EDITOR'S PROFILE of this issue

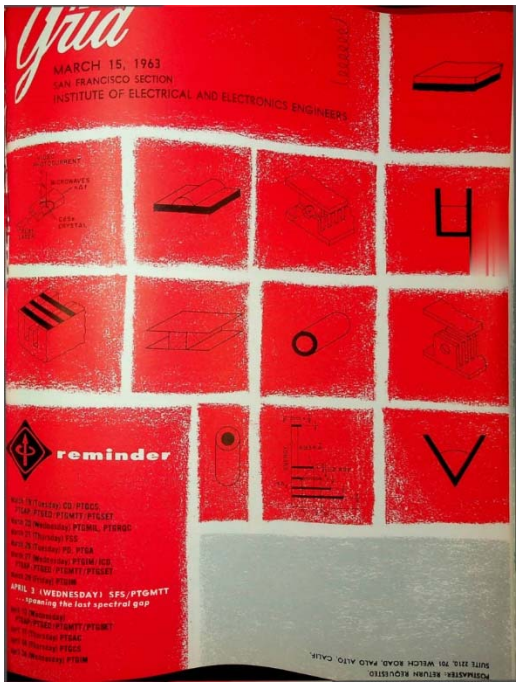
from a historical perspective …

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

March, 1963 (mid-month):

Cover: Diagrams show components of devices to cover the infrared-microwave gap for a lecture that will be given. More details on page 5.

Page 18: Cyril Elwell has died at 79. born in Australia, he graduated from Stanford in 1908. His company, Federal Telegraph, was the Santa Clara Valley's first electronics company, in 1909, as commemorated with a California Historical plaque in Palo Alto. He licensing the Poulsen arc transmitter from Denmark and commercialized it. Lee de Forest worked for him from 1911-1913, where he invented the oscillator and amplifier circuits that used the vacuum tube he had invented. The Federal transmitters were used by steamship companies around the Pacific, and by the US Navy during World War I. Stanford's first EE PhD, Leonard Fuller, became Chief Engineer in the early '20's. Doug Perham also worked at Federal Telegraph, and collected considerable artifacts from that era. See the February 1960 issue of the GRID.



Archive of available SF Bay Area GRID Magazines is at this location:
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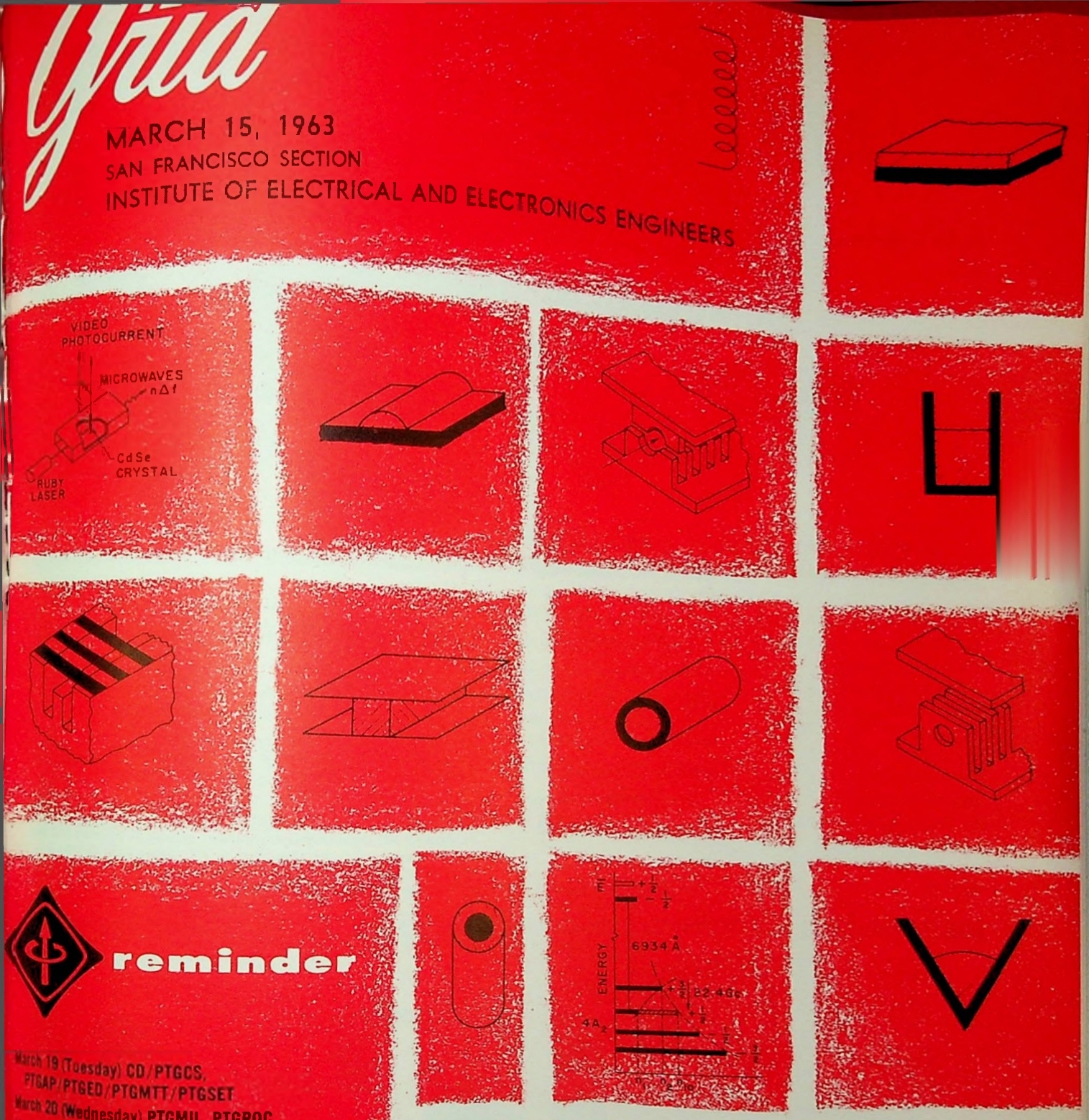
At time of scanning, the bound volumes are held by Paul Wesling. July, 2021 Contact p.wesling@ieee.org

Grid

MARCH 15, 1963

SAN FRANCISCO SECTION

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS



reminder

March 19 (Tuesday) CD/PTGCS, PTGAP/PTGED/PTGMTT/PTGSET

March 20 (Wednesday) PTGMIL, PTGRQC

March 21 (Thursday) FSS

March 26 (Tuesday) PD, PTGA

March 27 (Wednesday) PTGIM/ICD, PTGAP/PTGED/PTGMTT/PTGSET

March 28 (Friday) PTGIM

APRIL 3 (WEDNESDAY) SFS/PTGMTT

. . . spanning the last spectral gap

April 10 (Wednesday) PTGAP/PTGED/PTGMTT/PTGSET

April 11 (Thursday) PTGAC

April 18 (Thursday) PTGCS

April 24 (Wednesday) PTGIM

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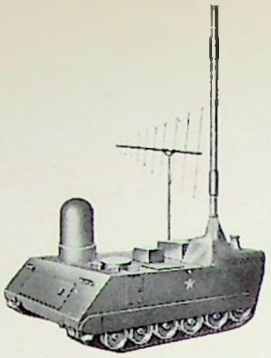
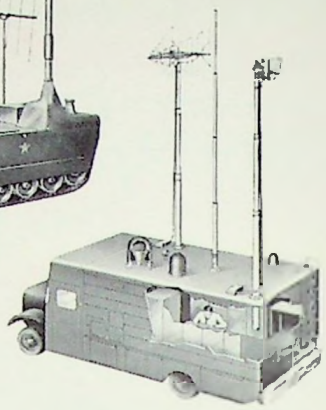
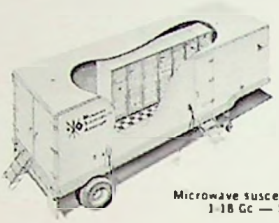


