EDITOR'S PROFILE of this issue

from a historical perspective …

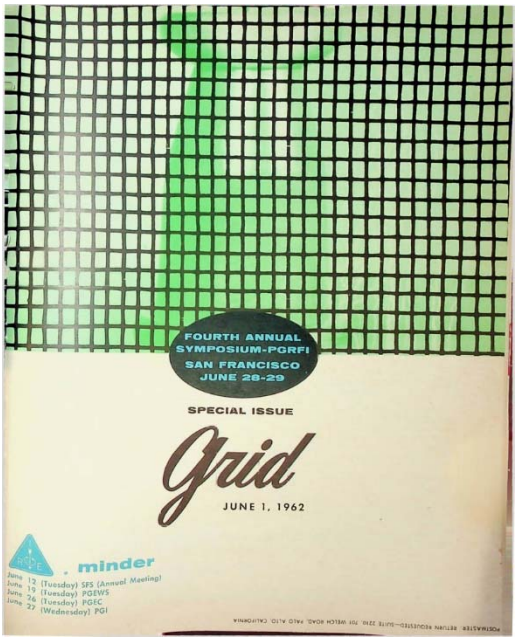
with Paul Wesling, SF Bay Area Council GRID editor (2004-2014)

June 1, 1962:

Cover: The image shows high-voltage isolation testing. This issue focuses on design approaches to radio-frequency interference (RFI). The conference program starts on page 8.

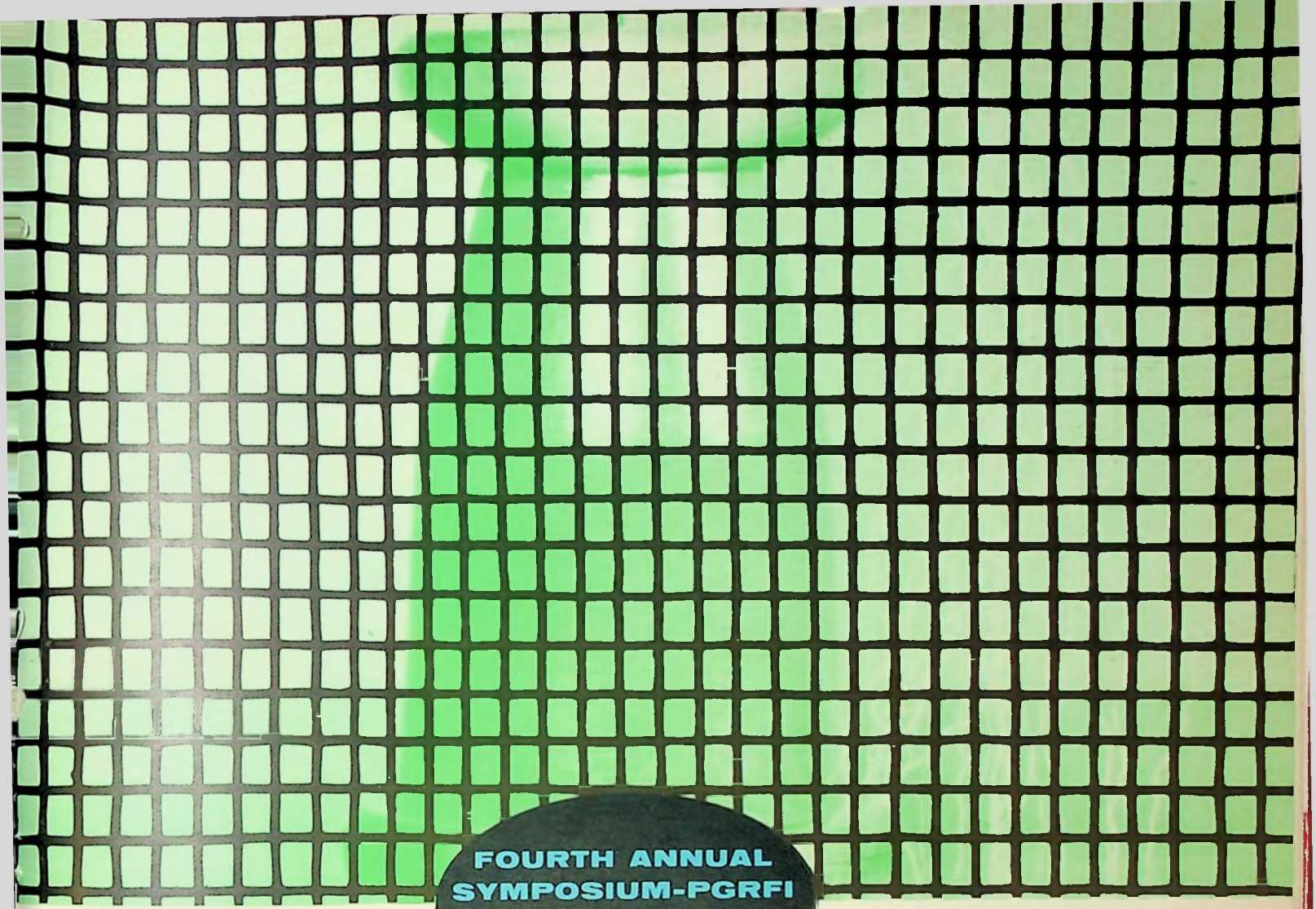
p. 18: Leonard Fuller, now retired in Palo Alto, is one of the judges of the AIEE/IRE Student Branch competition of student-prepared papers, held at Stanford. Prizes were $100, $50, and $25 plus payment of next year's dues.

p. 19: As a follow-up to the PERT meeting of a previous month, Varian is making available the PERT-O-GRAPH circular sliderule for $1 (to cover shipping and handling).



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

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



FOURTH ANNUAL SYMPOSIUM-PGRFI SAN FRANCISCO JUNE 28-29

SPECIAL ISSUE

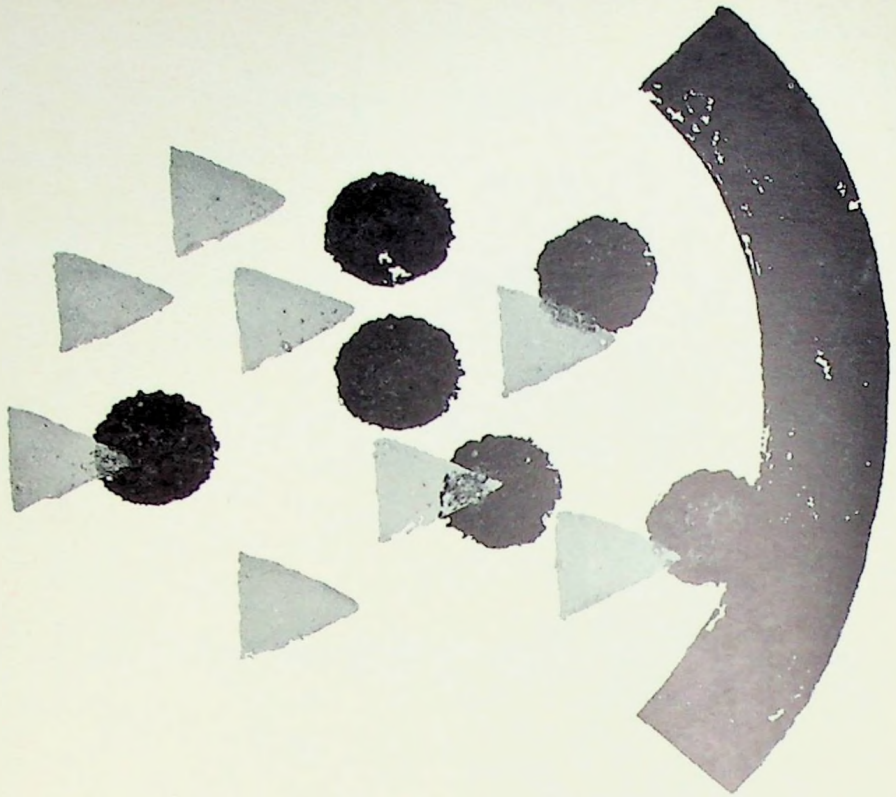
Grid

JUNE 1, 1962

minder

June 12 (Tuesday) SFS (Annual Meeting)
June 19 (Tuesday) PGEWS
June 26 (Tuesday) PGEC
June 27 (Wednesday) PGI

POSTMASTER: RETURN REQUESTED—SUITE 2210, 701 WELCH ROAD, PALO ALTO, CALIFORNIA



Said Michael Faraday: *"The amounts of different substances deposited or dissolved by the same quantity of electricity, are proportional to their chemical equivalent weights."*

Increasing requirements for pure, very thin films—especially those of ferro-magnetic elements and alloys—have become critical. To break this bottleneck, one production method under investigation is a chemical process from an aqueous solution—using metallic salts and a reducing agent.

Scientists at Lockheed Missiles and Space Company have conducted some highly successful experiments, in which extremely pure and thin ferro-magnetic film was deposited on such material as glass and plastics.

Thin film deposition is but one of many phenomena now being investigated at Lockheed Missiles & Space Company in Sunnyvale and Palo Alto, California, on the beautiful San Francisco Peninsula. Engineers and scientists of outstanding talent and ability naturally gravitate to Lockheed. For here they can pursue their special fields of interest in an ideal environment.

A leader in the aerospace field, Lockheed is Systems Manager for such programs as the AGENA Satellite series and the POLARIS FBM. Why not investigate future possibilities at Lockheed? Write Research and Development Staff, Dept. M-28C, 599 North Mathilda Avenue, Sunnyvale, California. U.S. citizenship or existing Department of Defense industrial security clearance required. An Equal Opportunity Employer.

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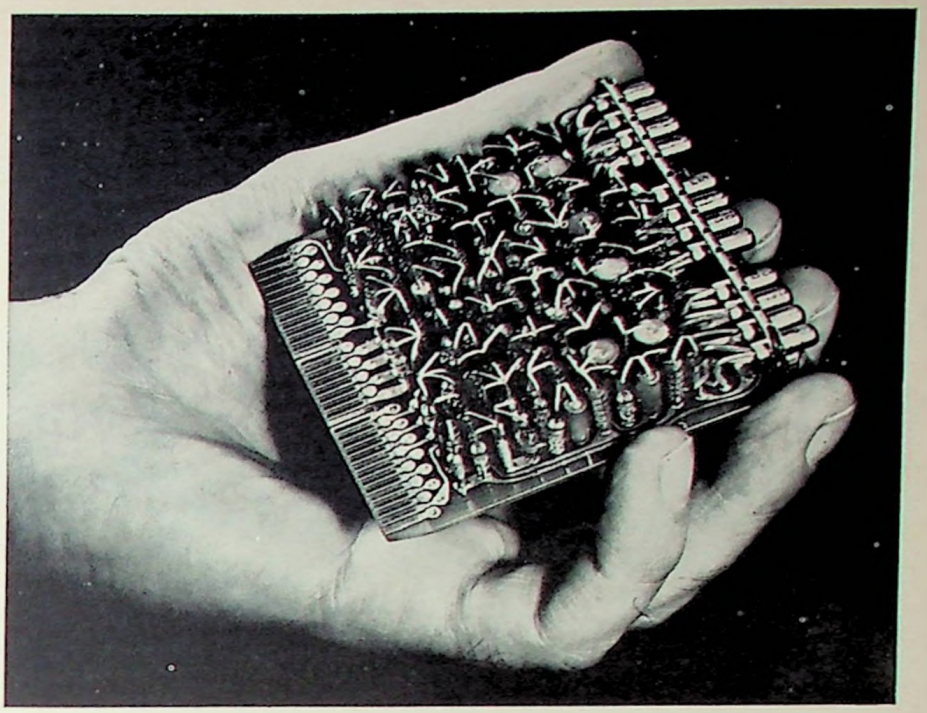
Systems Manager for the Navy POLARIS FBM and the AGENA vehicle in various Air Force Satellite programs. Other current projects include such NASA programs as the OGO, ECHO, and NIMBUS.

