING OF MAN-MACHINE SYSTEMS
Friday, August 26
2:00 PM to 5:00 PM
Location: National Technical Schools
(Room 313)
4000 S. Figueroa Street, Los Angeles, Calif.
Type of Session: Roundtable Discussion with Panel
Moderator: J. Lyman, University of California, Los Angeles, California
Panelists:
J. Blaik, Stanford Research Institute, Palo Alto, Calif.
J. Meatsch, System Development Corp., Santa Monica, Calif.
(This is a continuation of Session No. 34)

WOMEN'S SESSION
ENGINEERING: THE WOMAN'S ROLE
Wednesday, August 24
3:30 PM to 5:00 PM
Golden State Room
Statler-Hilton Hotel
(Continued on Page 64)

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Technical Program Cont. from Page 63
Type of Session: Invited speakers with audience participation
Chairman: Noel E. Porter,
Hewlett-Packard Company,
Palo Alto, California

1. A Woman Engineer
By Rose Mary (Decker) Bernstein
Douglas Aircraft Co., Inc.
Santa Monica, Calif.

Most people are curious about such questions as:
What kind of woman want to do engineering?
Can they engineer?
Are they accepted by their "fellow" engineers?
This discussion will give a woman engineer answers to these questions and bring up related subjects, as the engineer's technical competence and the sociological adjustments necessary for both the woman engineer and the men working with her.
A question and answer period will follow the paper presentation to allow members of the audience to ask any questions in which they have a personal interest.

2. Debugging the Engineer
By Barbara L. Leitner
Los Angeles, Calif.

The Engineering Secretary copes not only with a complicated subject but with complicated people. Both are frequently confusing and may require evaluation and definition. Human factors involved are given emphasis. The girl who pushes the Engineering Paper Pusher presenting her view of engineers with some practical suggestions for standardization and quality control. As the wife of an engineer, certain comments are addressed to other wives.

3. Engineering: Staff and Distaff
By Phyllis R. Huggins
Bendix Computer Div.
Los Angeles, Calif.

A brief review of the variety of fields of supporting services to an engineering staff in which women may be found, their reasons for entering the more off-beat fields, their motives, drives, the pros and cons they may bring to the effectiveness of a technical organization, and the personal pros and cons their being in these fields brings to them. An example of a specific case of a woman working with technical people illustrated by the different types of technical people, the public relations problems they present, and how these problems may be met by the distaff side of an organization.

Sub-Section Goes Gay Nineties
On August 6th the San Fernando Valley Sub-Section will hold its annual dinner-dance, this year to be a Gay 90's Affair. It will be held at the Sportsmen's Lodge, 12833 Ventura Boulevard, North Hollywood.

The cocktail hour begins at 6:00 PM, with Dinner at 7:00 PM and the program beginning at 8:30 PM. Cost is $11.50 per couple. If you live in the Los Angeles area, reservations can be made through Jack Wills, Dickens 3-9958.

The Valley Sub-Section is the largest in L.A if not the nation, with more than 1600 members. Jack Wills, Rantec Corp. will be installed as chairman at the Gay 90's affair.
and convention — all starting in September when the Section hosted the Third National Symposium of the Professional Group on Engineering Writing and Speech at the Ambassador Hotel, under the guidance of Joseph Cryden, chairman.

In February, Los Angeles was the scene of the First West Coast Convention on Military Electronics. This event was co-sponsored by the National PGML and the Section. Eighty-three papers were presented — some being classified and made available through the cooperation of the ARDC — and produced a total attendance of over 2,000. Maj. Gen. O. J. Ritland was the honor speaker at the Military Services Banquet.

During the year, twenty chapters of the following professional groups were active in the Section: PGAP, PGAP/PGMTT (Orange Belt), PGAC, PGBME, PGCT, PGCS, PGCP, PGED, PGEC, PGEM, PGEWS, PGIT, PGI, PGMTT, PGMIL, PGRQC, PGSET, and PGVC. At mid-year, a new entry into the fold was PGNS.

There are six subsections in Los Angeles: Buenaventura, Orange Belt, Pasadena, San Fernando Valley, Santa Ana, and Santa Barbara. These held monthly meetings and most of them hosted the main Los Angeles Section some time during the year. Over 300 members were present at a Pasadena meeting when Professor A. C. B. Lovell, director of the Jodrell Bank Station, Manchester, England, spoke on his specialty of Radio Astronomy.

In May, Buenaventura and Santa Barbara’s six months of preparation proved fruitful when their “Host L.A. Meeting” attracted many Southland members to an all-day field trip of Point Arguello, with an evening banquet at the Miramar Convention Center in Santa Barbara. Separate activities were planned for the ladies during the day, but all joined together at the banquet when Adm. J. P. Monroe spoke on “The Navy in the Space Age.”

The six-hour Point Arguello tour included examination of launch sites for the Tumbleweed, Sunflare, Samos, and Midas radia-

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Inquiries from qualified scientists and engineers are invited to the personal attention of Dr. James Fletcher, president.

(Continued on Page 66)
Region Report Cont. from page 65

Santa Ana hosted the Los Angeles Section during January with an unusual meeting on Earthquakes and their Measurement by Scientific Means. When this meeting proved successful, Pasadena quickly followed with a repeat performance. Santa Ana had the largest turnout for any one meeting, when over 700 heard Dr. Joseph Banks Rhine of Duke University speak on the subject of extra-sensory perception. There was no doubt that the subject was popular, since an earlier PGI meeting, featuring Dr. Andrija Puharich, had drawn 300.