Electronic warfare system— Signal Corps



Spectrum surveillance and radar beacon check out system — Air Force & NASA



Microwave susceptibility analyzer, 1-18 Gc — Signal Corps

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- Automatic Electronic Checkout Equipment

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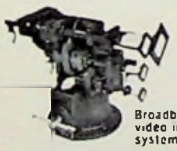
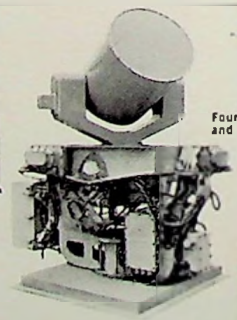
Panoramic data receiver, 1-10 Gc Air Force



Broadband crystal video intercept system — Signal Corps



Four-axis radar antenna and platform — BuShips

Typical microwave antennas

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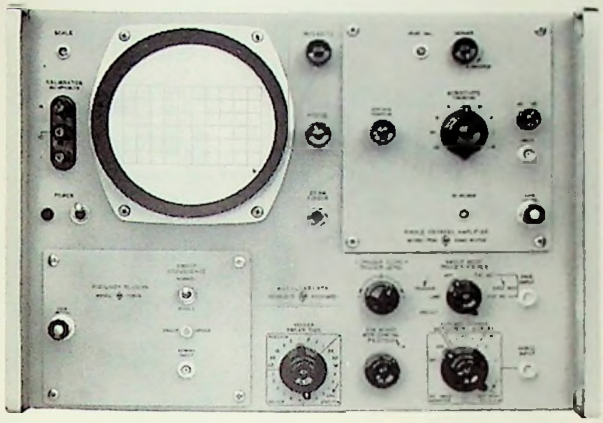

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Triggering Point:	Controls allow selection of level and slope
HORIZONTAL AMPLIFIER	
Bandpass:	DC to 500 kc
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VERTICAL AMPLIFIER	
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GENERAL	
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8241

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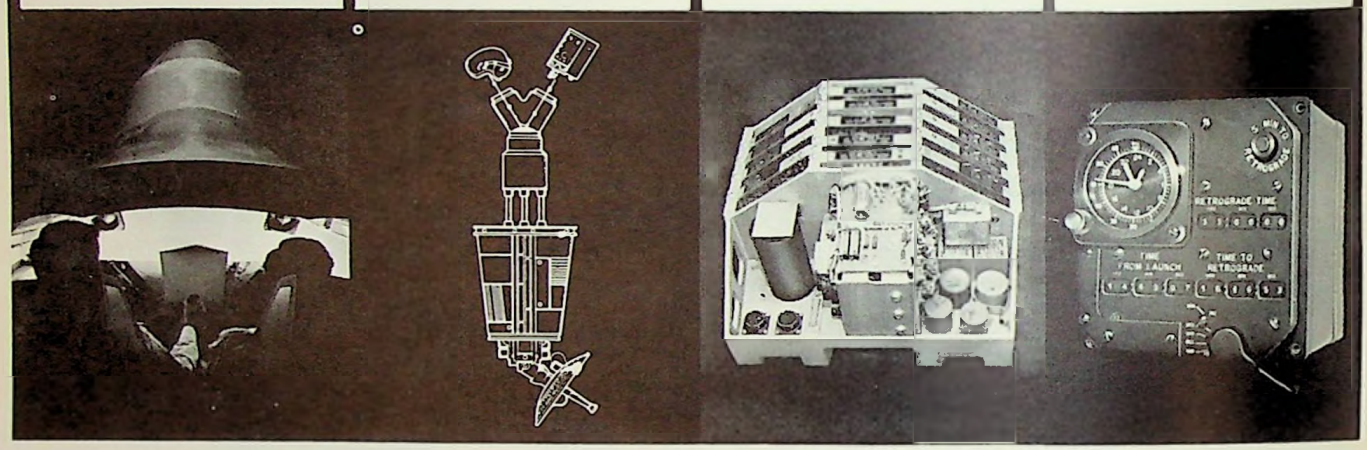

Early recognition of the inter-relationship between electronic innovation and aerospace development has been reflected in the historic achievements of McDonnell products in aeronautics and astronautics. To fill electronic requirements not met by standard equipment, McDonnell created its own electronic capability, now a separate division under the direction of a General Manager. The comprehensive capabilities of the Electronic Equipment Division (EED) are geared to provide advanced electronic equipment for ground, airborne and space applications.

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IEEE Grid

volume 9, number 14

MARCH 15, 1963

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cover

Design gives a sneak preview of the schematics Professor Paul D. Coleman will employ to point the way toward spanning an important spectral gap at the April 3 meeting of the Section and PTGMTT.

Aficionados of spring lasers (members of PTGAP, PTGED, PTGSET) will find this lecture fitting in nicely with that series. Prize award winners and Fellows will also be honored. For more, see page 5.

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(AIEE) Victor E. Kaste, General Electric Co.

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MEETING CALENDAR

SAN FRANCISCO SECTION

8:00 P.M. • Wednesday, April 3

(Joint meeting with PTGMTT)
Honoring 1962 Prize Award Winners and IRE/IEEE Fellows
"Spanning the Infrared-Microwave Gap"
Speaker: Dr. Paul D. Coleman, visiting professor, Hansen Labs, Stanford
Place: Physics Lecture Hall, Room 101, Stanford University
Dinner: 6:00 P.M., Red Shack, 4085 El Camino Way, Palo Alto
Reservations: Mrs. Doris Gould, DA 1-1332

FRESNO SUBSECTION

8:00 P.M. • Thursday, March 21

"Astron Reactor Design"
Speaker: Dean O. Kippenhan, project engineer, electronics engineering dept., Lawrence Radiation Laboratory, Livermore
Place: P.G. & E. Bldg., 1401 Fulton St., Fresno

TECHNICAL DIVISIONS

Communications

8:00 P.M. • Tuesday, March 19

(Joint with PTGCS)
"High-Speed Data Systems"
Speakers: Paul Radue, district engineer, telecommunications section, communications products dept.; Clinton DeGabrielle, data communication products and custom systems, computer dept., General Electric Co.
Place: Crown-Zellerbach Auditorium, 1 Bush St., San Francisco

Instrumentation and Control

8:15 P.M. • Wednesday, March 27

(Joint meeting with PTGIM, see below)

Power

8:00 P.M. • Tuesday, March 26

"High-Rise Apartments"
Speaker: H. E. Campbell, senior engineer, distribution systems engineering, electric utility engineering, operation, General Electric Co.
Place: Engineer's Club, 15th floor, 206 Sansome St., San Francisco

PROFESSIONAL TECHNICAL GROUPS

Antennas & Propagation

8:00 P.M. • Wednesday, March 27

Lecture No. 3: "Laser Techniques and Applications"
Speaker: Professor Anthony Siegman, Stanford University
Place: Physics Lecture Hall, Stanford University
Dinner reservations: Darlene Wheeler, DA 6-6200, Ext. 2695

Antennas & Propagation

8:00 P.M. • Wednesday, April 10

Lecture No. 4: "Laser Developments Overseas—Report on Third International Quantum-Electronic Conference, Paris, 1963"
Speaker: Dr. Malcolm Stitch, Hughes Aircraft Co., Culver City
Place: Physics Lecture Hall, Stanford University
Dinner reservations: Darlene Wheeler, DA 6-6200, Ext. 2695