SUNNYVALE. PALO ALTO. VAN NUYS. SANTA CRUZ. SANTA MARIA. CALIFORNIA • CAPE CANAVERAL. FLORIDA • HAWAII

IMAGINATIVE PACKAGING

Up to 247 standard parts on a 3-inch by 3-inch card with standard techniques



Electronic packaging engineers are perennially straight-jacketed with a multitude of system and functional constraints and then expected to enclose the several million parts of a complex electronic system into neat, logical, reliable, compact, efficient, economical, and readily producible and maintainable packages.

Litton packaging engineers drew just such an assignment when they were required to design packaging for a tactical digital data system to be installed in a carrier-based airborne early warning and control aircraft.

The constraints were: use standard parts; use standard techniques; achieve maximum producibility; confine system to a lesser volume of space than normally considered practicable; maintain flexibility required of a developmental system; and achieve better reliability than specified for airborne electronics.

Despite these stringent constraints, Litton packaging engineers successfully met all requirements. Most significantly, their efforts resulted in containing the system in half the weight and a quarter of the space of comparable systems.

Typical of the way in which packaging problems were resolved was the manner in which card-mounted digital circuits were handled. First, an extensive study was made of parts density, card space, and interconnections. The over 2000 cards in the system were composed of 120 types. 1900 of these cards (covering all 120 types) were designed to conform to a single standard grid pattern.

A square card (3" x 3") was selected for greatest loading efficiency. By edge-mounting the parts (standing them on end), densities as high as 247 parts per card were attained. Parts were distributed according to a technique that afforded the highest possible volumetric efficiency as well as optimum pin efficiency. On each card, circuits requiring many input/output leads were combined with those using only a few. Instead of the conventional 4 flip-flops per card, for example, 3 flip-flops and some logic gating were placed on a single card to avoid wasting leads. Moreover, several parts converging into a common connection were so placed that only a single lead was used. Parallel circuit paths were provided both on the card and through the connector to insure reliability.

By these and other techniques, packaging of extremely high density and reliability was attained. Analog circuits, including gear trains and servos, were mounted on the same type of cards as the digital circuits to make possible one standard card design and tooling.

Why talk about past engineering successes? With military and proprietary restrictions as they are, it's difficult to do otherwise. The point is, this was, and still is, pretty solid package engineering. Litton's new programs offer a host of extremely challenging problems that can be solved only through imagination-stretching, advanced electronic engineering. If such a climate appeals to you, write Harry L. Laur, Litton Systems, Inc., Data Systems Division, 6700 Eton Avenue, Canoga Park, California; or telephone Diamond 6-4040.

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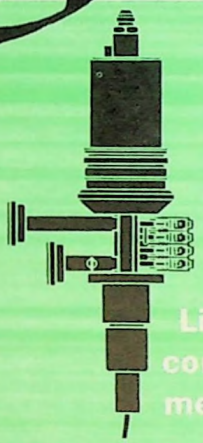

This Arabic script means "Long Life." For people who deal with complex microwave problems, "long life" means Varian klystrons—pulse, CW, reflex.

Simplicity of design, ruggedness, and precision manufacture make possible these histories: On Spruce Mountain, Nevada, a VA-220 reflex oscillator klystron was installed in 1956 in a TV transmission system. It has been operating unattended for more than 33,000 hours. Near the Arctic Circle, VA-842 super-power klystrons were installed in 1960 in a classified radar network. Eight tubes had reached 10,000 hours operation by December, 1961. In Norway, VA-800C CW amplifier klystrons were installed in 1958 in HOTLINE, a link in a NATO troposcatter system. Six tubes are still going after 10,000 hours; one has reached 20,000 hours. If your microwave system design calls for tubes that *last,* contact Tube Division.

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grid

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contents

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cover

Radio frequency interference and one of the less sophisticated ways of stopping it combine to form the illustration for the front cover—this being a special issue for the National Symposium of the Professional Group on Radio Frequency Interference. For the more sophisticated rfi techniques, see the program that follows on page 8 and attend the symposium itself, which takes place in San Francisco's Town House, June 28 and 29. Photographs were supplied by J. D. Bianco of Isolation Products Inc., Mountain View, manufacturers of high-voltage isolating components of the type shown under test.

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MEETING CALENDAR

SAN FRANCISCO SECTION

Tuesday • June 12

Annual Meeting—ladies are most cordially invited
(Joint meeting with all professional groups)
"Listening in on the Universe"
Speaker: Charles L. Seeger, acting director, Stanford Radio Astronomy Institute
Place: Fremont Hills Country Club, 12893 Viscaino Place, Los Altos Hills
Dinner: 7:30 P.M. (Cocktails: 6:00 P.M.) $6.00
For tickets by mail send check, payable to San Francisco Section, to Doris Gould, IRE Office, 701 Welch Road, Palo Alto. Tables of 10 for PG's and companies may be reserved. PG chairmen and company membership representatives have tickets.

PROFESSIONAL GROUPS

Electronic Computers

8:00 P.M. • Tuesday, June 26

"Opto-Electronic Devices Applied to Data Processing System"
Speaker: Frank A. Litz, president, Opto-Electronic Devices, Inc.
Place: Lockheed Auditorium, 3251 Hanover Street, Palo Alto
Dinner: 6:00 P.M., the Red Shack Hofbrau, 4085 El Camino Way, Palo Alto
Reservations: None required

Engineering Writing & Speech

8:00 P.M. • Tuesday, June 19

Annual business meeting and election of officers
Place: Star Dust Motel, 4320 El Camino Real, Los Altos
Dinner: 7:00 P.M., Star Dust Motel
Reservations: Miss Mary Furio, DA 4-3311, Ext. 45614

Instrumentation

8:00 P.M. • Wednesday, June 27

Lecture No. 4
"System Programmers and Summary"
Speakers: To be announced
Place: Hewlett-Packard Co., 1501 Page Mill Road, Palo Alto (main lobby)
Meet-the-Speaker Dinner: 6:00 P.M., L'Omelette Restaurant, 4170 El Camino Real, Palo Alto
Reservations: None required

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career notes

SUPPLY & DEMAND

As the recruiting season nears its peak, industrial offers to Stanford University senior engineering students range from $525 to $690 per month, with $565 a typical (median) figure. Paul Williams, Stanford's assistant director of placement, reports offers for those seeking a master's in engineering have run as high as $765 a month, with $680 a typical (median) bid. Overall, he notes, more companies are competing for fewer engineers at Stanford this year.

For every five Stanford students looking for jobs a year ago, only four are in the market now. More students are planning graduate work or starting military service, Williams explains. The number of firms that have already recruited on the campus this year—404—tops the total for all last year, he adds. Companies seeking more than one type of engineer—aeronautical and electrical engineers, for example—would be counted more than once in these totals.

remarks from the chair

THE POSITIVE ACCENT

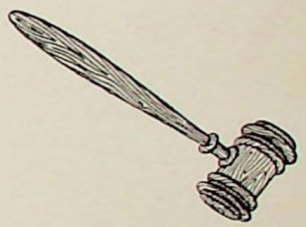
Whether or not San Francisco Section members favor the IRE/AIEE consolidation, it is one of their prime responsibilities to vote on the issue by returning their ballots promptly to national headquarters. In view of the tremendous expenditure of time and effort to bring this issue to the point of decision, it would be extremely unfortunate if less than the necessary third of the voting members cast ballots as required to make the vote definitive.

As you know, previous balloting by the Operating Committee and the Executive Committee has favored consolidation and the general tone of the Section meeting on April 26, including discussion by many former chairmen of the Section, the East Bay Subsection and the Palo Alto Subsection, favored the action. You are therefore urged by your officers to return a favorable ballot and to call at least one other member, asking him to vote—for or against.

Dr. Haggerty, on behalf of the national Board of Directors, also recommends a favorable vote in the statement below.

Stanley F. Kaisel

—STANLEY F. KAISEL
CHAIRMAN, SAN FRANCISCO SECTION
INSTITUTE OF RADIO ENGINEERS



Every engineer, whether a specialist or a generalist, needs plenty of crossroads as he, in the complex technology which characterizes our society, follows his own path of contributions to that society. Crossroads tie together and lead to specialties and to all pertinent technological disciplines from which useful products and services flow.

The proliferation of knowledge makes even greater specialization in technologies necessary, but if usefulness is to result from specialization, there must be interdisciplinary ties. This is one of IRE's prime functions: to help each of us perfect ourselves in our own areas of technological competence, but simultaneously provide us with improved accessibility to an increasing number of crossroads.

It is no longer possible to divide the technological content of electrical engineering between IRE and AIEE and, further, the areas of overlap are increasing at a rapid rate. The two societies have 6000 common members, and AIEE has an increasing number of members, belonging only to it, who are interested primarily in technology IRE has long considered its own.

Electrical engineering, as taught in universities today (and IRE has 19,000, AIEE 11,000 student members), is not readily divisible into specialities of one or the other societies. The best evidence of this is IRE's 217 Student Branches. Of these, 128 are IRE-AIEE Joint Student Branches. Of 61 national technical meetings sponsored in 1961 by IRE professional groups, AIEE co-sponsored 22.

The proliferation of knowledge and the technical specialties it produces have an explosive effect on the profession, tending thereby to create many professions, and this seems to call for an especially strong, unifying force.

Your board of directors believes that, with the bases for merger that have been defined, the IEEE, if approved, will be a stronger unifying force than if the two societies remain separate, and that those same bases for merger contain, not the infinite and external solutions to the problems involved in establishing the best professional society, but the flexibility and viability necessary for the members and their elected representatives to work for and toward a society of tremendous vitality, which will fulfill the needs of its members in the most special and useful manner possible.

P E Haggerty

—P. E. HAGGERTY
PRESIDENT
INSTITUTE OF RADIO ENGINEERS

Committee heads for the PGRFI Symposium at one of their recent meetings: Floyd Lewis, Sylvania; Peter Spencer, Filtron Co.; Richard Davis, Lockheed; William Clark, Filtron Co.; F. Perry Booker, Cooke Engineering; James Spagon, Filtron Co.; Fred Barline, Lockheed; and Paul Potter, RFI Shield Rooms. Not present: Richard Stone, G.E., and Guy Ottinger, Lockheed

rfi symposium

THE ANSWER: DESIGN

Beginning at 4:00 p-m, Wednesday, June 27, registration will open, at the Del Webb Town House near the San Francisco Civic Center, for the Fourth National Meeting of the Professional Group on Radio Frequency Interference. The symposium will run throughout Thursday and Friday, June 28 and 29, presenting 38 papers and a panel, and including a luncheon, a reception, a banquet, a field trip, and a hospitality program for the ladies. A symposium digest, to be distributed to all registrants, will include an additional six papers not given during the meeting.

Objective of the symposium committee has been to bring together a body of information emphasizing design problems in rfi, as well as some solutions that have been found, and techniques that may give better solutions.

By programming some sessions to include related material from communications and other system and equipment and design activities, the committee has attempted to present workers in the field of rfi with new insights into equipment and systems that may be expected to give rise to future problems and at the same time present to design specialists and system engineers a clearer picture of design considerations of major importance.

Selection of the theme, "Design: The Answer to RFI," is thought to be particularly timely in view of new requirements and specifications that may necessitate tighter design control and more complete documentation.

The Field Trip

Stanford University has arranged a visit to the linear accelerator in the Hansen high-energy physics laboratories. There will be discussions of the two-mile linear accelerator, construction on which is currently in progress. Buses for this tour will depart from the Town House at 10:00 a-m, Thursday, June 28, and return at 3:00 p-m.

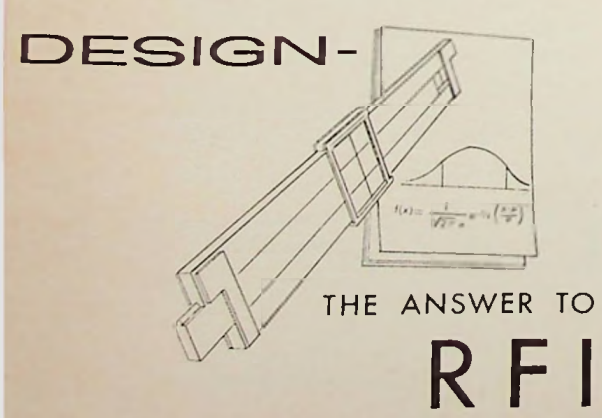
Ladies' Program

Opening at 9:00 a-m Thursday, a hospitality room will be provided for a get-acquainted hour during which tours of interest in San Francisco and environs can be arranged—a qualified representative being present. Ladies are invited to attend a 10:00 a-m brunch after the get-acquainted hour.