The San Fernando Valley meetings covered wide ranges of subjects and offered some interesting field trips. The Valley presented the Annual All-Industry meeting which saw major executives from most Valley engineering firms in attendance. Dr. William Pickering, director of JPL, was the speaker.

All in all, 165 meetings were held in the Section, with a total attendance of close to 12,000. Although the Section membership was increased by 900 over the past year, to 8300, the students are not forgotten. With the Section's student membership ranging between 700 and 1000, the Annual Student Day program brings many of these students together with industry. In March, we returned to the Biltmore Hotel, the site of February's PGMIL Convention, to host 225 students in an all-day program of technical sessions, exhibits, and evening banquet, all at no charge to the students.

In April, the Section hosted the National IRE President, Dr. Ronald McFarlan, at a luncheon with the professional group chairman, and dinner with the Section's Executive Committee.

For the first time, four members-at-large joined the Executive Committee, after being elected by the Section membership. This was in accordance with the previous year's by-law changes which were adopted and proved successful in allowing for more experience and greater representation on the Committee. The Section concluded its activities for the year with a final inaugural ball for the new officers. Ronald Tansky Assistant Business Manager

(Continued on Page 67)
Phoenix

It was a busy year, and a productive one, for the Phoenix Section. During the summer of 1959, a poll of the membership was taken. Results indicated that the members preferred not to have dinner meetings, as had been held previously. Therefore, it was decided that meetings during the 1959–1960 season would be held at the Westward Ho Hotel, with refreshments served afterwards. A dinner party would be given the speaker of the evening before the meeting by the section officers, with members and their guests invited.

Approximately fifty people have been involved in the operation of the Section during the past season, serving on the various committees, including the 1961 Seventh Region Conference which will take place here at the Westward Ho, April 26 to 28.

A special project has been the formation of a Bylaws Committee charged with the responsibility of revising the Section bylaws to help simplify Section organization and provide uniform administrative operating procedures. It has also been recommended that we appoint a Section historian to compile records of the section from 1951 to 1960.

Section membership has grown from 435 one year ago to slightly over 500 at the present time. The total membership is made up of 6 Fellows, 69 senior members, 338 members, and 90 associate members. There are also 117 student members within the boundaries of the Section.

The Section held ten meetings during the year with an average attendance of 50, or 10% of the total memberships, a small gain over previous years.

The first meeting of the newly organized Professional Group Chapter on Electronic Computers was held in April at Arizona State University. Dr. Carl R. Zimmer presented an informative paper on tunnel diodes. The attendance far exceeded expectations with a total of 145 actually at the meeting. The last meeting of the season, in June featured Dr. Richard Stasier of G.E., speaking on Circuit Techniques of Tunnel Diodes. A nomin-
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Regional Report Cont. from page 67

The IRE executive board has also approved a petition to form a statewide chapter of PGMIL. The membership of this group will include interested members of the Phoenix, Tucson, and Fort Huachuca Sections. Meetings will be held alternately at each of the three locations.

Student activities during the season included: a joint meeting with the student branch at ASU, Tempe; presentation of the Annual IRE Student Award to Carl N. Gotch, a senior at ASU; $75 award to Leroy Baker, also a senior at ASU, for his winning paper in the annual student papers contest entitled Feedback Amplifier Design Using Matrix Methods. Baker’s paper was further selected for presentation at the Seventh Region Technical Conference at Seattle.

Each year, the Phoenix Section sends one or two high-school students to the WESCON Future Engineers Show as a result of competition conducted in conjunction with the Central Arizona Regional Science Fair. This year the winning exhibit at the fair was by Nick Hugen of Phoenix West High. Hagen’s project has to do with the Effect of Ozone on the Dielectric of a Flyback Transformer. Both the exhibit and a paper will be presented by the student at the WESCON Show in August. The prizes include a substantial scholarship award and savings bonds.

This year saw the formation of a Section awards committee consisting of nine members representing industry, education, electronics, engineering and radio-television. The purpose of this committee is to select deserving candidates from within the Section for the annual Section achievement award, the Seventh Region Electronic Achievement Award, and awards at the National IRE level.

The objective of the Section achievement award is to give recognition for outstanding contributions in the Phoenix Section area. This year the awards committee

(Continued on Page 69)
Dr. E. O. Hartig
Phoenix Section Award Winner
Dr. E. O. Hartig, Goodyear Aircraft Corp., received the Phoenix Section Award, illustrated above. The winner’s company also receives a roving counterpart. Hartig was honored for contributions to the development of advanced radar systems and outstanding leadership in research.

Region Report Cont. from page 68
has named Dr. E. O. Hartig, assistant manager of the aerophysics department, Goodyear Aircraft, as the winner of the Section award. Hartig’s citation is for outstanding leadership in research and development of advanced radar systems. The award consists of an individual plaque, and another plaque to serve as the roving award to be displayed at the recipient’s company.

Edward Shepard, chairman

Portland

The Portland Section has seen three of its long-sought objectives come to life during the past season:
1. Concrete plans for graduate-level engineering study in Portland have been made. Classes start in September. This has been a long uphill struggle, with many people and other organizations helping.
2. The Professional Group on BIO Medical Electronics has gotten off to an active and very promising start. The Medical School of the University of Oregon is located in Portland and is engaged in many fine research projects, most of which require electronic instrumentation. The new group has already been responsible for many fine meetings which we are sure will be a help to the medical and electronic people in this area in the future.
3. A monthly IRE newspaper known as the “Portland P’t” has just completed its first hectic year. Only those of you who have tried starting a newspaper will realize how hectic a first year can be.