Audio

8:00 P.M. • Tuesday, March 26

(Joint meeting with The Audio Engineering Society)
"Voice-Responsive Machines"
Speaker: William C. Dersch, vice president, Voice Systems, Inc., Campbell
Place: Stanford Research Institute, Conference Room B, Menlo Park
Dinner: Cocktails, 6:00 P.M.; Dinner, 6:30 P.M., Atherton Club, 3319 El Camino Real, Atherton
Reservations: Stan Oleson, 326-6200, Ext. 3584

MEETING CALENDAR

Automatic Control — 8:15 P.M. • Thursday, April 11
"Air Traffic Control: The Man-Machine Relationship"
Speaker: Dr. Albert S. Jackson, president, Control Technology, Inc.
Place: Electrical Engineering 126, Stanford University
Dinner: 6:15, to be announced
Reservations: Mrs. Pauline Eckman, DA 1-3300, Ext. 286, by noon Wed., April 10

Communications Systems — 8:00 P.M. • Tuesday, March 19
(Joint with Communications Division, see above)

Communications Systems — 8:00 P.M. • Thursday, April 18
(Joint with Communications Division)
"The Duobinary Techniques for Digital Communications"
Speaker: Adam Lender, senior staff engineer, Lenkurt Electric Co., Inc.
Place: Lenkurt Electric Co., Inc., engineering bldg., Brittan Ave. and Industrial Way, San Carlos
Dinner: The Gold Platter, 1000 El Camino Real, San Carlos
Reservations: Sue Manzi, LY 1-8461, Ext. 287

Electron Devices — 8:00 P.M. • Wednesday, March 27
(Tutorial Lecture Series: Joint with PTGAP, PTGMTT, and PTGSET, see above)

Instrumentation & Measurement — 8:15 P.M. • Wednesday, March 27
(Joint with Instrumentation & Control Division)
Lecture No. 3: "The Instrumentation and Performance of the Mariner II Experiments"
Speaker: John S. Martin, senior research engineer, space science division, JPL, Pasadena
Place: Lockheed Auditorium, Bldg. 202, 3251 Hanover St., Palo Alto
Dinner: 6:15 P.M., L'Omelette Restaurant, 4170 El Camino Real, Palo Alto
Reservations: Mrs. Marje Andrews, DA 1-3300, Ext. 273

Instrumentation & Measurement — 8:15 P.M. • Wednesday, April 24
Lecture No. 4: "Detection of Planetary Life"
Speaker, place to be announced

Instrumentation & Measurement — 8:15 P.M. • Wednesday, May 29
Lecture No. 5: "Instrumentation for Man in Space"
Speaker, place to be announced

Microwave Theory & Techniques — 8:00 P.M. • Wednesday, March 27
(Tutorial Lecture Series: Joint with PTGAP, PTGED, and PTGSET, see above)

Microwave Theory & Techniques — 8:00 P.M. • Wednesday, April 3
(Joint with SFS, see above)

Military Electronics — 8:00 P.M. • Wednesday, March 20
"Electron Beam Recording for Military Application" (Unclassified)
Speaker: Reginald T. Lamb, mgr. electron beam recording section, Ampex Corp., Redwood City
Place: Lockheed Auditorium, 3251 Hanover Street, Palo Alto
Dinner: 6:00 P.M., Red Shack, 4085 El Camino Way, Palo Alto
Reservations: Vic Conrad, 326-4000, Ext. 2212

Reliability & Quality Control — 8:00 P.M. • Wednesday, March 20
"Impact of Microelectronics on Reliability"
Speaker: Jesse Alderman, senior engineer, ARINC Research Corp., Palo Alto
Place: Room 100, Physics Lecture Hall, Stanford University
Dinner: 6:30 P.M.—Ed's Chuck Wagon, Mountain View
Reservations: Jean Cravens, YO 8-6211, Ext. 2126, by March 18

Space Electronics & Telemetry — 8:00 P.M. • Wednesday, March 27
(Tutorial Lecture Series: Joint with PTGAP, PTGED, PTGMTT, see above)

meeting ahead

FELLOWS & LAST SPECTRAL FRONTIER

The joint SFS/PTGMTT meeting on April 3 will see 1962 prize award winners and Fellows honored and hear a distinguished visitor from the University of Illinois.

Dr. Paul D. Coleman, founder and director of the ultramicrowave lab at UI, will discuss current problems in his favorite subject, the generation, transmission, and detection of coherent radiation in that last spectral frontier, the infrared-microwave gap.

Paul D. Coleman

Just prior to his presentation in Room 101, Physics Lecture Hall, Stanford, new award winners and IRE/IEEE Fellows within the Section will be honored by Victor Kaste, Section chairman (AIEE). Professor Coleman, himself a new Fellow, will be among those who will receive diplomas.

Solutions to the challenging problem of bridging the gap have yet to be found despite heroic efforts to extend conventional methods of generation plus exotic schemes to exploit phenomena in all branches of physics.

Submillimeter waves are an important diagnostic tool for spectroscopy, plasmas, solid state, and other areas of physics. If efficient sources and appropriate components could be developed, short-range ground and long-range space communication systems would inevitably result. At the moment, the luxuries and possibilities of tens of watts of submillimeter wave power are difficult to comprehend.

(Continued on page 6)

remarks from the chairs

FACILITY CHAIRMAN TECHNIQUE

Over the past few years a number of the professional groups, including the Professional Group on Antennas and Propagation (now PTGAP), have had to face the problem of a dwindling attendance at meetings.

The reasons for this dwindling attendance are many and varied. The increasing competition between the many professional groups for the engineer's time is part of the trouble. The shortage of topnotch speakers is perhaps another reason.

John B. DaMonte

But probably the most important reason why professional group members do not attend meetings is that no one has taken the time or effort to encourage them to attend! By this, I do not mean that they haven't been made aware that a meeting was about to take place, via a meeting notice or a mention in the **Grid**. I am referring to the fact that no one has taken the time to extend a personal invitation to participate in the meetings and activities of the professional group.

This need for "grass roots" representation among the membership has led PTGAP to adopt the facility chairman technique. The approach is to provide an informed representative of PTGAP on the staff of every company and university which has an appreciable number of PTGAP members. This representative, the facility chairman for the particular facility, then acts as a sort of ambassador, providing the membership with the latest information regarding activities of the PTGAP and IEEE. Specifically, his duties can be summarized as follows:

- Be attentive to the desires and needs of the membership.
- Encourage member participation in the group by means of attendance at chapter meetings and by the submittal of worthy papers for publication.
- Foster a professional spirit among the membership.
- Spread the benefits of membership in PTGAP by inviting engineering people to join the PTGAP and IEEE.
- Provide chapter officers with suggestions for formulating the PTGAP program for the year.

The PTGAP facility chairmen for the San Francisco Chapter are: John B. Damonte, Dalmo Victor Company; Raymond D. Egan, Granger Associates; Albert F. Gaetano, Lockheed Missiles and Space Co.; Perry H. Vartanian, Melabs, Inc.; Frank Butterfield, Philco Corporation; Rolf B. Dyce, SRI, radio propagation and communications laboratories; Harold S. Rothman, SRI, remainder of the facility; Robert R. Buss, Stanford University; Bernard J. Lamberty, Sylvania; Harry M. Engwicht, San Jose State College; and William J. Welch, University of California.

We hope that members of PTGAP, any member of IEEE, or any interested party will feel free to contact us on any questions regarding PTGAP, either by phone or by letter. Any suggestions or ideas for the improvement of our Professional Technical Group programs will be greatly appreciated.