On the Committees

Local Section members whose efforts are behind the planning and execution of the symposium include: Peter F. Spencer, Filtron Co., general chairman; Richard W. Thompson, R. W. Thompson Assoc., vice chairman; Richard G. Davis, Lockheed, technical program chairman; Richard H. Stone, Jr., technical program vice chairman; William A. Clark, Filtron Co., secretary; J. W. Wattenbarger, Sierra Electronic Corp., finance; Emory M. Wright, III, Carl Stone Assoc., arrangements; Paul Potter, RFI Shield Rooms, and George Grinnell, Vitro Electronics, public relations and publicity; and Wilbur D. Hayter, IBM, field trip.

Advisors to the Symposium were: André J. Devot, Harold E. Dinger, W. G. James, Frank Mansur, Fred J. Nichols, Henry Randall, R. B. Schulz, Ralph M. Showers, Samuel Skolnik, R. R. Stoddart, and Donald R. J. White.



pgrfi symposium

THE PROGRAM

Thursday, June 28, 1962

9:00 A.M.

Welcoming Address and Opening Remarks

Peter F. Spencer, general chairman
Richard G. Davis, chairman, technical program

10:00 A.M.

SESSION I

Design Specification Panel

THE NEW GOVERNMENT SPECIFICATIONS AND THEIR INFLUENCE ON DESIGN

Moderator: Leonard Milton, Filtran Co.

Panel Members: George Reese, U.S. Navy Bureau of Ships; Samuel Skolnik, U.S. Air Force; Herman Garlan, Federal Communications Commission; Stanley Bennett, U.S. Navy Bureau of Docks; Guy Johnson, U.S. Army; Paul Georgi, Annapolis, Md.; Robert Miller, Rome Air Development Center

10:00 A.M.

Field Trip: Stanford University Linear Accelerator

2:30-5:30 P.M.

SESSION II-A

MEASUREMENT TECHNIQUES AND EQUIPMENT

Chairman: F. J. Nichols, president, Genistron Company, Inc., 6320 West Arizona Circle, Los Angeles, California

Co-ordinator: James Spagon, Filtron Company, Inc., 926 Industrial Avenue, Palo Alto, Calif.

SPECTRUM MEASUREMENTS OF RADIO INTERFERENCE

David Fidelman, Electro-Magnetic Measurements Co., Roslyn Heights, Long Island, N. Y.

Many of the characteristics of electronic equipment that are important in determining their radio interference properties cannot readily be determined by conventional methods. These characteristics include such factors as: transmitter sideband splatter; nulls and lobes of pulsed signals (especially with frequency jitter); resolution of signals close to the same frequency; modulation characteristics; dynamic nature of the signal; frequency stability; and others that are well known to equipment designers. An accurate knowledge of these factors is necessary both in the design of equipment to help provide an interference-free design and in testing of the complete equipment to insure compliance with specifications.

This paper describes methods of obtaining this information by use of spectrum analysis. It presents a basic theoretical analysis of the spectrum

method in its application to interference measurements, discusses the merits and application of currently available instrumentation, and presents measured data illustrating the application and value of the information that can be obtained in this manner.

AN EARLY TRIAL OF THE DOD RADAR SIGNATURE COLLECTION PLAN

R. B. Marcus, HRB-Singer, Inc., State College, Pa.; and R. Powers, Rome Air Development Center, Rome, New York

In order to gain experience and to test measurement procedures, RADC set up a program with HRB-Singer to measure the spectrum signatures of several radars and communications sets following the DOD collection plan. The experience gained resulted in some useful modifications of the plan.

The spectrum signatures of several radar transmitters and receivers operating in the vhf and uhf were obtained at the Verona, New York, test site of RADC during the winter of 1960-61. The test equipment used, its operation, and its limitations are described, as well as auxiliary equipment considerations including the shielded test van and communications with the radar operator.

The spectrums of two radar receivers are presented with comments on the limitation imposed by the test equipment as seen in these signatures. It was found that all the radars whose spectrum signatures were measured had extra band radiation extending several hundred megacycles on each side of the radar fundamental.

The method used for measuring the antenna patterns in the field is described. The patterns obtained for several radar sets at design and non-design frequencies are shown.

THE TWO CURRENT-PROBE METHOD OF MEASURING CONDUCTED RADIO INTERFERENCE

James L. Brooks, U.S. Naval Civil Engineering Laboratory, Port Hueneme, California

Accurate measurement of conducted noise voltages for the purpose of determining interference acceptability of electronic devices has always been a problem. The principal difficulty has been the uncertainty associated with the impedance levels of the circuits under test while voltage readings were taken.

A method has been developed where the noise voltages under any operating conditions may be determined utilizing commercially available current probes. The current probe technique has the advantage that the probes may be clamped directly around the conductor without breaking the line anywhere and at the same time they present very little loading to the circuit under test. The noise currents may be measured directly using only one current probe.

A method of determining the impedance values of the circuit has been worked out which requires the use of two current probes. Either the noise source impedance or the load impedance or both may be determined by this method. Two separate measurements and calculations are required, however, one to determine the magnitude of the impedance and the other to determine the phase angle.

ELECTRO-INTERFERENCE TEST CONCEPT FOR COMPLEX ELECTRONIC SYSTEMS

R. B. Schulz and A. Eckersley, United Control Corporation, Seattle, Washington

The electro-interference test concept was devised to ascertain compliance of complex electronic systems with military specification MIL-I-006051B. A major requirement is to determine experimentally that the interference level in the system is at least 6 db below that which would cause an unacceptable response.

This test concept is unique in several respects.

(Continued on page 10)

meeting review

THE TWT IN SPACE

Dr. L. A. Roberts, a member of the technical staff of Watkins-Johnson Co. of Palo Alto, presented a very interesting discussion at the April PGSET meeting on traveling-wave tubes and their capabilities. These tubes are among the most promising r-f amplifiers available for satellite and missile communications. They can be designed to have very long life and high reliability and to maintain high efficiency.

In his discussion, Roberts described the helix type of traveling-wave tube. The helix in the tube forms part of a transmission line, and in the tube, power is added by the action of the electron beam in the helix. Longer helices can provide more gain than shorter ones; thus one parameter of a tube is its db gain per inch of helix length.

The traveling-wave tube is made up essentially of three independent elements: the electron-beam gun, the helix, and the beam-collection element. Since these elements are relatively independent of each other they can be designed for long life, reliability, and efficiency without excessive compromise. The tube is naturally a very wide band device, in the order of hundreds of megacycles.

Electrons emitted by the heated cathode are shaped into a beam, passed through the center of the helix in a constant electrical field, collected at the other end by the collector, and returned to the power supply.

Preservation and protection of the cathode surface does most towards providing long tube life. Cathode life can be extended by using a low current density. The low-density beam can be made to converge, by a ratio of several hundred, into a very small beam for application to the helix element of the tube. Operation at low cathode temperatures also increases life.

The cathode is most seriously damaged by ion bombardment. Bombardment and damage can be reduced by: removing more of the ions with better and higher vacuum techniques, not producing them during tube operation through means of good electron-beam control (typically less than 1 per cent of the electron beam goes into the helix due to focus etc.), and cathode ion protection by adjusting the electric fields to keep the ions away from the cathode.

Power, weight, and size savings have

(Continued on page 10)

annual meeting

NOW IT CAN BE TOLD

Things have been firmed up and it is possible to fill in some of the missing details, for lack of which you may have been holding back on your reservations for the Annual Section Meeting, June 12. To begin with, the speaker, Charles L. Seeger, is acting director of the Stanford Radio Astronomy Institute, in the sabbatical absence of Ronald Bracewell. His background in the field includes serving as chief scientist for the construction of the Benelux Cross—the 5-km-by-5-km antenna located astride the Belgian-Netherlands border and described as "perhaps best viewed from the moon."

A graduate of Cornell, Seeger has been on that faculty for eight years, as well as serving as a guest research associate at the Chalmers Technical Hochschule in Gotenberg, Sweden; as a consultant to N. V. Philips of Eindhoven, Netherlands; and as a member of the Leiden Observatory staff. His presence promises a stimulating evening.

Besides the customary ceremony of honoring this year's Fellows in the Section (see December 1961 **Grid** for identifications) there will be a presentation of certificates and vouchers for a year's membership dues to seven outstanding students as follows: William N. Compagno, University of Santa Clara; William Drummond, Heald Engineering College; M. E. Hall, Fresno State College; Paul Ivaska, Stanford; Fred Nase, San Francisco State; Jerald F. Swartz, University of California; and Maj. Robert F. Werner, USMC, U.S. Naval Postgraduate School.

Charles L. Seeger, annual meeting speaker

As a new feature of Annual Section Meetings, this year's affair will be organized by tables composed of parties from company staffs and individual professional groups. Get together with your friends and associates and make your table reservation now! (Unless you're reading this in the middle of the night. In this case, tomorrow will do.)

MORE TUBES

been made with the use of a cobalt platinum structure to provide the magnetic field to maintain the electron beam within the helix of the tube. Although very expensive, the magnetic material can produce twice the field of the next-best material and has a temperature coefficient one-fortieth that of ferrite materials. Other overall efficiency contributions come from insuring low r-f losses, providing good coupling between the line and the helix, designing the cathode structure for low power and high efficiency, and operating with a depressed collector.

Helix cooling at higher frequencies and higher powers produces a serious problem. Special techniques provide suitable heat paths and also give increased mechanical support to the helix. Such constructions can withstand 30-g forces with very little a-m or f-m.

Roberts gave some examples of traveling-wave-tube characteristics. One example had a saturation gain of 35 db; saturation power output of 13 watts; and an overall efficiency, including cathode heater, of 25 per cent. Gain variation from −35 to +110 C was only 0.4 db and noise, better than 25 db down. The overall unit, including converter and metal case, weighed only 32 oz.

The traveling-wave tube can be used successfully for satellite and missile communications. It has a high efficiency (which can approach 40 per cent), very high reliability, and a life of hundreds of thousands of hours.

—JOE BARKLEY

meeting review

CUDDLED COMPONENTS

The April meeting of the PGPEP consisted of a panel discussion on packaging of parts and equipment for proper protection during storage and shipment. Members of the panel were Bronson Baker, manager of packaging, handling engineering, and conservation at Lockheed; R. M. Bracamonte, president of R. M. Bracamonte Company; and Harry Wood, packaging engineer for Hewlett-Packard.

Baker started the presentation with a talk and slides giving the details of a program of protective packaging and handling developed for "Cradle to Grave Protection" of high-reliability electronic and electromechanical parts used on project Midas. The first area of improvement was in the packaging of

(Continued on page 12)

PGRFI meets the speaker at dinner before the mid-May meeting. The speaker was Robert Friedman, Polarad Electronics, seated third from left

meeting review

MEASURING THE MICROWAVE

After a well-attended dinner, members and guests of PGRFI moved from Rickey's to Lockheed to hear Robert Friedman, application-engineering manager of Polarad Electronics, Long Island City, N. Y., speak on rfi measurements in the microwave spectrum.

As he pointed out, measurements can be made by application of either the power-density or field-intensity concepts—the latter being commonly used for lower frequencies. He discussed the inter-relationships, units, and conversions, giving illustrative examples. He described the latest techniques in microwave receiver calibration, putting emphasis on the near- and far-field effects on absolute accuracy. Both a slide presentation and an equipment demonstration were given to show practical use of the hardware.

Friedman has been with Polarad for five years. His experience has included project engineering on ground-support equipment for missile and aircraft systems, countermeasures equipment, and radio-noise and -interference meters.

—GEORGE SPELVIN

MORE PROGRAM

Application is to a system composed of (nonlinear) digital and linear subsystems. Furthermore, no attempt is made to measure the interference signals and then to become involved in an analysis and interpretation of the effects of such signals on system operation. Instead, the approach for the digital subsystems is to interference-sensitize them by 6 db and note if an unacceptable response ensues.

Sensitization is accomplished basically by inserting d-c emf's in series with critical interface connections between bistable circuits. These are adjusted for half the values required to reach threshold respectively from quiescent and logic levels. A major portion of this paper is devoted to the problems associated with this approach.