One activity of the Portland Section which might be of interest to other IRE Sections is our annual meeting with the student section at Oregon State College. The format for this meeting consists of a one-hour formal meeting with a speaker or panel from the Portland Section discussing the problems which will be faced by an engineering graduate. This meeting is held on “Dad’s Day” at the College and the students are encouraged to attend a luncheon with their fathers. The IRE visitors and the college staff have lunch together and are informed of the progress of the engineering and science branches of the college. During the afternoon a display of the products from local electronics firms and manufacturers’ representatives is presented. The students are urged to bring their fathers to this exhibit and it provides an opportunity for the Section members, the students and their parents to get to know each other better. The day is finally topped off by a basketball game.

The local student papers competition is gaining in both scope and number of colleges participating. This year’s winners were James M. Donnelly of Reed College with a paper on the “Anelastic Behavior of Brass,” Wallace Helm and Gilbert Marguth of Oregon State College with a paper on “A Binary Counter Using Rectangular Looped Magnetic Material” and Roger Cogan of Lewis and Clark College with a paper discussing “The Maser”. Linfield College was also added to the list of participants this time.

New officers for 1960-61 are (Continued on Page 71)

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Page 69
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Ladies Cont. from page 44
In the center of the room is a recessed circular area in which there are a circular sofa and dining table. The kitchen and guest rooms are also on the lower level.

Electronics Executive George Brubaker designed his own Brentwood home to include many unusual features, one of which is a circular dining room with a floor that slowly revolves to give each guest a view of the classical Japanese garden outside.

Rijiro Nunakawa, internationally known Japanese landscape architect, designed the grounds, which include authentic handcarved granite lanterns dating to the 17th century, a do bashi bridge brought from Japan, and an authentic teahouse.

The living room of the house features a fireplace with a fireproof glass back wall, behind which are tropical plants. The family room features an honest-to-goodness soda fountain. Rooms are grouped around a central patio with a freeform pool. The master bedroom includes a large “working” desk, adjoining bath and sitting pool.
as follows: Lang Hedrick, Tektronix Inc., chairman; Dr. Kenneth E. Davis, Reed College, vice chairman; Dr. Merle M. Morgan, Electro Scientific Industries, secretary-treasurer.

—Jack C. Riley, past chairman

Salt Lake City

The Salt Lake City Section started its 1959-1960 year by honoring as distinguished visitors Dr. Ernst Weber, past president of the Institute, and Mrs. Weber. Leaders of Utah’s engineering schools and electronic industries gathered at a special dinner at the Hotel Utah which culminated in a talk by Dr. Weber, “Space Age and IRE.”

Leadership for the Salt Lake Section during the year was very ably provided by Rowland W. Haegele, manager of the Eitel-McCullough plant in Salt Lake City. Professor Charles Alley of the University of Utah served as vice chairman, and A. W. Vodak of Sperry Utah Engineering Laboratories served as secretary-treasurer. For the forthcoming year, the chairman will be Professor Alley, vice chairman, A. W. Vodak; and secretary-treasurer, Professor J. Dalley, University of Utah.

During the past year Prof. Alley, R. W. Haegele, and Dr. L. Dale Harris of the University of Utah served as judges for the Utah State High School Science Fair. Winners for the electronic division were high school students Law and Magalby, of Highland High School. These students under the guidance of their science teacher, Grandy, constructed an outstanding exhibit of Doppler Radar. The exhibit actually works and is reported to have been built for a cost of only $12.00. The Section is sending all three individuals to WESCON in August.

Another highlight of the Salt Lake City Section 1959-1960 year was the presentation of technical papers by college engineering students. These papers were given by Robert L. Allen of Utah State University, Malcom D. Crawford of the Brigham Young University, and Alvin M. Despain of the University of Utah. Despain won first prize with his paper on Non-Linear Network Frequency Divider.

Membership of the Salt Lake
San Diego
The San Diego Section wound up its 1959 season with an election of new officers by mail ballot with a contest occurring in both the vice chairman and secretary-treasurer offices due to the withdrawal from the election race of last year’s secretary-treasurer. The new officers are R. E. Honer, chairman; D. G. DeHaas, vice chairman; E. W. Carlson, secretary-treasurer. Participation in the election was again approximately 50 per cent, which still speaks well for mail balloting in a Section with 850 members.

Regular monthly meetings were held through the remainder of the year from July of 1959 until the present writing of this report.

Included in the topics covered were—Recent Studies of the Sun by Radio; Semiconductor Physics and Devices; Engineering Techniques for Special Telephone Services; Principles and Applications of Inertial Guidance; New Developments in Radio Astronomy; The Use of Electronics in Neurophysiology; Interplanetary Travel; Electroluminescence; Optimization of Airborne Special-Purpose Computers; Soviet Computer Technology 1959; Geodetic SECOR for World Mapping and Thermal Noise at Microwave Frequencies.

The outstanding event of the year was the National Professional Group Symposium on Microwave Theory and Techniques held at the Hotel del Coronado in May. Describing this symposium, Electronic Design reported as follows:

“. . . Conduct of the meeting definitely shattered some old myths about the narrow bandwidth and information-handling capabilities of the human being. Information passed steadily soon after eight in the morning until midnight. Whenever the neuron activity rose too high or existed for too long a duration, signal sources were shut down temporarily and nerve conductors were cooled by a dip in the ocean. Buffer storages were cleared by a quick inhalation of sea breeze. Within a few minutes the flow of information would continue.