JOHN B. DAMONTE
CHAIRMAN, PTGAP
SAN FRANCISCO CHAPTER

MORE SFS/PTGMTT

Representative, current scientific and technological efforts in the areas of classical and quantum electronics will be presented. Also the challenge of transmitting and detecting coherent ultramicrowave signals will be hurled at the audience.

Dr. Coleman supervises research on submillimeter wave generation, detection, and propagation. His research interests have included aircraft antennas, electromagnetic theory, microwave electronics, megavolt electronics, Cerenkov radiation in scalar and tensor media, frequency conversion in ferrites, plasmas, semiconductors, and quantum electronics. He was a member of the founding administrative committee of the PTGMTT. He is a visiting professor in the Hansen Labs, Stanford University.

William C. Dersch

meeting ahead

AND NO BACK TALK

Voice-responsive machines will be covered by William C. Dersch, vice president and director of research, Voice Systems, Inc., Campbell, at the March 26 meeting of PTGA, held jointly with the Audio Engineering Society.

Present data-processing concepts involve source-data collection, transcription for machine entry, machine output, and distribution to the user. Voice-responsive machines will allow the source-data collector to reduce the data to machine-readable form and still leave his eyes and hands completely free. The requirements on such machines and their impact on future systems designs will be discussed. A 10.5-minute professionally filmed color sound movie developed by the speaker will be shown, together with a demonstration.

Mr. Dersch graduated from Union College with a B.S. in electrical engineering. With IBM, he first worked as a field service engineer and later was assigned to the laboratory. After a brief period with Hughes Aircraft in 1953, he worked on the check reader at SRI for ERMA. In 1954-57 he was service manager for Varian Associates, and then returned to IBM until 1962, where he developed the voice-responsive "Shoebox." In 1963, together with a former Varian acquaintance, he founded Voice Systems, Inc. He has thirty patents, applications, and patent publications to his credit.

meeting ahead

BEAM RECORDING

Electron beam recording for unclassified military applications will be discussed by Reginald T. Lamb, manager, electron beam recording section, Ampex Corp., at the March 20 meeting of PTGMIL.

The orientation discussion on the

(Continued on page 8)

Performance advantages of a better broadband instrumentation tape

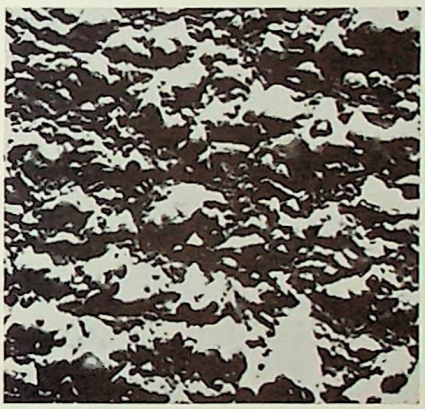
—in pre-detection, pulse code modulation, and other critical high-frequency instrumentation recording applications.

The shortest wavelengths in broadband recording are less than five times those of visible light. To magnetically record and reproduce such wavelengths requires a tape surface smoothness approaching that of an optical surface.

Memorex Type 62 Broadband Tapes look smooth to the eye, but what is more important, they look smooth even to the electron microscope — competitive products do not. They are twice as smooth as the best competitive tape, and this near-perfect surface is produced unerringly over the miles of tape on each roll.

Electron microphotographs of surfaces of Memorex tape and competitive product at the same magnification (6000x).

MEMOREX TAPE



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Users of Memorex Type 62 Broadband Tapes receive important performance advantages, including:

as much as 6 db more response at the highest frequency — the result of the ultra-smooth surface;

as much as 3 db greater undistorted output — the result of a coating more densely packed with well-oriented particles of oxide;

more than 3 db higher signal-to-noise ratio — the result of extreme uniformity of distribution of particles within the coating;

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These improvements in performance were measured on a Mincom CM 100. Still greater improvements can be expected when using recorders with more extended bandwidth.

Memorex broadband tapes offer you a wider choice of coating thickness to suit your recording application:

62J (370 μinch coating) — for high output

62K (270 μinch coating) — a new intermediate coating thickness

62L (170 μinch coating) — the thinnest coating offered to date, giving you 25% more playing time per roll.

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MEMOREX CORPORATION
PRECISION MAGNETIC TAPE

Radue

DeGabrielle

meeting ahead

HIGH-SPEED DATA

On March 19, 1963, Paul Radue and Clinton DeGabrielle will present "High-Speed Data Systems" to a joint meeting of CD and PTGCS.

Mr. Radue is district engineer for the telecommunications section of the communication products department, General Electric Company, Redwood City, and is responsible for the design and layout of point-to-point radio and multiplex systems. A native of Wisconsin, he has had several articles published relating to telecommunications transmission problems.

Mr. DeGabrielle is responsible for sale and application of all data communication products and custom systems for the computer department of GE. In his twenty-four years with the company he has been associated with major sections of the communications business in various financial, manufacturing, and marketing phases. In his present assignment, he has been instrumental in achieving for General Electric a system for on-line nationwide order processing and distribution which provides for optimum customer service while effecting sizeable inventory reductions with better management control.

meeting ahead

SIZE AND COMPLEXITY

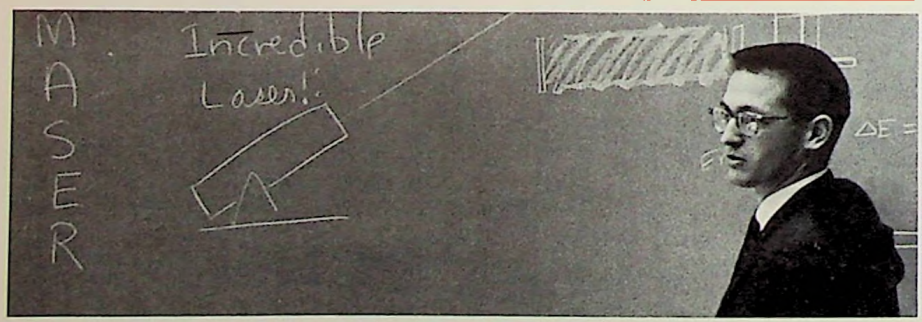
The impact of microelectronics on reliability will be minutely but reliably described by Jesse Alderman, senior engineer, ARINC Research Corp., Palo Alto, at the March 20 PTGRQC meeting.

Component size has diminished while the complexity of systems has increased. The only way complex systems can be feasible is for reliability to increase as rapidly as complexity. In this respect, as well as others, microelectronics holds great promise.

Of the many approaches to microelectronics, one trend is toward the use of integral devices, constituting circuits that cannot be broken down into smaller segments without destroying the entire unit. These circuits may be semiconductor functional blocks comprising both passive and active elements within a single crystal substrate, thin-film passive elements on a ceramic or glass substrate, or combinations of both thin films and semiconductor elements.

The speaker will discuss new technologies, their advantages and disadvantages, and the potential impact of reliability on future systems, including results of a study to determine expected effects of microelectronics upon reliability of an avionic system.

Mr. Alderman joined the staff of ARINC Research Corp. in 1955 and is presently located in Palo Alto with its western engineering department, engaged in reliability studies of shipboard, airborne, and satellite systems. More recently, he has investigated for USAF research, engineering, logistic, and economic factors in integral electronics for military electronic systems.



Siegman spellbinding recent PTGSET meeting

meeting ahead

THIRD OF LASER SERIES

Lecture number three of the four-part laser tutorial series will be delivered by Professor A. E. Siegman of Stanford University, Wednesday evening, March 27, in the Stanford Physics Lecture Hall. His talk, entitled "Laser Techniques and Applications," will include a discussion of modulation and demodulation techniques, their problems and their possibilities.