AN EQUIVALENT NOISE SOURCE MODEL IN THE VLF RANGE AND BELOW FOR TYPICAL POWER-CONVERSION DEVICES

Frederic M. Livezey, The Moore School of Electrical Engineering, University of Pennsylvania

This paper describes methods of determining the Thevenin equivalent conducted noise source voltage and source impedance as a function of frequency from 150 cps to 15 kc for electrical machines and equipment. Results of tests performed on a number of 3-phase 60-cps synchronous generators ranging in size from 5 kva to 150 kva, a 400-cps 10-kva generator, two d-c generators and several other pieces of equipment are presented.

EQUIPMENT FOR THE MEASUREMENT OF SPURIOUS EMISSIONS

O. F. Hincklemann and R. L. Sleven, Airborne Instruments Laboratory, Deer Park, Long Island, N. Y., and L. F. Moses, Rome Air Development Center, Griffiss AFB, N. Y.

A new type of equipment has been developed to measure the spurious output power from microwave transmitters. A breadboard model of this equipment to be used with s-band transmitters has measured power at the second and third harmonic frequencies to an accuracy better than ± 1 db.

The power measurement is performed by sampling the electric field at the boundary of an oversize section of waveguide. Use of the oversize waveguide causes essentially plane wave propagation and significant simplifications in the expressions for power flow in the waveguide. With these simplifications, the average of the power coupled by electric probes on the boundary of the enlarged waveguide is a simple function of the waveguide power.

The fixed probes and the simple mathematical operation of averaging lend themselves to rapid, automatic sampling techniques. Unlike other probing techniques, a computer is not required.

2:30-5:30 P.M.

SESSION II-B

DESIGN ANALYSIS

Chairman: Albert R. Kall, Ark Electronics Corp., 624-26 Daviaville Road, Willow Grove, Pa.

Co-ordinator: Floyd V. Lewis, Sylvania Electric Products, Inc., Mountain View, Calif.

A SURVEY OF BANDWIDTH CONSERVATION TECHNIQUES

Joseph Chernof, ITT Federal Laboratories, San Fernando, California

A fundamental consideration, which should be the concern of those engineers who are involved in the control and reduction of radio-frequency interference, is that of obtaining effective radio-frequency spectrum utilization through the conservation of bandwidth.

This paper first discusses some of the major types of electro-magnetic radiating systems (of both the military and commercial varieties) which

are in current or projected use, from the standpoint of their spectrum utilization properties. Particular attention will be given (within the usual bounds of security restriction) to techniques involving spread spectrum signals, such as the "Chirp" radars and similar devices which involve the utilization of signals of rather large extent in both the frequency and time domains.

The concept of a minimum signal (that signal which provides the best utilization of the available information in the sense that it possesses the smallest product of effective time duration by effective bandwidth) is introduced.

SYSTEMS SUSCEPTIBILITY EVALUATION AT LOW FREQUENCIES

R. M. Showers and Julius Goldhirsch, The Moore School of Electrical Engineering, University of Pennsylvania

Procedures for evaluating the susceptibility of electronic and other systems in the frequency range below 100 kc have the advantage over more general procedures in that methods of prediction are more reliable. This frequency range is important for low-frequency communications such as in submarines and other military applications. A discussion of the principles involved are therefore presumably readily susceptible to experimental documentation, so that the discussion of them should prove to be useful in formalizing such procedures at higher frequencies. The absence of formalized procedures for system evaluation has probably contributed to the fact that much of this type of work is done more as an art than a science.

The burden of this paper will be to derive quantitative test procedures, from fundamental electromagnetic field and circuit principles, that will result in quantitative evaluation of the margin of safety of the overall system design. As a consequence, the quantitative basis for evaluating the relative effectiveness of system-interference control procedures will be available.

RELIABLE ELECTRICAL CONTACT THEORY APPLIED TO RFI CONTROL

O. P. Schreiber, Technical Wire Products, Inc., Cranford, New Jersey

Good reliable electrical contact is very important in two areas of RFI control: 1) Grounding and 2) R-F gasketing.

In both cases voltages are usually in the "dry circuit" range. This means that voltages are so low that dielectric breakdown of surface films is not a reliable means for establishing electrical contact. Since many of the modern computer and control circuits operate at very low voltages, the entire problem of reliable contact at voltages below 50 millivolts has received much attention lately. A review of the work done in this field and the resulting findings are useful to rfi engineers seeking dependable grounding and r-f gasket designs.

On the basis of these considerations, gold and tin are the best choices for reliable low-voltage contact. From a cost consideration, gold is usually excluded; tin (in the form of solder) is a very readily available material and is easily applied to surfaces. It is, therefore, suggested that tin should be considered more frequently as a material for grounding and r-f gasketing.

PREDICTION OF PULSE SPECTRAL LEVELS

Harold L. Rehkopf, The Boeing Company, Seattle, Washington

This paper gives the design engineer a clear and practical application of Fourier analysis to aid him in designing for interference-free operation. It gives the relationship between pulse shape and pulse-interference level in terms that allow the designer to predict quickly and accurately the interference levels his circuits will produce at all frequencies. He then can determine

(Continued on page 12)

parts supplied by vendors. In many cases the packaging was satisfactory for shipment of parts to the receiving dock but protection was lacking for further in-plant handling.

For example, by working with the vendor a blister package was developed and is now specified for diodes, capacitors, resistors and similar components. It features a tear-off convenience for single issue from stock and tear strips on the back for testing the part without removing the part from the package or touching it with bare hands. This improvement alone accounted for estimated annual savings of $52,000 in labor and material.

Skin packaging, in combination with reusable thermo-formed neutral polyethylene trays, provides protective-packaging for items such as circuit boards. The tray and film not only meet clean-room requirements but also allow only one subassembly at a time to be exposed prior to its assembly with other parts. This preserves the lot number and part identification as well as the planned sequence of assembly as certified by inspectors and eliminates the possibility of substitution without evidence of tampering.

PGPEP panelists Harry Wood, Bronson Baker, and R. M. Bracamonte with moderator Thomas E. Scatchard after April meeting—Harmon R. Traver photo

The cost of the package is about six cents and the major portion of it is reusable. In actual operation, the circuit boards are re-packaged after the inspection of each sequence of operations. With addition of a desiccant, the package can be used for long-term in-plant storage.

Another area that required attention was the handling of high-value parts that are easily damaged by shock. A gyro that had previously been shipped in a metal can, which required extra cushioning material because the can does not mitigate shock and vibration, was packaged in a plastic container known as Kudl-Pak. The plastic container reduced the cushioning material required, eliminated the need for tools to open and close the metal container, and provided much better protection.

A completely integrated modular system of standard plastic tote boxes was developed for the handling of small parts. This replaced the hodge-podge of cartons, bread pans, and old-style tote pans previously used. The larger sizes of the new standard tote boxes are multiples of the small box dimensions. This permits mixed stacking and saves space. A nesting feature allows large quantities of empty boxes to be stored in a minimum space. A snap-on top made of clear plastic provides protection and permits visual identification of parts and shop orders without opening the box. Pre-cut slots in the dunnage permit dividing the box interior into various sized compartments to keep parts from contact with each other.

In concluding, Baker stated that the place to start reduction of costs in the operations of government contractors is with the beginning of the material handling cycle.

Woods presentation was based on the packaging of electronic parts and test instruments. His approach to the problem is represented by the letters MWLC. The reduction in cost is made by reducing Material, Weight, Labor, and Cube. MWLC means lower-packaging costs while maintaining a high degree of protection. Not every factor is necessarily reduced in a particular case. For instance, lower costs can sometimes be achieved by increasing material costs but more than offsetting this through cutting weight, labor, and cube.

The importance of packaging and material handling is emphasized by the fact that some 20 billion dollars of our GNP is spent in these areas. In fact, packaging and material handling is estimated to account for 20 to 30 per cent of total manufacturing cost.

The four methods used to implement the MWLC approach are skin packaging, floater packs, expanded polystyrene foam, and triple-wall corrugated. The goal of the total program is to save $375,000 per year. Of this, $300,000 would be in domestic transportation costs which is mainly a customer benefit, $50,000 in overseas transportation to other Hewlett-Packard facilities, and $25,000 in packaging labor savings.

Skin packaging has been used for the shipment of waveguide instruments and spare parts as well as the protection of purchased and fabricated parts in the receiving and stores areas. The results achieved in the last 1½ years have been an increase of 250 per cent in the effectiveness of labor, a 40 per cent reduction in material costs, and the

(Continued on page 14)

the type and amount of suppression to design into his circuits to comply with military specifications. This results in more rapid design and simpler design because filtering and shielding can be kept down to the required minimum.

Curves showing the interference level for eight common pulse shapes are derived and interpreted. A line drawn tangent to the peaks of the lobes of the envelope of the spectral lines is shown to represent closely the interference level. Characteristics of the resulting curves, such as the interference level at low frequencies, the corner frequencies, and the slope in decibels per octave at high frequencies are pointed out. The difference between the spectra of different pulse shapes is explained in terms of pulse length, number of discontinuities, rise time, the sharpness of the corners, etc. For any pulse shape, the interference level at low frequencies is shown to be dependent only on the area under the pulse and the interference level at high frequencies is shown to depend upon the time of rise and fall of the pulse and to be independent of pulse duration. Interference level for any odd pulse shape can be estimated from these curves.

ANALYSIS OF CABLE-COUPLED INTERFERENCE

L. J. Greenstein and H. G. Tobin, Armour Research Foundation, Illinois Institute of Technology, Chicago, Ill.

The ever-increasing complexity of advanced weapon systems, and the coexistent emphasis on economy of space and weight, have imposed the necessity for packing more electronic cables into smaller volumes. Associated with the increased proximity of cables servicing power, control, and communication circuits has been an increase in the potential interference problem.

The interference between any two circuits having long conductors in physical proximity arises from two phenomena, namely, magnetic field induction and electric field induction. The former is brought about via the mutual inductance between the circuits, while the latter occurs via the mutual capacitance. The magnitudes of the resultant interference signals depend on several factors, notably: 1) the magnitudes of the coupling parameters (mutual inductance and mutual capacitance), 2) the impedance properties of the two circuits, and 3) the characteristics of the source signals of the circuits. Whereas factors (2) and (3) are dictated by the operational requirements of the circuits, some control can be exercised over the coupling parameters.

THE SHIELDING EFFECTIVENESS OF A CONDUCTING PLANE

W. T. Cronenwett, The Electro-Mechanics Co., Austin, Texas

In compact systems, such as aerospace vehicles, where the metallic structure of the vehicle is used as a common conductor for both electrical power distribution and low-level signal circuits, the impedance of the vehicle structure provides an undesired mutual coupling. One of the problems of radio-interference-suppression engineering in such systems is that of minimizing the amount of spurious power-frequency energy coupled into signal and servo circuits.

In cases where a power conductor is routed on one side of a conducting metal wall and a signal circuit on the opposite side of the wall uses part of the wall as a return conductor, a power frequency voltage is induced in the signal circuit. Determination of the effectiveness of the metal wall in shielding the signal circuit from the power circuit will not yield to a simple computation of voltage drop, and must instead be attacked from a field theory standpoint. Available shielding analyses deal largely with high-frequency waves rather than with the low-frequency induction fields typical of power-frequency cables.

Application of the work to radio frequency in-

terference studies is discussed from both the viewpoints of analysis and design.

6:30-7:30 P.M.

RECEPTION

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7:30 P.M.

BANQUET

THE GROWING PROBLEM OF RADIO INTERFERENCE

George F. Maynahan, San Jose State College

A discussion of the relationship between engineering education and an effective approach to signal compatibility.

Friday, June 29, 1962

9:00 A.M. to 12:00 Noon

SESSION III-A

EMI CONTROL PROGRAMS

Chairman: Dr. J. H. Vogelman, vice president—research, development, and engineering, Capehart Corp., Richmond Hill, Long Island, N. Y.