“If one calculated the figure of merit of the convention as the dividend of information received over miles traveled, even the Boston visitors fared well. Cost of travel proved no barrier as attendance at the southwestern tip of the United States was as high as if the conference were held in the center of the microwave industry.

“The convention did not try to be all things to all people. All papers focused on only a few themes. There were no commercial exhibits so the noise level of all communications was exceptionally low . . .”

To the existing PGAP, PGA, PGBME, PGMTT, and PGML, are being added two new chapters: PGROC and PSET.

At the 7th Region Executive Committee Meeting held in Seattle on May 26 it was agreed that the 7th Region Convention would be held in San Diego in 1963. The San Diego Section Executive Committee has already started action to establish dates and early planning necessary for this convention.

—E. W. Carlson

San Francisco
Around San Francisco, this may be looked back upon as the year in which the Section took stock of its growth and ramification and inaugurated procedures and organizational changes leading toward greater efficiency in its routine activities. Having within its compass one Sub-Section and fourteen active Professional Group chapters at the beginning of the year, the Executive Committee authorized formation of a new Operating Committee (OPCOM) comprising the officers

(Continued on Page 73)
and directors of the Section which could meet relatively often to relieve the Executive Committee (EXCOM) from routine matters. By year's end, this procedure had saved the Section hundreds of man hours of meeting time. Ocopposition was Victor B. Corey, chairman; Donald A. Dunn, vice chairman; Stanley F. Kaisel, secretary, Peter D. Lacy, treasurer; Earl G. Goddard, Jr., past chairman; and Samuel Silver, C. W. Carnahan, and John V. N. Granger, directors.

Simultaneous with this development was the inauguration of a new professional groups committee under the direction of the vice chairman, Donald A. Dunn. This group concerned itself chiefly with integration of the various professional group meetings for the best utilization of time and the least conflict of interest.

A new bylaws committee, under the chairmanship of Peter D. Lacy, undertook the necessary research and development to produce the first draft of a new set of bylaws.
Field Trip No. 6 takes visitors to RCA's Missile & Surface Radar Div., Van Nuys, Calif. to see a new 50 acre research development. Picture shows computer racks in Digital Systems Laboratory.

Field Trip No. 2 at Space Technology Laboratories will show visitors center for payload Lab test experiments related to Explorer and Pioneer missile series. Here STL engineers test Pioneer V (sun orbit) gear.

Field Trip No. 7 includes a trip to Librascope, manufacturers of large scale industrial control equipment and digital computers. Picture shows check-out facility in Burbank for LGP-30 digital computers.

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covering in full the Section operation at its present level of complexity and, hopefully, projecting for the problems of future growth. These bylaws were approved by the Section membership at the annual meeting in June.

In another major shift of function, the IRE Section Office, the joint activity of WESCON, WEMA, and IRE, was moved from its previous location in the Villa Hotel Building, San Mateo, to the Whelan Building, 701 Welch Road, Palo Alto. A full-time manager, Miss Grace Pacak, was installed. This shift and the organization necessary to handle the expanded volume of Section services rendered from this location were handled under the direction of Stan Kaisel, Section secretary.

Other Section individuals providing services beyond the call of duty during the season included Earl Goddard and Jerry Rosenberg for their work with the Section historical committee, Don Harris for his outstanding contributions through the awards committee, and Henry Schroeder for his competent handling of those problems which always descend upon the arrangements committee.

Through the year, the Section exhibited a 17 per cent growth in membership to arrive at a figure of 3892. Members’ interests are distributed throughout the activities of the following sub-organizations: (Of 88 total meetings held in the Section during the season, individual figures are shown in parentheses after each group. Since many of these were joint meetings, the figures actually total 113.) San Francisco Section (7), East Bay Subsection (5), PGAP (10 including a 3-part lecture series), PGA (3), PGB (3), PGBME (7), PGCS (4), PGED (9), PGEC (9), PGEM (5), PGWES (5), PGMI (10), PGMIT (7), PGPT (9), PGROC (9), and PGSET (10). PGI held their first post-organizational meeting.

Within the broader-scale activities of the Section during the season were several symposia. In September, the National Symposium on Space Electronics & Telemetry,

(Continued on Page 77)
FUTURE ENGINEERS

Top left: Arnold Schimsky, San Diego with his project: "Silicon Carbide Diode".

Bottom left: Jerry Busick, Puyallup High School, Washington.

Top right: Steve Walther, Punahou School, Honolulu, "Seeing with Sound".

Bottom right: Cloud Chamber Research", by Melvin Rosowski, Concord, Calif.

Bottom right: Melvin Rosowski's "Cloud Chamber Research", Clayton Valley HS, Concord, Calif., Richard Mack, left and John Coral of SF Section selection committee study exhibit.

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sponsored by PGSET, presented nine sessions of 41 papers and a full range of other activities including exhibits, under the general chairmanship of R. E. Rawlins, Dyemic; and the technical program chairmanship of G. L. Larse, Lockhead. In May, the San Francisco Section was host to the Western Joint Computer Conference, a joint endeavor of AIEE, ACM, and IRE. General chairman was Robert M. Bennett, IBM, while Howard M. Zeidler, SRI, was chairman of the technical program.