The speaker's daily familiarity with modern laser development, in both its practical and theoretical advancement, makes him well qualified to present up-to-date tricks of the laser trade.

Campbell

Alderman

meeting ahead

HIGHER AND HIGHER

High-rise apartments will be discussed by H. E. Campbell, senior engineer, distribution systems engineering, electric utility engineering operation, General Electric Co., at the March 26 meeting of the Power Division.

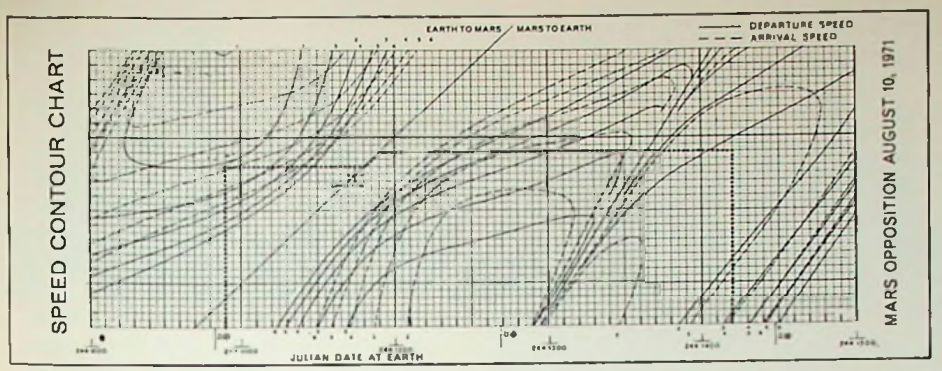
All-electric living in high-rise apartments has become feasible due to the economic advantage of an interior primary distribution system throughout the building. Distribution equipment has been developed which will give the same order of reliable service as a residential underground system.

Graduated from Virginia Polytechnic Institute in 1935, with a Bachelor's degree in electrical engineering, the speaker, since coming to GE in 1940, has worked in electric power distribution engineering. He is presently responsible for load analysis, economics of kilovar supply, and urban system design. He is editor of "Distribution" magazine, a professional engineer in the state of New York, and a Fellow of AIEE.

MORE PTGMIL

use of electron beam recording for military applications will include wideband instrumentation, radar recording, data display, and photographic interpretation. A question period will follow.

Holder of a B.S.M.E. from the University of Rhode Island, the speaker spent ten years as a motion-picture engineer, ten years as an airborne scanner designer, and was formerly with Eastman Kodak Co., Hawkeye Optical Works.



At Lockheed Missiles & Space Company, a dedicated team of scientists devotes its entire attention to problems in interplanetary navigation. Of particular interest are problems attendant to the guidance of a manned vehicle to another planet. With many successful accomplishments to their credit (such as the Polaris and various Agena missions), this group faces every new challenge with confidence.

A promising means for manned spacecraft guidance includes taking celestial and planetary optical sightings, feeding that information into an onboard computer, and computing the spacecraft's position and velocity to predict its future course. The computer will then calculate the predicted destination planet error, decide if a correction is necessary, and compute its value. These procedures would be repeated continually until the planet is reached. The optimum timing and magnitude of correction, in view of the information obtained from the observations, is the subject of continuing study.

Even before work on hardware for an interplanetary mission is begun, orbit characteristics must be determined to set the requirements to be built into the spacecraft. An optimum trajectory must be shaped for the specific mission, in order to realize ultimate effectiveness. An outstanding accomplishment by Lockheed scientists is the computation of some 250,000 different orbits to Mars and a similar number to Venus. Each orbit varies as to speed, fuel, departure, arrival, and elapsed time.

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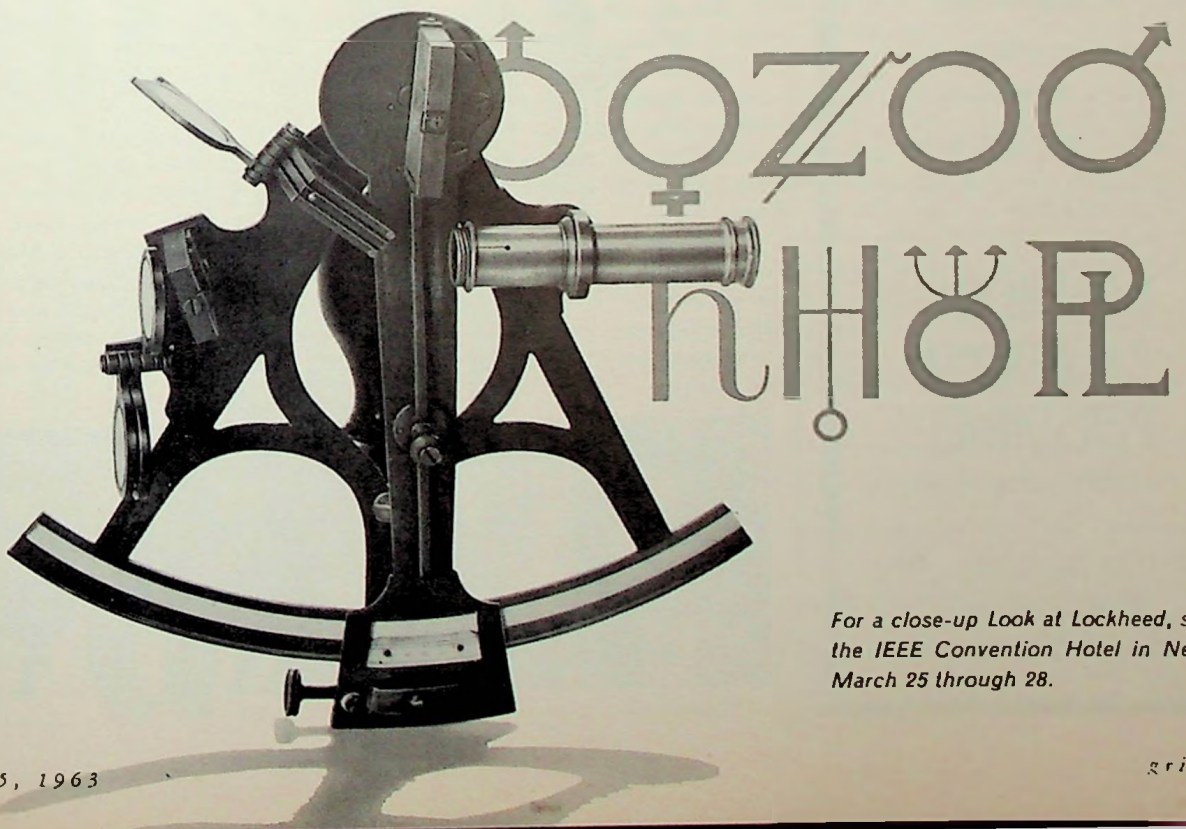

For a close-up Look at Lockheed, see us at the IEEE Convention Hotel in New York, March 25 through 28.


L. G. FitzSimmons


W. G. Hoover


J. A. White

aiee/ieee fellows

FITZ SIMMONS, HOOVER & WHITE

Three AIEE/IEEE members were presented Fellow diplomas at the joint section meeting held February 12 at San Francisco State College, Dr. A. Tilles, chairman of the Transfers Committee, making the presentations.