Co-ordinator: Guy L. Ottinger, Lockheed Missiles & Space Company, Sunnyvale, California

REAL TIME SIMULATION OF RADIO-FREQUENCY ENVIRONMENT

B. C. Pierstorff and A. I. Matheson, Radio Corporation of America, Burlington, Massachusetts; and S. Seideman, Rome Air Development Center, Griffiss Air Force Base, New York

Under the Department of Defense electromagnetic compatibility program, efforts have been established in three distinct areas: Signature Measurement, Interference Analysis and Prediction, and Environmental Simulation. In the area of measurement, the signatures of all transmitters and receivers will be obtained under the military collection plan for spectrum signatures.

A program for the detailed analysis and prediction of the interference environment and the compatibility of existing and new equipment within this environment has been established under the direction of the electromagnetic compatibility analysis center at Annapolis, Maryland.

THE COMPREHENSIVE EXAMINATION OF RFI PROBLEMS BY COMPUTER TECHNIQUES AND ITS APPLICATION AS A DESIGN TOOL

H. O. Beers, S. A. Scharff, and J. H. Vogelman, Capehart Corporation, Richmond Hill, Long Island, N. Y.

This paper describes experience with a digital computer program for the analysis and prediction of rfi. The program is particularly well adapted to use in design projects to produce equipment capable of meeting operational requirements without causing or suffering from rfi. Our experience indicates that such a computer analysis should be part of the design of any major electronic system because: 1) It permits handling complex interference and environments impossible to analyze by manual methods, and 2) It permits testing for interference using preliminary design data before major development effort and production is undertaken. Changes or additions required as the design project progresses may be tested for rfi effects before further commitments are made.

The computer program is based on an engineering/mathematical conception and process which may be summarized as follows. The essential question is whether the power from a given transmitter at the input terminals of a given receiver is large enough to cause interference.

To resolve this simple question in real situations, however, requires coping with many com-

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PGMIL Speaker Victor Conrad and Walter Prise

meeting review

A NEW ARMY

The speaker at the May PGMIL meeting was Major General Victor Conrad, USA (ret). Conrad, a graduate of West Point in the class of 1924, served with distinction in the Army Signal Corps until 1961, where his last position was that of chief signal officer, Allied Command for Europe. He is currently assistant to the president at Varian Associates, Palo Alto.

Conrad spoke on "The Army Reorganization." This pertains to the noncombat side of the Army, particularly to the seven technical services. These seven are the Corps of Engineers and the Signal, Quartermaster, Chemical, Ordnance, Transportation, and Medical Corps. Because these are the people in the Army who do the research and development work or contract to have it done and who procure many thousands of items needed by the Army, any reorganization that affects them is of interest to industry. Under the present organization the chiefs of these services report jointly to two deputy chiefs of staff of the Army: the Deputy for Research and Development and the Deputy for Logistics. This automatically places a large command and operations responsibility on these general staff members.

The purposes of the reorganization are several and may be summed up in a general way as follows: a) To make an organization more responsive to the needs of the modern Army; b) To com-

(Continued on page 16)

MORE PACKAGING

shipment of about 50,000 waveguide instruments with not one damaged.

Floater packs are used on electronic instruments. A pair of floaters is used on the top and bottom or ends of the instrument rather than accordion-folded corrugated on all six sides. Each of the corrugated floaters has a layer of polyurethane sandwiched between two die-cut built-up collars. The instrument is held central in the carton by these floater pads.

On an instrument weighing 40 to 70 pounds the material cost was increased slightly from $2.72 to $3.17. However, the dunnage weight was cut in half—from 21½ to 10¾ pounds, labor decreased from 7.65 to 2.33 minutes and the cube from 6.9 to 5.0 cubic feet. The number of different stock items to be procured and stored decreased from 9 to 3. Since H-P started to use floater pack three years ago, damages reported have decreased from 1 in 200 in 1960 to 1 in 3,200 in 1961 and 1 in 4,200 for the last six months. Thus greatly increased protection was gained while lowering unit package costs.

Expanded polystyrene foam is used to gain even further savings by using it to replace the floaters or corrugated spring-pad packs. The biggest saving over corrugated is in weight. An additional advantage is achieved by using a ribbed design for the molded foam parts. The amount of shock transmitted to one particular instrument through the package when it is dropped was reduced from about 23 to 17 g.

Triple-wall corrugated used on shipments requiring military II B method of pack has greatly reduced costs as compared to the wooden box method. On a 120-pound instrument the cost was reduced as much as one-third and the gross shipping weight from 250 to 195 lb. Slides were used to show the comparison between the various packages. In conclusion, Wood stated that millions of dollars can be saved annually in the Bay Area alone through good basic engineering in packaging and handling.

The final presentation was made by Bracamonte assisted by two of his packaging specialists, Frank Hamilton and Pat McVey. As independent packaging experts, the Bracamonte Company not only provides manufacturers with the latest in materials and equipment but also performs the packaging function of completed equipment to specification. McVey had recently attended the National Packaging Exposition in New York City. Here many new materials and packaging equipment were on display. He noted that in a number of cases the materials and techniques being shown as new have been in use for some time on the Pacific Coast.

A lively question-and-answer period followed the effective formal presentation by the panel. These questions and the large attendance at the meeting clearly indicated the interest in this important subject.

—HARMON R. TRAVER

MORE PROGRAM

plications. It is the complexity of calculations plus the requirement to carry them out for many pairs of transmitters and receivers that makes the computer program necessary. The ability to carry through this analysis, in turn, is what makes the program such a powerful tool.

THE IMPACT OF SPECTRUM-SIGNATURE PROGRAMS ON EQUIPMENT AND TEST INSTRUMENT DESIGN

A. H. Sullivan, Jr., H. D. Zink, and J. J. Dozier, Frederick Research Corporation, Wheaton, Maryland

During the post 40 years, and particularly in the 15 years since the end of World War II, rfi has become a problem of increasing concern to agencies and personnel who control and use the radio frequency spectrum. The general usefulness of the radio frequencies from 10 kc to 10 gc has led to the rapid development of communication-electronic equipment, systems, and components. These vary from high power long range ionospheric "scatter" communication systems and frequency diversity radars to radio frequency welding machines, garage door openers and cooking equipment.

Unfortunately, the radio spectrum is a natural resource of fixed dimensions. Various government agencies have embarked on long-range programs for more effective spectrum utilization.

This paper will concern itself largely with the measurement of system and environmental parameters and the prediction of interference.

ESTABLISHMENT OF AN ELECTROMAGNETIC-INTERFERENCE CONTROL PROGRAM

C. M. Norton and J. C. Toler, NASA, Marshall Space Flight Center, Huntsville, Alabama

The electromagnetic interference control program initiated by the NASA, Marshall Space Flight Center, Huntsville, Alabama, will be discussed in this paper. The purpose of this program is to establish a comprehensive interference control philosophy and organization applicable to space vehicle checkout and test complexes. Entrusted with the final acceptance or rejection of certain NASA Space Vehicles prior to launch, the pressures of time and economics preclude a hit-or-miss approach to interference control. Therefore, a very definite approach was developed, and is now being implemented, to attain a comprehensive system interference control program.

THE ARMY'S ELECTROMAGNETIC ENVIRONMENTAL TEST FACILITY

George D. Brosius, U.S. Army Electronic Proving Ground, Fort Huachuca, Arizona

The field facility of an electromagnetic environmental test facility is being constructed by the U.S. Army, under the direction of its electronic proving ground, in the desert of Southern Arizona. This facility will generate the electromagnetic environment of an Army Corps, and will provide automatic control and testing facilities to examine the interference problem thus created.

Although many methods of realistic environment generation were considered, the method selected is based on the use of actual Army electronic equipment, slightly modified to provide automatic control. The location and number of the environment generators is determined by the application of certain reduction factors to a realistic tactical scenario. This paper presents the philosophy of environment generation, in conjunction with an explanation of the methods used to achieve its implementation.

USE OF THE EMETF FIELD FACILITY FOR VALIDATION OF INTERFERENCE PREDICTION MODEL

A. J. Haehn, Bell Aerosystems Company, Tucson Arizona

One of the more important uses of the EMETF

field facility will be for the formal system validation of the interference prediction model. It is considered necessary to check the computer simulation results against actual field measurements in order to assess suspected areas wherein the modeling techniques may not provide completely accurate simulation. The field facility provides another and even more important function; namely, the capability for long-term validation to determine unsuspected areas of difference between the predictions and actual measurements.

9:00 A.M. to 12:00 Noon

SESSION III-B

EQUIPMENT DESIGN

Chairman: O. P. Schreiber, Technical Wire Products, Inc., 129 Dermody Street, Cranford, New Jersey

Co-ordinator: Bernard Schonker, Lockheed Missiles & Space Co., Sunnyvale, Calif.

VERY-LOW-FREQUENCY SHIELDING EFFECTIVENESS OF HIGH-PERMEABILITY MATERIALS

R. B. Schulz, United Control Corporation, Seattle, Washington

Very-low-frequency shielding theory is examined for a special experimental setup in which a small receiving loop is used on the opposite side of a planar shielding sheet from the transmitting loop. For the small solid angle subtended by the receiving loop, the divergence of the wave passing through the shield may be ignored and the wave propagation regarded as substantially plane, although of low impedance. Hence, plane-wave shielding theory applies to the setup.

The paper describes investigations on the effects of small variations in experimental setup used in an estimate of measured precision at approximately ± 2.5 db. These variations include current through the transmitting coil and loop-to-shield spacings. Experimental results are given for shielding effectiveness over the frequency range from 45 cps (as low as 20 cps in some instances) to 5 kc (as high as 20 kc in some instances).

MATERIALS FOR R-F SHIELDED CHAMBERS AND ENCLOSURES

William R. Cuming, Emerson & Cuming, Inc., Canton, Massachusetts

A variety of materials have been developed for use in conjunction with shielded chambers or enclosures. These include: Metal-foil wallpaper; metal-foil tape; conductive caulking compounds; conductive pipe-thread compound for conduit; conductive surface coatings; conductive adhesives; conductive lubricants; bulk resistive concrete and concrete blocks; bulk resistive plastic sheet material; and accessories such as honeycomb vent, strain insulator, and r-f weatherstripping.

Each item will be described in detail with respect to constituents and method of application. Data will be presented to indicate insertion loss versus frequency when materials, structures, or components are tested in accordance with Mil Std 285.

FLAT-CONDUCTOR FLEXIBLE CABLE, AN AID TO RFI CONTROL AND REDUCTION

Joseph E. Wettstein, Polaris value and production engineering, Lockheed Missiles and Space Company, Sunnyvale, California

Experience in weapon-system development indicates that almost every new design of a missile has more electrical and electronic equipment than the previous model, with a resulting increase in size and weight of intercabling. Miniaturization of electronic components and assemblies has progressed remarkably, but there has been no parallel miniaturization of wiring. Directly related to the weight and radio-interference problems in missile wiring has been a tendency to cling to the use of individual or round wires to make up a cable. Flat-conductor flexible cable offers a

(Continued on page 16)

capsule advertisement

MODULAR RFI ENCLOSURES

New cabinets effectively contain electrical signals generated by various combinations of equipment. Tests conducted by NASA(MSFC) show a 65 db or better attenuation over the scale 15 mc to 1000 mc.

Enclosures can be vented for cooling without affecting attenuation; instrument mounting of standard EIA sizes does not affect the rfi seal; cabinets can be mounted in series as individually sealed units, or inter-connected to form one large sealed unit; and gasketing is readily replaceable in the field.

Companion line of non-rfi cabinets, identical in appearance, dimensions, and characteristics permits combined installation with shielded cabinets.

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FILTERS

MODEL NUMBER D-30

Voltage	250 AC/500 DC
Current Rate	30 amperes — 400—
Attenuation	100db from 90kc to 45,000mc
Size	22" x 4" x 4"
Weight	14.5 lbs.

MODEL NUMBER D-60

Voltage	250 AC/500 DC
Current Rate	50 amperes — 400—
Attenuation	100db from 90kc to 45,000mc
Size	22" x 4" x 4"
Weight	18 lbs.