This event was followed almost immediately by the Second Annual Bay Area Reliability Seminar in Monterey. This was operated by the San Francisco Chapter PGRQC under the chairmanship of C. Bruce Clark, with cooperation from ASOC.

Following a mail ballot, new officers for the forthcoming year were determined as follows: Donald A. Dunn, Eitel - McCullough, Inc., chairman; Stanley F. Kaisel, Microwave Electronics Corp., vice chairman; Peter D. Lacy, Wiltron Co.,

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Electrical outputs optional! Where “hard copy” of test results is not required, the addition of electrical outputs and print control capabilities is a costly, unnecessary luxury. EI provides these new instruments, in every measuring configuration, either with or without these features.

Sensitivity control eliminates effect of noisy readings! A front panel sensitivity control is provided on each of the instruments to overcome unusual noise conditions and give, as a by-product, a qualitative measurement of the noise present.

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  ±10.00 to ±99.99;
  ±100.00 to ±999.99
- **Accuracy:** ±0.02% ±1 digit for 10 microvolt range of 0001 to ±99999 v. ±0.01% ±1 digit from .0001 to 999.9 v
- **Input Impedance:** 1000 megohms up to 9999 v; 11 megohms up to 999.9 v
- **Average Reading Time:** 50 milliseconds
- **Operating Ambient Temperature:** 0.50°C
- **Maximum Source Impedance:** 5 K ohms on 10 microvolt range; only; noncritical all other
- **Automatic Features:** Ranging, polarity

**DC VOLTAGE SPECIFICATIONS:** Apply to all instruments except those incorporating the pre-amplifier

- **Range:** ±0.0001 to ±9999;
  ±1000 to ±9999;
  ±10000 to ±99.999;
  ±100000 to ±999.999
- **Accuracy:** ±0.01% ±1 digit
- **Input Impedance:** 1000 megohms to ±9.999 v;
  11 megohms to ±999.9 v
- **Average Reading Time:** 50 milliseconds
- **Max. Balance Time:** 200 milliseconds
- **Operating Ambient Temperature:** 0.50°C
- **Automatic Features:** Ranging, polarity

**DC RATIO SPECIFICATIONS:** Apply to all instruments measuring DC ratios

- **Range:** ±9999;
- **Accuracy:** ±1 digit
- **Input Impedance:** 1000 megohms
- **Average Reading Time:** 50 milliseconds
- **Max. Balance Time:** 100 milliseconds
- **Reference Voltage:** 10 volts ±10% (nominal)
- **Reference Input Impedance:** 1000 megohms
- **Operating Ambient Temperature:** 0.50°C

*With properly chosen reference supply, ratios of up to 100 times unity may be measured.

**AC VOLTAGE SPECIFICATIONS:** Apply to all instruments measuring AC voltages

- **Range:** ±9999 VAC; ±9999 VAC; ±9999 VAC; ±9999 VAC
- **Accuracy:** ±0.1% and two digits
- **Frequency Response:** 30 cps to 10000 cps
- **Input Impedance:** 1 megohm shunted by 30 mmfd up to 9999 VAC; 10 megohms shunted by 30 mmfd up to 9999 VAC
- **Average Reading Time:** 2 secs. low freq.; ½ sec. high freq. (400 cps and up)
- **Operating Ambient Temperature:** 0.50°C
- **Automatic Features:** Ranging

**RESISTANCE SPECIFICATIONS:** Apply to all instruments measuring resistances

- **Range:** 0.1 ohms to 999.9 ohms; 1000 ohms to 9999 ohms; 10.00 K ohms to 99.99 K ohms; 100.00 K ohms to 999.9 K ohms
- **Accuracy:** ±0.01% ±1 digit to 99.99 K ohms; ±0.01% ±1 digit to 999.9 K ohms
- **Average Balance Time:** 200 milliseconds
- **Operating Ambient Temperature:** 0.50°C
- **Automatic Features:** Ranging (decimal point placement)

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Region Report Cont. from page 77

secretary; Charles Susskind, University of California, treasurer; and Albert J. Morris, Levinthal Electronic Products, director. These announcements were made at the annual meeting which filled the Empire Room of Berkeley’s Claremont Hotel. Attendees hailed the eight new Fellows (P. W. Crapuchettes, R. A. Helliwell, J. G. Linvill, Theodore Moreno, T. H. Morrin, Walter T. Selsted, D. F. Tuttle, Jr., and V. H. Rumsey); applauded the awards to outstanding students from five local educational institutions; and listened with mixed awe and skepticism to a paper on Extrasensory Perception by Dr. Andrija Puharich, neurophysiologist and research consultant in the field of parapsychology.

As the season drew to a close, Section members were saddened by the news that a respected and beloved colleague, Jack Bolljahn, had lost his struggle against cancer.

A founding member of the Section Publications Board and 1959 Wescon Technical program vice chairman, Jack was executive vice president of Granger Associates and formerly assistant director of engineering research at Stanford Research Institute. His absence from the San Francisco scene will diminish every one of us.

—Frank Haylock

Seattle
This year the Seattle Section had the privilege of playing host for the 7th Region Conference. The three-day technical program featured nearly 50 invited papers covering

(Continued on Page 81)

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beloved colleague, Jack Bolljahn, had lost his struggle against cancer.

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(Continued on Page 81)

GRID-BULLETIN, August 1960
the three fields of solid state electronics, control systems, and electromagnetics.