Honored were Laurence G. FitzSimmons, Jr., chief engineer, Bay Area, P.T. & T., "for achievements in the development of communication services"; Dr. William G. Hoover, technical director, Granger Associates, "for contributions to coordinated electronics and high-voltage engineering, and to engineering education"; and James A. White, chief of the instrumentation division, NASA Ames Research Center, "for contributions to wind tunnel electrical instrumentation."

They will be honored, along with 15 IRE/IEEE prize award winners and Fellows, at the June 15 annual dinner of the Section.

meeting series review

SPACE INSTRUMENTATION

On February 6, Dr. Francis S. Johnson, head of the atmospheric and space sciences division of the Graduate Research Center of the Southwest, Dallas, initiated the PTGIM space instrumentation series, thoroughly engrossing his audience in the scientific aspects of space atmospheric measurements.

The second event of the series, a panel discussion narrated by Dr. J. W. Muehlner, senior member of Lockheed's electronic sciences laboratory, was held on February 28. Engineering constraint was the central theme toward which Dr. Muehlner directed the panel.

The first panelist, Dr. R. G. Johnson, senior member of Lockheed's physical science laboratory, spoke on the influences of orbital space environment upon instrumentation. One aspect of this environment, minute pressure, increases the evaporation rate of lubricants, introducing mechanical difficulties.

Other pressure effects include outgassing of the vehicle and enhanced high-voltage breakdown. Temperature problems from rapidly changing thermal environments are a further handicap the equipment designer must anticipate. Micrometeorites are not a severe limitation, particularly at low altitudes.

One of the most severe handicaps is imposed by high-energy particles, both natural and man-made. The specific latter example was that of the July 9, 1962, U.S. atomic explosion in space from which there resulted a belt of 0.5 Mev to 5 Mev electrons. These particles are trapped by existing magnetic fields and have half-lives from one month to perhaps years. A direct result of this artificial


Muehlner


Johnson


Libby


Martin


Blicke

environment is the rapid deterioration of space craft solar cells.

L. Libby, manager of the design techniques department at Lockheed, expanded upon the design of space hardware to accommodate intended requirements within the constraints of available technology. Microminiaturization is dramatically meeting the challenge posed by size, weight, and power restrictions in a very effective manner. At the same time it promises bonuses in the form of improved reliability and reduced cost. The implementation of semiconductor integrated circuits, thin-film circuits, etc., simultaneously offers the opportunity to employ redundancy and further improve reliability.

In designing equipment for space applications, the engineer must have cognizance of the environment severity and its implication upon resultant performance. The effect of transistor Beta and I_{co} deterioration with radiation must be circumvented by making the design insensitive to these parameters. Digital techniques should be employed where feasible because of their potential immunity to component parameter variation. In essence,

(Continued on page 12)

the electronic circuit designer must have a significant amount of peripheral knowledge in physics and chemistry to intelligently understand his constraints.

Mr. Libby also emphasized the importance of the scientific community's publicizing new materials, techniques, etc., which might be applied by the design engineer.

B. D. Martin, Jet Propulsion Laboratory, spoke on the subject of "Data Transmission Constraints." With particular reference to interplanetary, long-distance missions, he discussed the limitations imposed by most advanced communication links on the information rate now and in the years to come. While present-day techniques are quite satisfactory for transmitting data of the order of 10,000 bits per second within lunar distances, much more restrictive conditions prevail at planetary distances. For instance, the recent Venus probe was operating at rates of only 32 or 8 bits/sec. Transmitting data from the edge of the solar system is impossible with present means, but might be expected as a possibility within the next five years or so.

Mr. Martin further discussed the efficiency of various coding schemes and showed convincingly the tremendous progress made in recent years and the additional advantages to be gained by the introduction of redundant codes and matched-filter receivers. In the over-all system of data transmission from deep space, the problem does not lie necessarily in the limited capacity of the space-to-earth link. While the low data rates during the Venus experiments could be transmitted quite well through teletype channels from the original receiving stations around the world to the data center at Pasadena, the expected increased information rates of future missions will pose serious problems because of the limited channel capacity of existing ground communication channels.

Mr. Martin also discussed the desirability of on-board data processing and editing for the purpose of bandwidth compression, but mentioned the reluctance of scientists to look at data predigested by machines.

The subject of reliability in space experiments was covered by Dr. J. A. Blickensderfer, manager of Philco's reliability service section. This engineering facet displays its vital importance by a brief look at the records. Although universally acknowledged in importance, meaningful quantitative specifications are difficult. A particular example is the specification requiring a "90 percent probability of satellite survival for one year." Unless a wastefully large number of satellites are placed under life test, satisfactorily meeting this requirement would necessitate exceeding the contract duration, if not the obsolescence of the vehicle.

Dr. Blickensderfer expounded on the virtue of statistical models of components and circuits, to enable insight that would require prototype years in a few minutes of computer time. Other space instrumentation reliability considerations, such as possible in-flight repairs, the inability to predict single future events, the use of excessive telemetering, were also brought out.

Dr. Muehlner recapitulated many of the highlights brought out by the panelists, showing various distinctions between orbital and deep space flights.

IRWIN WUNDERMAN

ENDS, PICKS, TWINNING, CABLES

The January dinner meeting of PTGPEP featured a discussion of wire and cable production for electronics by Robert Wisnom and Frank Stefkovich, followed by an extensive tour of the production facilities of the Tensolite Insulated Wire Pacific Division, Inc., at Redwood City.

Frank Stefkovich, plant manager, opened the discussion by outlining the range of wire products used in the electronics industry. These range from small-gauge solid and multistrand insulated hookup wires to special cables that consist of many different types of wires that may be assembled in various insulated and shielded groups as a single bundle. Insulated wires are prepared by extruding primary and secondary jackets around the wire or cable assembly. Polyvinyl chloride polyethylene, Teflon and nylon are typical insulation materials. Nylon is normally used as a transparent secondary jacket over PVC jackets to afford environmental resistance to the insulated wire. He further indicated that Teflon insula-

(Continued on page 14)

tion was added by either extrusion or tape wrapping, with the Teflon-tape-wrapped wire being more flexible than the wire with an extruded Teflon jacket. He concluded by saying that the local plant which the PTGPEP group would tour had a capacity of approximately six million feet per day of PVC-jacketed wire and 500,000 feet per day of Teflon-jacketed wire, with tens of thousand feet capacity per day for cabling and jacketing special wire assemblies.

Robert Wisnom, sales supervisor, then described step by step the processes and products that would be seen in the Tensolite plant. A single strand of wire was defined as an "end." A "pick" is a number of "ends" in a parallel flat lay that is normally braided with other "picks" to form a metal shield around insulated wires and cables. Shielding is also accomplished by wrapping wires or cables with a metallized plastic tape where weight and size reduction is important. "Twinning" was defined as the process of twisting two insulated wires together to form a "pair." Cabling was defined as the process of twisting two or more wires together.

Mr. Wisnom then detailed the wire and cable production processes as starting with wire drawing to achieve specific gauges, followed by a continuous twinning process which prepares the "ends" for stranding to form larger area conductors, or braider respooling as "picks," or jacketing. Following this, the processes and machinery for jacketing, twinning, cabling, and quality control were discussed and the specific operations to be observed during the tour of the Tensolite plant noted.

After Mr. Wisnom's presentation, the group traveled to the plant, where W. Field, supervisor of quality control; W. Hartman, supervisor, production control; Ed Wray, technical supervisor, engineering; Mr. Wisnom, and Mr. Stefkovich acted as guides for the tour of the facilities.

W. D. FULLER

meeting review

NEW SHIELDING SPECS

PTGRFI held its February meeting at Lockheed Missiles and Space Company, Sunnyvale, the guest speaker being Dr. Elery L. Buckley, chief elec-

Elery L. Buckley

tronic engineer of Emerson and Cuming, Canton, Mass., who spoke on new shielded enclosures and shielding materials.