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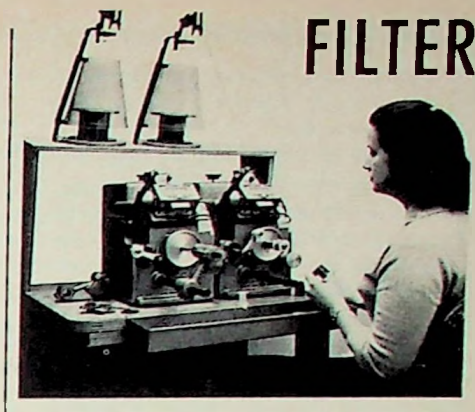

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MORE COMPUTERS

recorded. It is augmented by a special report on the Computers for Peace session, prepared by Robert Hardgrove.

Copies of the tapes, or disk pressings if demand indicates, are to be made available by Interdisc and its parent company, Communications Contact. Companies or individuals interested can communicate with Interdisc at P.O. Box 3665, Stanford, California.

As commentator Winkless described their procedure, ["We wandered around with a tape recorder looking for comments on what people thought this conference might produce. We caught Philip Zenner of General Precision. 'Suppose you were able to address the assembled great men of this conference, do you have a question burning within you that you'd like to have answered by them? Something that's bothering you or important to you, what would you ask?' "]

"It would be a very simple question which doesn't mean that the answer would be very simple. I would ask, 'where is the computer industry headed?' In order to get an idea of the kind of forces that are going to work on us in the computer field and on the entire economy, it becomes necessary to get an idea of where computers will go. What will be the probable form of evolution in the combination of data processing and machine control? What kind of problems will be posed and what kind of problems will have to be solved, in bringing together the skills that now constitute data processing and the quite different skills that now constitute factory automation, machine tool control, and so forth. And finally, as computers get cheaper and their applications get more difficult, the ratio between the cost of the computer and the cost of making it do the work that it could do—the applications work, the engineering—this ratio continues to shift unfavorably for the computer industry. 'How are we going, somehow, to enable our users to get out the very best that the computer could offer them, and still sell the thing at a reasonable price?' "

["Another comment. This is Ted Brough of NRDL in San Francisco."] "If you're not embroiled in the everyday difficulties, **not** knowing that a certain thing cannot be done, as an outsider you may propose something with enough force to make the computer people say, 'Well, gee whiz, we know it can't be done but let's look at it anyhow.' But if you are in the field, you may not even have thought of this angle. This is why the crossover idea is worthwhile."

["What would you like for the guys who are gathered here to hand you as a result of this great conference at great expense?"]

"A cheaper faster computer, I guess."

["I chatted with Bud Barnard of Philco, who was the general chairman of this conference, and Dr. Dick Tanaka of Lockheed, who was chairman of the technical program. Tanaka speaks first."]

"You have to recognize the very definite importance of these hallway discussions where, at one meeting, you can get

(Continued on page 20)

MORE PROGRAM

SPURIOUS AND HARMONIC EMISSIONS FROM TRANSMITTERS: DESIGN AND MEASUREMENT CONSIDERATIONS

Albert R. Kall, Ark Electronics Corp., Willow Grove, Pa.; and Alfred Eckersley, United Control Corp., Seattle, Washington

The origins of spurious and harmonic emissions from a communications transmitter are discussed, together with methods to reduce their magnitude by proper design. The need is demonstrated for proper inter-stage design with adequate low-pass filtering in the antenna output line.

The results of a program study for the Naval Air Development Center, Johnsville, Pa., are presented. First, the philosophy of measurements of spurious and harmonic frequencies in the transmission line connecting the transmitter output to its design antenna (as opposed to measurements in the field) of levels radiated from the antenna, is presented, with arguments in favor of each alternative method shown dependent upon what is fundamentally required. The chief argument in favor of measurement in the line is that it permits comparison of one transmitter with another. Also, measurements are reproducible. Finally, a summary of findings and conclusions on the program is presented, together with some recommendations.

2:00 to 5:00 P.M.

SESSION IV-B

SUSCEPTIBILITY AND NEAR-FIELD EFFECTS

Chairman: Dr. R. M. Showers, The Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, Pa.

Co-ordinator: J. P. Booker, Cooke Engineering Co., 1305 S. Railroad Avenue, San Mateo, California

A NEW LOOK AT FRESNEL-REGION PHENOMENA

Benjamin Lindeman, Naval Experimental Engineering Station, Annapolis, Maryland

The DOD Collection Plan (MIL Standard 449A) for the acquisition of spectrum signature data calls for measurements in the far field of the antenna being measured. Determination of the far field is not always an easy matter. The commonly accepted dividing line between the far field and the fresnel region is the distance determined by $2d^2/\lambda$ where d is the largest linear dimension of the antenna under test (assuming the measurement antenna is the smaller of the two, as is usually the case), and λ has the usual connotation. A brief intuitive explanation of the significance of this value is given in terms of equiphase surfaces by use of a discrete two-element antenna system. The basic principles are readily extended to multi-element arrays and continuous systems.

The basic thesis of this discussion is that extreme care must be used in the application of the formula. In a free-space environment the d in the formula is simply the spacing between the two elements in the simplified example. In a non-free space environment the formula can still be used provided the proper value of d is used.

POWER FLOW MEASUREMENTS IN THE NEAR FIELD

R. A. Bartfeld, The Moore School of Electrical Engineering, University of Pennsylvania

Present standards for measurements of spurious radiation emanating from electronic equipment, electric machinery and the like, provide for a measurement of either the E or H field a given distance from the radiating source. Military specifications require a distance of three feet between the receiving antenna and the radiating source. This distance corresponds to the near field at about and below 100 mc. The near field of a radiating source is typified by a wave impedance much higher or much lower than that of free

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student papers

JOINT CONTEST

Late in April, the Stanford University joint AIEE/IRE Student Branch served as hosts for the annual student papers conference. Entrants were the first-place winners from each of the eight schools having student branches—in both the graduate and undergraduate divisions.

An outstanding group of papers was ably presented by their authors—whose extensive efforts were in many cases in addition to their regular courses of study.

Awards for first, second, and third prizes in each division will be presented later by the faculty representatives at the schools of the winners, and prizes of $100, $50, and $25, plus a voucher for the first year's membership dues for each of the winners, were provided by the AIEE and IRE Sections.

Winners in the undergraduate section were William N. Compagno, Jr., USC; Lt. Clement D. Hamm, Jr., USNPGS; and William F. Ragsdale, University of California.

William N. Compagno, Jr. undergraduate first prize winner

Graduate winners were Lt. Comdr. Robert L. Ashford, USNPGS; Keith Johnson, Stanford; and Melvin A. Breuer, University of California.

Judges were Leonard F. Fuller; Jules S. Needle, Sylvania; F. Schnurer, GE; Donald Harris, SRI; Vigo Smith, Shell Development; and Bill Grear.

space, depending on whether the source belongs to the electric or magnetic type. Consequently, one field component, either E or H, will be dominant in the near field. Since the radiating source is in general unknown and, furthermore, can exhibit different properties at different frequencies, an interference measurement based on the measurement of either the E or H component is not indicative of the electromagnetic power actually radiated by that source.

A measurement which, if proven feasible, avoids the above cited disadvantages is a Poynting vector measurement. The feasibility of direct Poynting vector measurements depends to a large extent on the complexity of the required instrumentation. A basic outline of such instrumentation is given. Basic problems posed by the theoretical requirements of such an instrument are examined. As a result of these considerations it appears, at least in principle, that a Poynting-vector measuring instrument is feasible.

NEAR-ZONE IMPEDANCE DESIGN CRITERIA AND MEASUREMENT METHODS

M. N. E. Bachman, White Electromagnetics, Inc., Bethesda, Maryland

The area emphasized in this paper deals primarily with empirical design criteria for magnetic and electric field coupling and related intra-system functions. The area of coupling has received considerable attention in the available literature and symposia proceedings. Some of the basic considerations associated with these problem areas include: a) Electromagnetic coupling as a function of length and separation distance of ordinary conductors, b) Determination of impedance characteristics of transmission and former lines, c) Effects of physical environment on long-line conductors, and d) Effects of bundle position of conductors carrying different types and levels of signals. Superimposed on these considerations are the basic physical parameters of frequency, time.

A basic system network concept is presented in this paper, which outlines the guides for approaching present and future emi problems. This concept has been applied to a number of discrete problem areas which will be discussed in detail.

A REALISTIC APPROACH TO RECEIVER SUSCEPTIBILITY TESTING FOR ANTENNA-TO-ANTENNA INTERFERENCE PREDICTIONS

Lawrence R. Pangburn, Light Military Electronics Department, General Electric Company, Utica, New York

There are no magic formulas for the realistic evaluation of antenna-to-antenna interference. Instead, the solution lies in expending energy in a logical and practical manner. This paper deals with an approach to receiver testing that will permit the realistic evaluation of antenna-to-antenna interference.

The total system approach outlined here is based on a study of the characteristics of the transmitter, the receiver, and the antenna system to predict potential problems.

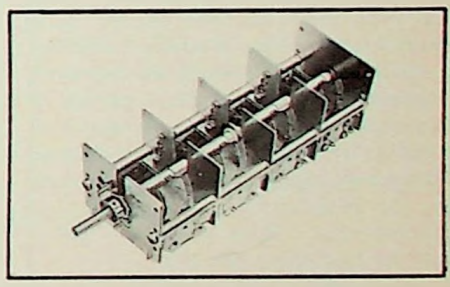
Besides outlining a realistic approach to receiver testing, this paper describes a prediction technique for use with the data obtained from the testing. To simplify the discussion, it is assumed that the antenna-system characteristics—a paper in itself—are known.

SUSCEPTIBILITY OF RADAR SEARCH ANTENNAS TO RFI

Richard C. Johnson, Engineering Experiment Station, Georgia Institute of Technology

The susceptibility of radar search antennas to radio frequency interference is chiefly determined by the minor lobe structure. The use of detailed three-dimensional patterns to predict rfi is not practical because the fine structure of the antenna pattern changes with frequency, modifications of

(Continued on page 20)



from all parts of the country (in fact from all parts of the world) most of the people working in a given problem area. Every paper in the program was selected for its excellence. The program committee does not feel that any paper is better than any other, or that it has any more paricular interest. There were some papers that appeal to most people. I think the distinction between particular interest and general interest should be made."

[Then Barnard.] "In saying that most people would be interested in it, we don't mean this was the decision of just our own committee. If you look in the Proceedings you'll see that there were well over a hundred reviewers who looked over the papers and augmented the decision information necessary for us to come up with ones which were an aggregate opinion of what would be of the most interest to everybody concerned and of the highest quality that we could get."

["Next, Max Polevski of Scientific Data Systems."]

"Whereas ten years ago at a show like this, people would ask, 'What's the mean time to failure of your machine?', 'How many components does it have?', people now assume that whoever builds computers builds them so they work, and there really isn't any problem with the reliability of the machine but rather the problem now is really the economic problem. Probably as many people at any given company are concerned with software for machines as are concerned with hardware: that is, who are working on programming. It's really that problem that I think you get a better feel for at a show like this."

["We had some comments on machine languages from Dr. Adriaan Van Wijngaarden, who was featured luncheon speaker on the second day of the conference."]

"The first idea of talking to a computer in a language which was not the most appropriate one from the computer's point of view, that is to say the computer language itself, originated in Switzerland in 1952 I think. Since then a great step forward has been taken in the U. S. by the development of a language like Fortran, which is a more human way of speaking to a computer in the scientific field.

"To start with 1958, a real international cooperation between different European and U. S. groups has come to establishing a language called Algol, which means algorithmic language. This ended in 1960 by a beautiful report of the language Algol 60. Now this language, Algol 60, is a much more high-brow language than a language like Fortran. It's harder to implement on the machine, hard to learn for a machine, so to say, to understand it, but it's much more powerful, much easier to use for human beings, more or less like mathematics. It's oriented not towards the machine but towards the problems, say to engineering and scientific problems. Similar languages have been developed for other fields."

SJCC luncheon speaker Adriaan van Wijngaarden

["Dr. Robert M. Howe of the University of Michigan who delivered a paper at the conference, incidentally, and Jerry Kennedy of Applied Dynamics had some interesting comments on computer application."]