The trade show, co-sponsored by the Instrument Society of America, brought to Seattle the largest and best technical exhibit of instruments and electronic equipment yet to be seen here. Over 180 display booths in the National Guard Armory were occupied by the exhibits.

Dr. Frank S. Holman, chairman of the conference, was ably assisted by Rush Drake, exhibits; Frank Little, treasurer; John Tate, secretary; Mel Paisley, arrangements; Bill Harrold, publicity; Dr. Don Reynolds, technical program; and Joanne Holman, women's activities.

The Section was privileged to receive visits from two IRE Presidents in the same year. Dr. Ernst Weber addressed the Section at the season's opening meeting in August, 1959, and Dr. Ronald McFarlan addressed the opening session of the 7th Region Conference in May, 1960.

The Section's activities were suspended for the summer following a well attended field trip to the U.S. Navy's megawatt transmitter at Jim Creek, Washington.

The Section is enjoying a steady growth in membership which now stands at 820 of member grade or above.

—L. C. Perkins, chairman

**Tucson**

The Tucson Section of the IRE enjoyed an array of excellent speakers discussing many interesting and

(Continued on Page 82)
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Grid-Bulletin, August 1960

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Fieldtec Appointed

Fieldtec field engineering service, Tustin, Calif., has been appointed sales-service representative for Cryogenic Engineering Company of Denver.

Business Activity—North

Rockwood to Varian

Varian Associates announces the appointment of Clifton G. Rockwood as manager of applications engineering. Reporting to Rockwood will be five regional application engineering managers for the United States. Rockwood will be directing the tube division's sales activities in cooperation with Varian's nationwide staff of sales representative groups.

AFCEA Names Stoner

Frank E. Stoner, assistant to the president, Varian Associates, has been named Fourth Vice President and West Coast Representative on the Executive Committee of the Armed Forces Communications and Electronics Association, Washington, D.C.

Stoner served with the United States Army from 1914 to 1947, retiring with the rank of Major General. He was United Nations' Chief of Communications from 1946 to 1950. During the Palestine Truce, for which Ralph Bunche received the Nobel Prize for World Peace in 1953, he served as a member of Count Bernadotte's staff.

Raytheon Moves

Raytheon Company has announced the move of their San Mateo, Calif., commercial sales office to new quarters at 486 El Camino Real, Redwood City, Calif. Addition of the following sales representatives is being made at this time: E. J. Leonelli, commercial apparatus and systems division, and R. C. Bosshard, communications and data processing.

(Continued on Page 88)
AT THE CONTROLS on three new frontiers...

ROCKET TESTING
Rover... one of EG&G's major current activities is the design and operation of a control, instrumentation and data acquisition system for Project Rover, the project for development of nuclear powered rocket engines and vehicles for deep outer space exploration. EG&G is the principal instrumentation contractor for all past and presently planned full-scale testing of the Rover engines.

NUCLEONICS & INSTRUMENTATION
Plowshare...this is the program for development of peacetime uses of nuclear explosions. Measurement, timing, control and recording instrumentation by EG&G is vital to Plowshare's Project Gnome, the project for the evaluation of techniques for underground generation of nuclear power and production of isotopes for industrial use.

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Edgerton, Germeshausen & Grier, Inc.
BOSTON • LAS VEGAS • SANTA BARBARA
Rapid commercial expansion creates IMPORTANT NEW OPPORTUNITIES IN LOS ANGELES FOR KEEN MINDS IN TRANSISTOR CIRCUITS & ELECTRONIC DESIGN

TRANSISTOR CIRCUITS ENGINEERS (Senior and Intermediate) — Highly creative positions are available in circuit analysis and design. Duties include advanced mathematical studies in transistor circuitry, evaluation of transistor circuitry, component studies and keeping abreast of computer circuit advances. Circuit analysis ability and solid understanding of transistor theory essential. E. E. degree required. ELECTRONIC DESIGN ENGINEERS (Senior and Intermediate) — To form new group in design of general-purpose digital buffers and peripheral equipment. Three to five years' logical and transistorized circuit design of digital equipment preferred, with additional background in ferrite magnetic core memories or input-output equipment. ELECTRONIC PRODUCT DESIGN ENGINEERS — To form nucleus of a new product engineering and manufacturing liaison group. Positions require 2-3 years of electronic design experience, preferably in digital computing equipment or transistor circuits.

PRODUCT DEVELOPMENT — Experience desired in system design of data-processing equipment, central processor, command codes, peripheral equipment and associated buffers, writing of functional specifications with additional experience or training in logical design, programming techniques or systems and procedures for data-processing. Additional openings in: TRANSISTOR POWER SUPPLY DESIGN AND TEST EQUIPMENT DESIGN. Please send resume to Norval Powell, Personnel Manager

National

Business Activity—South

J. M. Loge

Loge Expands

J. M. Loge, pioneer Los Angeles sound engineer and electronics manufacturer, has announced the incorporation of his company under the new name of Loge Electronics, Inc. The firm has been known as J. M. Loge, Sound Engineers, since its establishment in 1923.

Loge, who remains president and treasurer, said the new corporate structure would enable the firm to expand its operation in the advanced design and development of intercommunications systems. “Within 60-90 days we will initiate a program that will double our present manufacturing facilities,” Loge said.

He predicted that the company's manpower would be increased 80% as a result of the growing demand for quality and specialized communication systems by the industry-at-large, missile test ranges and other military installations. The firm manufactures a complete line of electronic inter-office communication equipment. Featured in the product line is the newly patented executive model "Kwik-Kall", a miniaturized space-saving unit which incorporates a telephone instrument of matching color.