Dr. Buckley said that military requirements are responsible for much of the work done on shielded enclosures to date. More recent military requirements have brought about a development of the shielded anechoic chamber, a chamber designed to exclude outside electromagnetic influences and to control internal reflections.

A brief review of the shielding effectiveness of various metal sheets and foils was made. Except for low-frequency magnetic fields, high-permeability metal sheets are not necessary for good shielding effectiveness. The theoretical shielding effectiveness of these materials is never achieved when fabricated into any practical chamber. This is due, for the largest part, to the discontinuities in the shield material necessitated by construction requirements and providing a means of access into the chamber.

There are now available various conductive coating compounds and tapes that can be used to minimize the effects of the discontinuities in fabricated shielded enclosures. This makes possible the use of a small and inexpensive corrugated sheet metal building as a fairly effective shielded chamber.

The novel suggestion of, in effect, wallpapering a room with stainless steel foil was made. Where the requirements for low-frequency magnetic field shielding are not too great, this type construction gives nominal performance as a shielded enclosure. R.F. joint sealer is required where the foil overlaps.

Nonmilitary application of shielded chambers exists in hospitals where sensitive equipment, such as an encephalograph, is used. Workers in geophysics also have a need for a shielded chamber. The requirements,

in this instance, are much more severe because it is the earth's (d-c) magnetic field that must be shielded, a field in which a shielded chamber is not very effective.

Practical and realistic specifications for shielded enclosures were discussed, and the limitations of evaluation procedures called out by current and proposed MIL specs were emphasized.

After Dr. Buckley's talk, members and guests made an inspection tour of Lockheed's new 30x30x60-ft. shielded anechoic chamber presently under construction. This afforded an opportunity for close inspection of many of the features of chamber design discussed by the speaker.

Dr. Buckley has been actively engaged in research and development of microwave dielectric materials for application to Luneberg and other special purpose lenses, to microwave absorbing materials and to shielded anechoic chambers.

JOHN W. WATTENBARGER

meeting review

MORE STEP RECOVERY

On February 20 PTGMTT heard Robert Mouw discuss "A Step-Recovery Diode Microwave Frequency Mark Generator," an instrument that generates a "ruler spectrum" of markers at 10, 100, and 1000 mc intervals.

The step-recovery diode differs from others in having a sharply discontinuous curve of capacitance versus voltage. This distinguishes it from the ideal rectifier (a resistive device) and the varactor, with a smoothly varying curve of capacitance versus voltage. In an untuned circuit the sharp discontinuity of the step-recovery diode produces more power in higher harmonics than does a varactor. The harmonic content of the former varies as $1/n$, while that of the varactor varies as $1/n^2$. Efficiency of the step-recovery diode is limited by spreading resistance, which causes a finite transition time.

Coaxial marker generators have been built in the 1-2 gc, 2-4 gc, and 4-8 gc bands, and a waveguide unit in the 8-12 gc band. In the coaxial instruments a 10 mc signal is fed to an H-P BA 104 diode, and both the output of that diode and a 100 mc signal are then combined to drive a Fairchild FD 600 diode. The latter unit is in a coaxial mount having a shunt in-

(Continued on page 20)

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historical notes

CYRIL FRANK ELWELL

The Section has lost one of its most distinguished pioneers in the passing of Cyril F. Elwell on February 11, 1963.

Born in Melbourne, Australia, in 1884 to American parents, Elwell came to the United States to attend Stanford, where he received the A.B. ('07) and E.E. ('08) degrees. Following graduation, Elwell was engaged in the development of electrical smelting until two of his Stanford professors persuaded him to undertake an investigation of a radio telephone system invented by Ignatius McCarty. After convincing himself that McCarty's ICW system and others based upon spark generated carriers were not the answer for a practical radio telephone communications system, Elwell negotiated with Valdemar Poulsen of Denmark for the U.S. patent rights for his CW arc generator.

In 1909 Elwell formed the Poulsen Wireless Telephone and Telegraph Company, which was later to become the Federal Telegraph Company. Elwell brought together the famous team of Lee De Forest, Charles Logwood, and Herbert Van Etten, who were responsible for the invention and application of De Forest's Audion amplifier. The Poulsen Arc and the De Forest Audion made possible greatly improved long-distance communication. Elwell established a network of stations linking Chicago, Seattle, San Francisco, and Honolulu.

In 1913 he resigned from the company he founded to go to England, where he was chief engineer of the British Universal Radio Syndicate and later founder and director of the Mullard Radio Valve Company. He played an important role in Allied communications during World War I. High-powered radio stations designed and built by Elwell were located throughout the world. The events in Elwell's professional career provide an interesting and exciting account of the conception, growth, and development of several facets of the radio and electronic industry.

A particularly interesting story is Elwell's involvement as a technical consultant to the movie industry in the Fox Vitaphone patent suit in the early days of talking motion pictures. Elwell made a thorough study of the development of motion pictures as it had occurred in the U.S. and Europe. His testimony was vital to the decision which freed the industry from the monopoly which the Fox Vitaphone patent would have created. He returned to the Bay Area to retire and had served as a consultant to the Hewlett-Packard Company since 1947.

EARL G. GODDARD

T. J. Zilka

the worried deans

Fourth in a series on the engineering candidate lag. Professor Zilka is chairman, Engineering Department, San Francisco State College.

I thank you for inviting me to write my thoughts for **Grid** under the heading, "The Worried Deans." But I must begin by saying that I do not qualify for this assignment on two counts—first, I am not a dean and, second, I am not worried about the national downward trend in engineering enrollments. I am concerned, quite; alarmed, somewhat; and challenged, definitely.

In the four years since I came to San Francisco State College to develop an engineering program (and thus was forced to take special note of national trends in engineering education), I have noted such rapid changes in all technical fields that an educational program considered advanced in the late 1950's now risks early obsolescence, unless continuously studied and revised.

This is not to say that the basics of engineering curricula are in themselves changing rapidly, but that new topics, combinations, analogies, integrations, teaching methods, devices, and laboratory equipment are constantly being introduced. This means that the boys across the road, whoever they may be, have found it possible to cram a little more into the undergraduate curriculum. So, "it's back to the old drawing board" —do a redesign, or a revision.

Isn't this activity, in fact, a reflection of changes and adjustments in the profession of engineering? The trend must certainly be noticeable to discerning counselors, parents, and at least some of the aspiring engineers. They must find it difficult to get a clear image of engineering today.

We in engineering education are applying our talents to the design job quite aggressively but we are not working strenuously enough on the sales and follow-up job. For this latter job, especially, we need the help of practicing engineers.

If engineering as a profession had the public acceptance of law or medicine, which it deserves, it should not be difficult to make it attractive to the better high-school students. Thus we must attach great importance to the current work in the development of a unified voice for engineering in the U.S., already started with the birth of IEEE. The results could be far-reaching in building stature for the profession and giving obvious solidarity, which seem important to today's youth in their drive for security and recognition.

The colleges and universities also need more practicing or ex-practicing engineers on their faculties—the kind who has established a high reputation for being able to produce. Such men may come, more quickly than we anticipate, as a result of the expected shortage of engineers. As the pace in industry accelerates, and more demands are placed upon the existing engineers, we can expect them to be attracted to the relative calm of a college environment. This trend is already discernible in the Bay Area. Secondly, a shortage of engineers will increase the opportunities for regular faculty members to increase their consulting activities. This could be good for the students and the institutions, and, in the long run, the profession. We should be able to do a better job in preparing new men for the profession with this help from some real "pros."