"Re-entry of a hypersonic lifting wing-type vehicle such as the Dyna-Soar is a particularly interesting subject these days. We have set up an analog simulation of this problem very much speeded up in time. As a matter of fact, we're running the problem about 70,000 times faster than real time so that we're taking about a 10,000-mile re-entry trajectory and compressing it into 1/20th of a second and we're running 20 re-entry trajectories per second. This allows us to take the actual trajectory and display it on the face of a cathode-ray oscilloscope and in this fashion one can see continuously displayed the shape of the trajectory—the altitude as a function of down-range distance. Then at the same time we can vary other problem parameters such as the bank angle of the vehicle. (This is the way in which one side-maneuvers a vehicle of this sort.) And as we change the bank angle continuously from say minus 45 degrees to plus 45 degrees during the solutions, one can, in effect, get a number of trajectories which bracket the entire maneuver landing capability or footprint

(Continued on page 22)

the local environment of the antenna, and range effects such as trees, buildings, waves, etc., along the propagating path. In addition, some of the most troublesome interference problems are caused by fresnel-zone radiation from closely spaced equipment. The use of detailed pattern data for this case is not practical because the fine structure of the fresnel-zone pattern depends on the distance between the observation point and the antenna. The problem is further complicated when one considers antenna susceptibility to cross-polarized signals and out-of-band frequencies. Use of a statistical description of the radiation characteristics of an antenna is a more practical approach to the rfi problem.

AMBIGUITIES IN CONDUCTED SUSCEPTIBILITY INTERFERENCE MEASUREMENT

Hollice A. Favors, Hughes Aircraft Company, Culver City, California

Radio-frequency conducted-interference requirements vary slightly from specification to specification mainly with regard to the range of frequencies over which tests are performed.

However, if any degree of accuracy is to be attained in determinng the level of signal required to cause malfunction or degradation of performance, important factors must be considered which have not been taken into consideration in present specifications. Those factors are bandwidth of the test sample and overall system bandwidth if the component is a part of a system. **(Following papers will appear in the Symposium Digest but will not be presented)**

MODE-SCATTERING TECHNIQUE FOR INTERFERENCE MEASUREMENTS

Vernon G. Price and William A. Edson, Electromagnetic Technology Corporation, Palo Alto, California

This paper describes a new and simple method for determining the special output of microwave tubes and of the attenuation characteristics of filters used to suppress unwanted spectra. Design of interference-free electromagnetic systems requires the ability to measure the quality of individual system components which either generate or attenuate interfering signals. Such measurements tend to be complicated in high-frequency systems where energy can propagate in higher-order modes of the transmission lines. In the device reported herein, the higher-order mode problem is circumvented by the use of an element that scatters incident energy uniformly amongst the various modes that can propagate at the measurement frequency.

In this paper, experimental values are given to illustrate the performance of the technique. Sensitivity and accuracy are discussed as well as advantages and limitations compared to other methods.

FIELD-STRENGTH MEASUREMENTS IN A MULTIPATH FIELD

Clark C. Watterson, National Bureau of Standards, Boulder, Colorado

One of the difficulties that are commonly encountered in making field-strength measurements in the vhf-uhf region of the spectrum is caused by the prevalence of multipath propagation. The radiation from any transmitter usually will arrive at a measuring location over a number of separate paths because of reflections from the ground, buildings, and other objects. Field-strength measurements made under such conditions vary greatly with relatively small changes in the position of measurement and result in measurements that have limited value.

This paper describes an investigation that is being made of an aperture-synthesis technique of measurement for obtaining the amplitude, time phase, polarization, and direction of arrival of each of the multipath components of a coherent

multipath field. Such a technique may be useful in making field-strength measurements at a proposed receiving site so that the measured results can be used in combination with a knowledge of the proposed receiving-antenna pattern to predict the interference that will be caused by the measured field.

AN ANALYSIS OF RADIO-FREQUENCY INTERFERENCE DUE TO MIXER INTERMODULATION PRODUCTS

James W. Steiner, executive engineer, ITT Federal Laboratories, Nutley, New Jersey

In modern communication systems many high-power transmitters and sensitive receivers are frequently colocated at a common site. The problem of radio-frequency interference due to the generation of spurious frequency components in the receiver-mixer becomes more and more acute as the number of colocated transmitters is increased. The problem is especially critical for fixed service installations in which the propagation paths traverse international boundaries and in which frequency assignments must be coordinated with several host governments and usually one or more extra-national coordinating groups. Under these circumstances it is especially important to frequency engineer the communications system to avoid interference due to intermodulation products since the reassignment of frequencies following the system activation would result in lengthy and costly delays.

AN ANALYSIS OF SPURIOUS RESPONSE LEVELS

Herbert W. Pollack and Morris Engelson, Polarad Electronics Corporation, Long Island City, N. Y.

This paper presents a quantitative method of determining the levels of the various spurious responses resulting from the mixing process in a superheterodyne receiver. The equations and resulting curves describing the levels of the spurious signal for various combinations of local oscillator and signal harmonics up to the fourth harmonic of each are derived from the basic considerations of the non-linear transfer function of a mixer.

AUTOMATIC H-F TRANSMITTING MULTI-COUPLER—A BREAKTHROUGH

M. T. Ludvigson and L. R. Duncan, Collins Radio Company

This circuit was chosen only after considerable computer investigation at the Collins Radio Company, first to get the desired operating characteristics and then to adopt the circuit chosen to automatic tuning. The equipment consists of two inductively coupled high-Q resonant circuits that will provide the necessary impedance isolation, 45 to 50 db of forward and back attenuation at ± 15 per cent frequency spacing and efficiency of better than 60 per cent. This scheme makes it possible for simultaneous correction of several circuits on the common antenna for a change of that antenna's impedance characteristics as a result of either environmental factors or antenna loading caused by switching other circuits.

ELECTROMAGNETIC-SUSCEPTIBILITY-TESTING TECHNIQUES FOR AIRBORNE EQUIPMENT

Carl B. Pearlston, Nortronics, Division of Northrop Corp., Hawthorne, Calif.

The broad objective of susceptibility testing is to ensure that electronic equipment will operate properly when installed in the operational environment. Thus, to attain this objective the equipment should be exposed to the highest levels and the broadcast spectrum of interference that might possibly exist in the intended operational environment. This paper will examine the susceptibility requirement of the various specifications, discuss their limitations, and suggest techniques for more adequately ensuring compatibility between the equipment of a system and its environment.

— END —

IT IS REPORTED:

Microwave Electronics Corp has announced that it will construct a combined general office, research, and manufacturing facility on a six-acre tract in Stanford Industrial Park. A first increment containing 46,000 sq ft will be built this summer for occupancy in the early fall, representing an investment of more than $800,000.

Architects and engineers are Simpson, Stratta and Associates; the project will be owned and managed by the Utah Construction and Mining Co., both of San Francisco.

Richard M. Whitehorn has been appointed chief engineer of the r-f systems division of **Radiation at Stanford**. Whitehorn was formerly manager of radiation research at Varian Associates.

Whitehorn

Arnold

The appointment of **Joseph B. Arnold** to the newly created position of manager of the Minuteman program office at the reconnaissance systems laboratories of **Sylvania Electric Products Inc.** has been announced. Arnold joined Sylvania's microwave tube laboratory in Mountain View in 1957, and moved to RSL in 1959.

Recently incorporated, **Climet Instruments** has announced the opening of their 4000-sq-ft plant in Mountain View to engage in manufacture of meteorological instruments. **Harold Thompson,** recently with Beckman & Whitley, is president and marketing manager of Climet; **Edward Kingman,** vice president and chief engineer; **Louis Petralli,** chief mechanical engineer; and **Theodore Deuel,** corporate secretary and chief electronic designer.

Tempress Research Company, Inc., has announced occupancy of its new plant at 566 San Xavier Avenue, Sunnyvale, California.

The new 6,000-sq-ft facility provides an area substantially greater than that of the former Sunnyvale plant.

C. Gus Grant has been named to the newly created position of vice president of marketing for **Ampex Corporation**. Grant formerly was manager of marketing for the ballast department, General Electric Company, Danville, Illinois, and had been with General Electric 16 years.

Gilbert E. Delore, formerly with Sperry Gyroscope Co., has been assigned to the **Granger Associates** special-systems section as project engineer; **David S. Pratt,** formerly at Stanford University's electronics laboratory, has been appointed project engineer; and **Charles F. Query,** industrial engineer formerly with Lenkurt Electric Co., has joined the manufacturing planning section.

Fairbanks

Grant

Western Electronic Associates has been appointed representative for **Custom Materials, Inc.,** and **Dolphin Incorporated.**

Arthur D. Little, Inc., has announced completion of its new and enlarged San Francisco laboratories and offices at 500 Sansome Street. The firm was formerly located at 314 Battery Street.

The board of directors of **Quantic Industries, Inc.,** has named **Morgan A. Gunst, Jr.,** president. Gunst has been vice president of the company since its formation in 1959.

Charles R. Newman has been named a vice president of the company and continues his post as general manager of the Pelmec division.

William R. Sears has been appointed manager of marketing services for the western development laboratories of **Philco Corporation.** For the past two years he has served as manager of the western region for corporate public relations.

Recently elected officers of the Peninsula Chapter of the **California Society of Professional Engineers** include: **Gordon A. Tillson,** president; **Keith W. Henderson,** Lockheed; first vice president; **C. R. Dalton,** Dalton Associates, second vice president; **Charles H. Dawson,** Philco, secretary; **Lloyd R. Quayle,** California division of highways, treasurer; and directors **Waldemar I. Bendz,** Lockheed; **John D. McLaughlin,** Lockheed; **Raymond E. Sickler,** Philco; and **Marshall A. Patch,** S and Q Construction Co.

Allied Electronics Corp. has established a new district office in Palo Alto. **Alan Abel** has been appointed head of the San Francisco area district and manager of this office.

T.S.L. Engineering **Company,** Fremont, has been named to represent **International Ultrasonics, Inc.,** Cranford, New Jersey.

Microdot has announced the appointment of **O'Halloran Associates** as representatives for the instrumentation division.

Grant Fairbanks has been made technical director and manager of the speech communication section of the communication laboratory of ITT Federal Laboratories at Palo Alto.

Birnbaum Sales Co., Inc., has announced it will represent **Peerless Electrical Products,** a division of Altec Lansing Corporation.

F. Joseph Van Poppelen, vice president for sales of Motorola semiconductor since 1958, has been named marketing manager of recently formed **Signetics Corporation.**

Van Poppelen

Gunst

security note

ARE YOU IN?

Be reminded of the Air Force offer for maintenance of six-month security files for attendance at classified meetings. The Section office still has a copious supply of blanks for this purpose.

WINNERS' CIRCLE

Eleven of the leading entries in today's "Electronic Sweepstakes" wear the Neely colors. The Neely Enterprises track is a big one covering the entire states of California, Arizona, Nevada and New Mexico. When you have a problem that involves thoroughbred knowledge of electronic equipment, be sure to call your Neely Field Engineer. He's highly trained and from starting gate right down to the wire you can bet he'll bring you into the Winners' Circle every time.

NEELY *enterprises*

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TUCSON 232 South Tucson Boulevard • Phone: MAin 3-2564 • TWX: TS 5981

11-85

events of interest

IN THE AREA

June 20-22—**Printed Circuit Symposium,** California Circuits Association and Stanford University. Dinkelspiel Auditorium, Stanford. Exhibits: Bill McGuire, Systron-Donner Corp., Concord, Calif. Tickets: $5 per session, $10 all three sessions, order from California Circuits Assoc., P.O. Box 1412, Palo Alto, Calif.

The symposium, to emphasize new developments in printed circuitry, will feature papers on such subjects as quality control of laminate products, multilayer circuits, cryogenics, program drilling, military specifications, welded modules, miniaturization, and company standardization and training. Keynote speakers for the event are W. Grant Ireson, Stanford Unversity, and Clyde Coombs, CCA president.

June 26-28—**University of California,** special program on the use of critical path methods. U.C., Berkeley. Speakers: James A. Baker, Lawrence Radiation Laboratory; William S. Jewell, U.C. operations research center; and Ernest Koenigsberg, CEIR Inc. Information: University Extension, University of California, Berkeley 4, Calif.

June 28-29—**Fourth National Symposium on Radio Frequency Interference.** Del Webb Town House, San Francisco. No exhibits. Program: R. G. Davis, Dept. 58-25, Lockheed Missiles & Space Co., P.O. Box 504, Sunnyvale, Calif. Digest: order from IRE Headquarters after conference.