SIA Renames Riggs

Directors of Strategic Industries Association, during their annual convention at Apple Valley Inn, renamed Harvey Riggs of Glendale, president of International Electronics Research Corp., Burbank, as president for the 1960-61 term.

(Continued on Page 88)
VARIAN IS DELIVERING
THE HIGHEST CW POWER AT X-BAND

5 kilowatts CW at 9.5 to 12.0 Mc
Noise 100 db below carrier*
50 db gain at 20 Mc bandwidth
Tunable 100 Mc**

Conservatively rated as a high power CW in operational environments, the VA-823 has produced over 20 kilowatts CW under test conditions. In system use these tubes are providing extremely low noise performance for X-band CW radar and communications. They open a new area of design possibilities to microwave radar, communications, and radio astronomy.

To assist you in your particular system design problems, Varian makes available its broad experience in super-power tubes at UHF and microwave frequencies. May we work with you or furnish further data?

*AM and FM noise is more than 100 db below the carrier in any 1 kc channel more than 1 kc removed from the carrier.

**Tubes in the range from 9.5 to 19.0 Mc tune 200 Mc.

Representatives throughout the world

VARIAN associates
PALO ALTO 21, CALIFORNIA

Klystrons, wave tubes, gas switching tubes, magnetrons, high vacuum equipment, linear accelerators, microwave system components, NMR & EPR spectrometers, magnets, magnetometers, stilts, power amplifiers, graphic recorders, research and development services

GRID-BULLETIN, August 1960
Nixon-Khrushchev Tape Planted

The now-famous television tape recording of the Moscow debate between Vice President Richard Nixon and Soviet Premier Nikita Khrushchev became a permanent part of U.S. history when Ampex Corporation presented its original VIDEOTAPE recording of the event to the U.S. Library of Congress.

In ceremonies at his office, Nixon accepted the historic tape on behalf of the Library from Phillip L. Gundy, vice president of Ampex Corporation, developers of the VIDEOTAPE television recorder. The gift was turned over to L. Quincy Mumford, Librarian of Congress, who was also in attendance at the ceremonies.

Lenkurt In Alaska

The U.S. Army Alaska Support Command has awarded a contract to Lenkurt Electric Co., Inc., to maintain and operate communications facilities for NIKE missile sites and their control center in the Anchorage-Fairbanks vicinity.

The sites comprise missile battery installations providing anti-aircraft defense for the Air Force bases in the area.

A&P Sales Selected

Federated Electronics has appointed A & P Electronics Sales, San Francisco, as sales representatives for its complete line of constant-temperature crystal ovens and frequency-control devices.

Marquardt Gets Board Post

Roy E. Marquardt, president of Marquardt Corporation of Van Nuys, California, has been elected to the board of directors of Systron-Donner Corporation, Concord, Calif.

In 1944 Roy Marquardt founded the company which bears his name. He is a graduate of California Institute of Technology, where he received his Bachelor's (1940) and Master of Science (1942) degrees in Aeronautical Engineering.

In 1942 he was appointed Engineer in Charge of Naval Research at Northrop Aircraft, Inc. As a result of research in methods of cooling engines mounted within the wings of an airplane, he discovered and expanded on the principles of the ramjet engine.
This 3 lbs. of transistorized new AC amplifier gives you 20 or 40 db gain, increases scope or VTVM sensitivity 10 or 100!

This new 466A AC Amplifier is just 4" high, 6" wide and 6" deep. Yet it can become one of the most helpful instruments on your bench, or in the field. It is ac or battery powered; battery operation gives you hum-free performance and easy portability. Response is flat within approximately 1/2 db over the broad range of 10 cps to 1 MC, distortion is less than 1%, and gain is stabilized by substantial negative feedback to virtually eliminate effects of transistor characteristics and environment.

For a demonstration on your laboratory or field application, call your representative or write direct.

**Specifications**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gain:</strong></td>
<td>20 and 40 db, ±0.2 db at 1600 cps.</td>
</tr>
<tr>
<td><strong>Frequency:</strong></td>
<td>±0.5 db, 10 cps to 1 MC;</td>
</tr>
<tr>
<td><strong>Response:</strong></td>
<td>±3 db, 3 cps to 1 MC.</td>
</tr>
<tr>
<td><strong>Output Voltage:</strong></td>
<td>1.5 v rms across 1500 ohms.</td>
</tr>
<tr>
<td><strong>Noise:</strong></td>
<td>75 μv rms referred to input, 100,000 ohm source.</td>
</tr>
<tr>
<td><strong>Input Impedance:</strong></td>
<td>1 megohm shunted by 25 μuf.</td>
</tr>
<tr>
<td><strong>Output Impedance:</strong></td>
<td>Approximately 50 ohms.</td>
</tr>
<tr>
<td><strong>Distortion:</strong></td>
<td>Less than 1%, 10 to 100,000 cps.</td>
</tr>
</tbody>
</table>
| **Power:**       | Ac line power normally supplied, but battery operation available. (12 radio type mercury cells, battery life about 160 hours.) Specify battery operation if desired.
| **Dimensions:**  | 6 1/4" wide, 4" high, 6 1/4" deep.                |
| **Price:**       | $150.00 f.o.b. factory. (Either ac or battery operation.) |