Briefly, I refuse to worry about enrollment trends; rather, I am determined to exert all possible effort to help in the continued growth of the engineering profession and to assist young people to realize fully its opportunities and challenges.

T. J. ZILKA

events of interest

May 13-15—**NAECON** (Nat'l Aerospace Electronics Conf.). Dayton Ohio. Exhibits: IEEE Dayton office, 1414 E. 3rd St., Dayton, Ohio. Program: same. Proceedings: order from Dayton after conference.

May 17-18—**Symp. on Artificial Control of Biology Systems.** Univ. of Buffalo, Sch. of Med., Buffalo, N.Y. Exhibits: none.

May 20-22—**Nat'l Symp. on Microwave Theory and Techniques.** Miramar Hotel, Santa Monica, Calif. Exhibits: none. Program: Dr. Irving Kaufman, Space Tech. Labs., Inc., 1 Space Park, Redondo Beach, Calif. Digest, order from IEEE hdqtrs. after symposium. DL, 1-15-63.

May 20-23—**Nat'l Telemetering Conf.** Albuquerque, N.M. Exhibits: Hugh Pross, Telemetering Corp. of Amer., Sepulveda, Calif. Program: Thomas Hoban, Sandia Corp., Albuquerque, N.M. Proceedings.

May 21-23—**Spring Joint Computer Conf.** Cobo Hall, Detroit, Mich. Exhibits. Proceedings.

May 27-28—**Seventh Nat'l Conf. on Product Engineering and Production.** Exhibits: C. W. Watt, Raytheon Elec., Lexington, Mass. Program: Jack Staller, Sylvania Elec., Needham, Mass. IEEE TRANSACTIONS on Product Engineering and Production.

MORE PTGMTT

ductor to allow biasing of the FD 600. The two diodes are so coupled that the 100 mc markers are 6 db larger than the 10 mc pulses. The 4-8 gc generator employs a second FD 600 diode, located in a loop-coupled cavity, to produce larger pulses at 1000 mc intervals.

The X-band unit employs the same principles, but the diode is located in a waveguide mount. This mount has one end terminated in a matched load and so suffers a 3 db loss in efficiency. The waveguide unit also produces 1000 mc pulses, but here a separate cavity is used for each pulse, these cavities being coupled to the primary harmonic generator mount.

The untuned mounts show a conversion loss of 35 db at the tenth harmonic of 100 mc (1 gc). This loss increases to 65 db at the 120th harmonic (12 gc). A completely tuned unit produced the sixtieth harmonic (6 gc) with 34 db conversion loss.

R. J. PRICKETT

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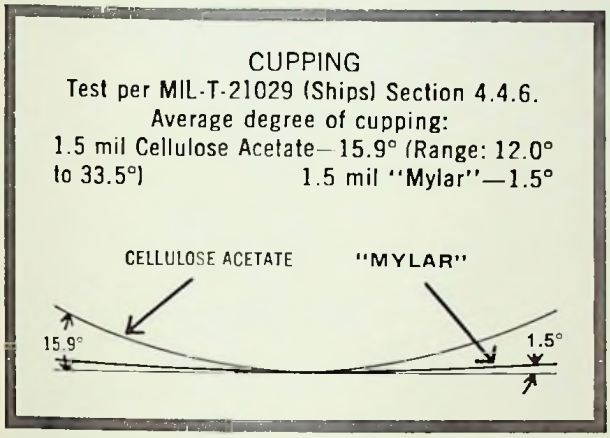

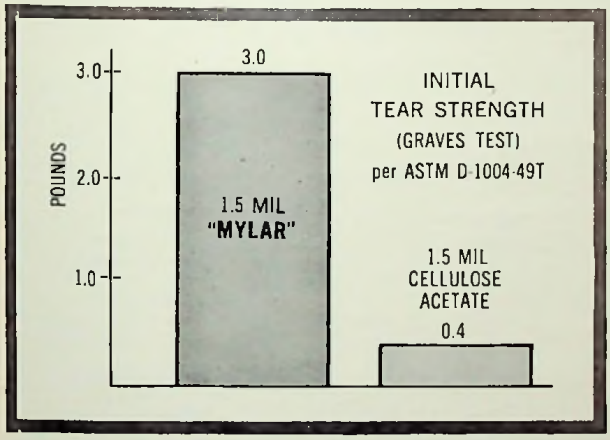

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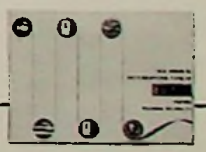

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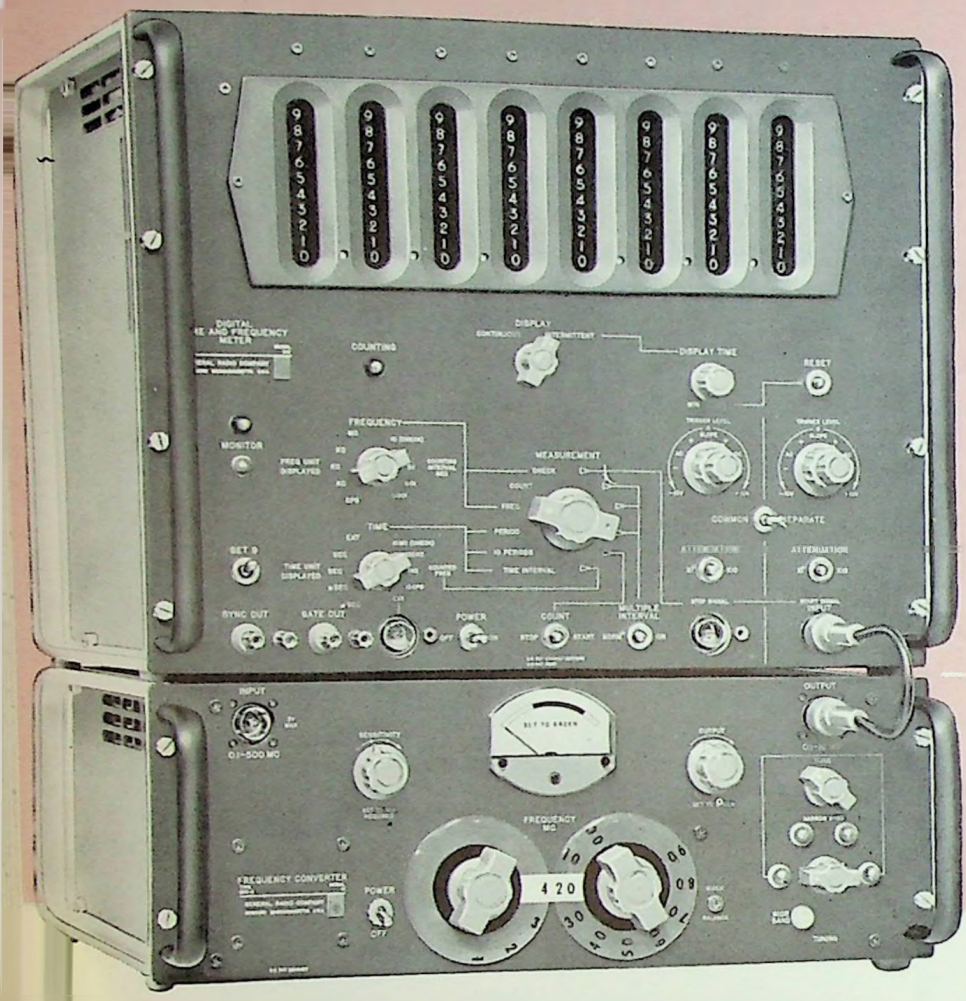

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