NON-LOCAL

June 17-22—**AIEE** Summer General Meeting and Aero-Space Transportation Conference. Denver Hilton Hotel, Denver, Colorado. Information: AIEE Headquarters, 345 East 47th St., New York 17, N. Y.

June 18-19—**Chicago Spring Conference on Broadcast and TV Receivers.** O'Hare Inn, Chicago. Exhibits: John H. Landeck, Admiral Corp., 3800 W. Cortland, Chicago, Ill. Program: Al Cotsworth, Zenith Radio Corp., 6001 W. Dickens Ave., Chicago 39. Proceedings: BTR Transactions, July 1962 issue.

June 25-27—**6th National Convention on Military Electronics.** Shoreham Hotel, Washington, D. C. Exhibits: L. D. Whitelock, 5614 Greentree Rd., Bethesda 14, Md. Program: John J. Slattery, Martin Co., Baltimore 3, Md. Proceedings: $5, order from IRE Headquarters.

June 25-30—**Symposium on Electromagnetic Theory and Antennas.** Technical University of Denmark, Copenhagen. No exhibits. Program: H. Lottrup Knudsen, Oster Volgade 10 G, Copenhagen, K, Denmark. Proceedings: Contact Pergamon Press, Oxford, England.

PAPERS CALLS

June 1—400- to 500-word abstract in triplicate and 50-word summaries for NEREM (Boston; Nov. 5-7). Send to: I. Goldstein, Raytheon Co., Box 555, Hartwell Road, Bedford, Mass.

June 15—1000-word summary, four copies, for Spaceborne Computer Engineering Conference (Anaheim, Calif., Oct. 30-31). Send to: R. A. Kudlich, chairman, Program Committee, AC Spark Plug Division, General Motors Corp., 950 North Sepulveda Blvd., El Segundo, Calif.

June 15 — 500-word abstract and brief professional record of author, five copies, for Ninth East Coast Conference on Aerospace and Navigational Electronics (Baltimore, Oct. 22-24). Send to: William C. Bergard, chairman, Technical Program Committee, Adv. Res. Dept., Bendix Radio, Towson 4, Maryland.

July 1—100-word abstract for the Symposium on Space Phenomena and Measurements (Detroit, Oct. 15-18). Send to: Michael Ihnat, AVCO Corp., 201 Lowell St., Wilmington, Mass.

July 15 — 100-word abstract for Broadcast Engineers Fall Symposium (Washington, D. C., Sept. 28-29). Send to: Wm. L. Hughes, School of Electrical Engineering, Oklahoma State University, Stillwater, Oklahoma.

August 1 — 200-word abstract for 1962 Electron Devices Meeting (Washington, D. C., Oct. 25-27). Send to: J. Earl Thomas, Jr., IBM Components Laboratory, Building 701, Dept. 677, Poughkeepsie, New York.

fective computer language is needed, along with its integration with the design of new hardware. He believes that many computer people, who have spent most of their adult life working on weapons, would welcome a chance to work with behavioral scientists if the opportunity could be provided (the necessary funds found).

Bateson, whose assignment was to discuss the credibility of computer recommendations, made the following points:

Computer gaming requires assumptions as to the nature and motivations of people; it imposes a model of behavior. If, then, people act upon the recommendations resulting from the gaming, the results tend to be self-validating. We would tend to become that which was assumed. However, real people are enormously complex and learn by experience. Thus the point is not so much to discover how to play the real international war-and-peace game better under existing or assumed rules ("the present rules are sinister") but rather to find out how to change the rules of the game while playing it. Very little is known about this process, except in individual psychoanalysis.

data source

STANDARDS

An up-to-the-minute blueprint for standardization is now available: the 1962 catalog of American Standards. The 76-page brochure provides a comprehensive reference to approved American Standards in many areas of industry. Copies are free for the asking from the American Standards Association, Dept. P 298, 10 East 40 St., New York 16, N. Y.

election note

VOTE EARLY (& OFTEN)

This is simply to remind you that your opportunities to exercise the franchise are manifold at this particular season of this particular year. In being certain that you get your AIEE/IRE consolidation proxy off in time, don't overlook the Section ballot just mailed. And don't let this cause you to forget your professional group elections. May the best men and issues win!

"A young engineer from Isles Virgin
Was bitterly set against mergin'
For he said, "I refuse
To admit the good news
That our parallel lines are convergin'!"

—H. O. ROPE in
Cleveland Section News

MANUFACTURER/REPRESENTATIVE INDEX

Accurate Instrument Co.	Jay Stone & Assoc.
Ace Engineering & Machine Co.	R. W. Thompson Assoc.
Aircom, Inc.	Components Sales California, Inc.
Airflow Company	Richard A. Strassner Co.
Allen Electronic Corp.	Straube Associates
Alloyd Electronics Corporation	Cain & Company
American Optical Co., Instrument Div.	J. T. Hill Co.
American Standard, Controls Div.	J. T. Hill Co.
Ampex Magnetic Tape Products	James S. Heaton Co.
Analab Instrument Corp.	V. T. Rupp Co.
Antlab, Inc.	Jay Stone & Assoc.
Applied Microwave Electronics	Walter Associates
Applied Research, Inc.	Jay Stone & Associates
Arnoux Corporation	Straube Associates
Associated Engineering Corporation	J. T. Hill Co.
Astra Technical Instrument Corp.	Straube Associates
Auto Data	Edsco
Baldwin-Lima-Hamilton, Electr. Div.	Neely Enterprises
Ballantine Labs, Inc.	Carl A. Stone Assoc., Inc.
Barnes Development Co.	W. K. Geist Co.
Barnes Engineering Company	Costello & Co.
Beckman/Berkeley Division	V. T. Rupp Co.
Behlman/Invar Electronics Corp.	T. Louis Snitzer Co.
Bogart Microwave	Jay Stone & Assoc.
Boonton Electronics Corp.	O'Halloran Associates
Boonton Radio Corp.	Neely Enterprises
Burr-Brown Research Corp.	W. K. Geist Co.
CTS Corp.	J. Logan & Assoc.
Caswell Electronics Corp.	R. W. Thompson Assoc.
Clary Arithmetic Centers	American Wireless
Components Corp.	Straube Associates
Components Engineering & Mfg. Co.	Premmco
Computer Instruments Corp.	Components Sales Calif.
Consolidated Microwave	Western Electronic Assoc.
Continental Connector Co.	J. Logan & Assoc.
Continental Sensing, Inc.	Birnbaum Sales Co. Inc.
Control Equipment Corporation	Belsco
Control Switch Div., Controls Co. of America	Belsco
Coopertronix, Inc.	T. Louis Snitzer Co.
Custom Materials, Inc.	Western Electronic Associates
Dage Div., Thompson Ramo Wooldridge	Neely Enterprises
Dale Electronics	James S. Heaton Co.
Datafilter Corp.	Jay Stone & Assoc.
Datapulse, Inc.	O'Halloran Associates
Delevan Electronics Corp.	Hodges and Glomb, Inc.
Dielectric Products	O'Halloran Associates
Digitronics Corp.	Components Sales California, Inc.
Diodes Inc.	Straube Associates
Dolphin Incorporated	Western Electronic Associates
Drexel Dynamics Corporation	J. T. Hill Co.
DuMont Labs, Tubes & Instruments	J. T. Hill Co.
Duncan Electronics, Inc.	Birnbaum Sales Co. Inc.
Dymec, Division of Hewlett-Packard	Neely Enterprises
Dynamics Instrumentation Co.	J. T. Hill Co.
E-H Research Laboratories, Inc.	V. T. Rupp Co.
Eastern Air Devices	James S. Heaton Co.
Edcliff Instruments (Conelco)	Walter Associates
Edgerton, Germeshausen & Grier, Inc.	J. T. Hill Co.
Eitel-McCullough, Inc.	James S. Heaton Co.
Elco Corporation	James S. Heaton Co.
Eldema Corporation	James S. Heaton Co.
Electra Manufacturing Co.	Birnbaum Sales Co. Inc.
Electro Assemblies, Inc.	Birnbaum Sales Co. Inc.
Electro Prod. Div., Western Gear	Straube Associates
Electromagnetics, Inc.	O'Halloran Associates
Electronic Measurements Co.	O'Halloran Associates
Electronic Production & Development, Inc.	Belsco
Elgin-Advance	James S. Heaton Co.
Emcor, Ingersoll Products Div.	Neely Enterprises
Empire Devices, Inc.	Carl A. Stone Assoc., Inc.
Eppley Laboratory, Inc.	W. K. Geist Co.
Equipto Electronics Corporation	Electronic Sales Associates
Erie-Pacific	O'Halloran Associates
Etchomatic, Inc.	James S. Heaton Co.
Fabri-Tek, Inc.	Costello & Co.
Fluke Mfg. Co., John	McCarthy Associates
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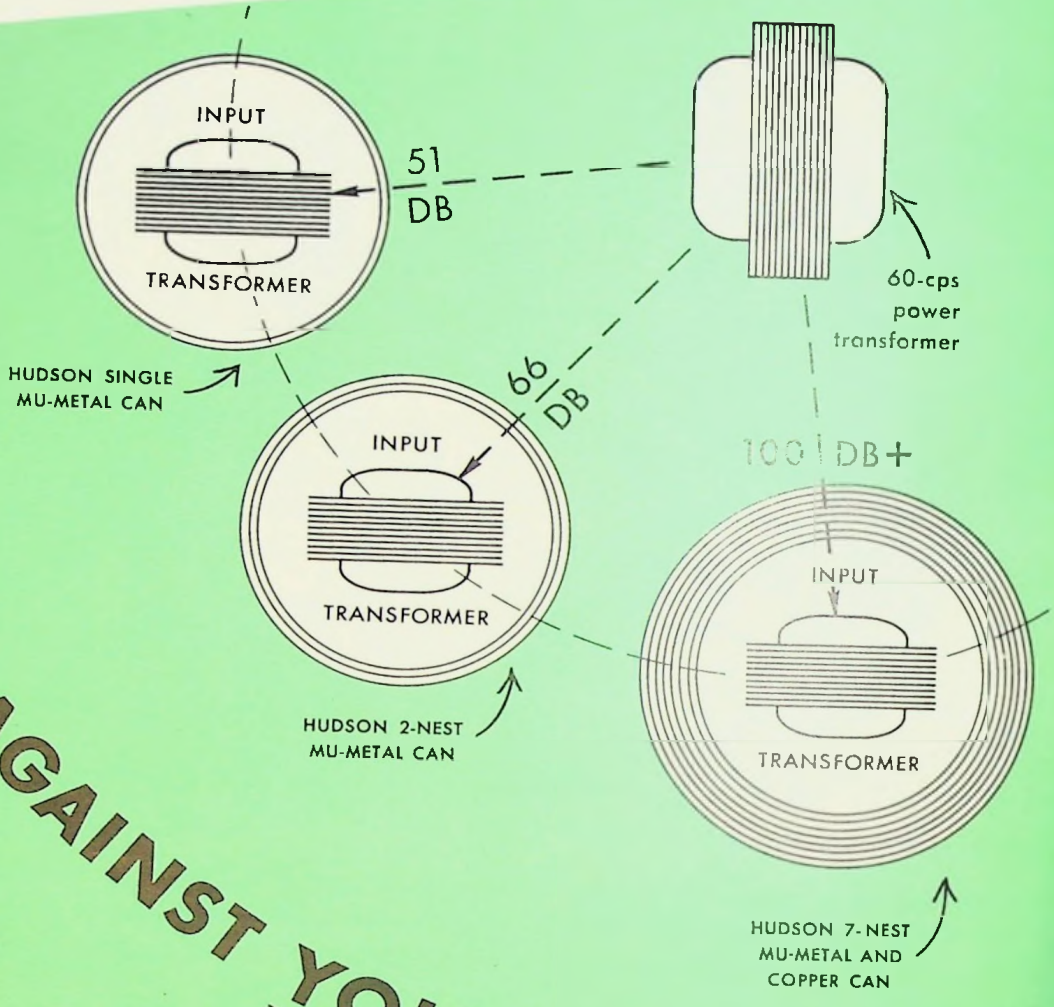

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