HEWLETT-PACKARD COMPANY

CONTACT OUR ENGINEERING REPRESENTATIVES, NEELY ENTERPRISES, FOR INFORMATION—Los Angeles, 3039 Lankershim Blvd., North H'w'd.; San Carlos, 501 Laurel St., L T 1-2826; Sacramento, 1317 Fifteenth St., Gl 2-8901; San Diego, 1055 Shelter St., AC 3-8106; Phoenix, 641 E. Missouri Ave., CR 4-5433; Tucson, 222 S. Tucson Blvd., MA 3-2544; Albuquerque, 6501 Lomas Blvd., N.E., AL 3-5386; Las Cruces, 114 S. Water St., JA 6-2484.
ANDREW RADOME EQUIPPED ANTENNAS DEFY ICE...SNOW...WIND
Andrew radomes provide excellent 2-way year-round protection for Andrew microwave antenna systems. First, they protect feed and reflecting surface against the attenuating effects of snow, ice and debris accumulation. Secondly, for tower mounted antennas they reduce the effects of wind thrust by 35%.

All Andrew radomes are lightweight and easy to install—clip directly to the dish rim of existing antennas. Unheated radomes are suitable for all but exceptional cases. In areas where freezing rain occurs, heated radomes can be provided.

### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Dia. Feet</th>
<th>Type No.</th>
<th>Attenuation @ 6 kmc. db</th>
<th>VSWR Contribution @ 6 kmc</th>
<th>Thrust at* 30 psf (FLATS), lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>R10</td>
<td>0.4</td>
<td>0.07</td>
<td>1,990</td>
</tr>
<tr>
<td>8</td>
<td>R8</td>
<td>0.4</td>
<td>0.07</td>
<td>1,640</td>
</tr>
<tr>
<td>6</td>
<td>R6</td>
<td>0.4</td>
<td>0.07</td>
<td>1,390</td>
</tr>
<tr>
<td>4</td>
<td>R4</td>
<td>0.4</td>
<td>0.07</td>
<td>760</td>
</tr>
<tr>
<td>2</td>
<td>R2</td>
<td>0.4</td>
<td>0.07</td>
<td>50</td>
</tr>
</tbody>
</table>

*Including antenna

### HEATED RADOMES

<table>
<thead>
<tr>
<th>Dia. Feet</th>
<th>Type No.</th>
<th>Attenuation @ 6 kmc. db</th>
<th>VSWR Contribution @ 6 kmc</th>
<th>Thrust at* 30 psf (FLATS), lbs.</th>
<th>Power Reqmts.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>HR10</td>
<td>0.7</td>
<td>0.02</td>
<td>1,990</td>
<td>3,400 watts</td>
</tr>
<tr>
<td>8</td>
<td>HR8</td>
<td>0.7</td>
<td>0.02</td>
<td>1,640</td>
<td>7,400 watts</td>
</tr>
<tr>
<td>6</td>
<td>HR6</td>
<td>0.7</td>
<td>0.02</td>
<td>1,390</td>
<td>2,000 watts</td>
</tr>
<tr>
<td>4</td>
<td>HR4</td>
<td>0.7</td>
<td>0.02</td>
<td>760</td>
<td>550 watts</td>
</tr>
<tr>
<td>2</td>
<td>HR2</td>
<td>0.7</td>
<td>0.02</td>
<td>50</td>
<td>150 watts</td>
</tr>
</tbody>
</table>

*Including antenna

**Power requirements for HR10 and HR8 are 3 wire single phase 60 cycle 220 volts.

Power requirements for HR6, HR4 and HR2 are single phase 60 cycle 115 volts.

For further details on ANDREW Microwave Antennas, Radomes, Wave Guides write for new Andrew Catalog M.

**VISIT ANDREW BOOTH NO. 439 AT THE WESCON SHOW**

"We have paid particular attention to antennas during high wind conditions of gusts up to 40-60 m.p.h. It is very obvious that these radomes quite materially reduce the wind loading on the parabolas—due to their shape factor." Washington State Patrol, Kennewick, Washington

"We have had up to four inches of ice on the radome with practically no reduction of antenna effectiveness." KLIX-AM-TV, The KLIX Corporation, Twin Falls, Idaho

"Our field forces report that the radomes produce a signal loss of less than 1 db per antenna. Several radomes were removed and antennas inspected following a heavy snow storm and no snow or ice was found in the antennas." Natural Gas Pipeline Company of America
Neely's code for service

You don't need a code book to understand the advantages you get from Neely. Neely Enterprises is the largest electronic manufacturers' representative firm in the nation. With Neely on the job you get quick information on new developments and how they can be profitably applied to your business. Neely's factory-trained Field Engineers can help you with your electronic requirements, and supply almost any combination of equipment you may need. You'll find offices in or near principal cities in California, Arizona, Nevada and New Mexico. Call the one nearest you today.
At The Ramo-Wooldridge Laboratories...
integrated programs of research & development
of electronic systems and components.

The new Ramo-Wooldridge Laboratories in Canoga Park provide an environment for creative work in an academic setting. Here, scientists and engineers seek solutions to the technological problems of today. The Ramo-Wooldridge research and development philosophy places major emphasis on the imaginative contributions of the members of the technical staff. ■ There are outstanding opportunities for scientists and engineers. Write Dr. Richard C. Potter, Head, Technical Staff Development, Department 34-G

THE RAMO-WOOLDRIDGE LABORATORIES
A DIVISION OF THOMPSON RAMO WOOLDRIDGE INC.
8133 FALLBROOK AVENUE, CANOGA PARK, CALIFORNIA