

EDITOR'S PROFILE of this issue

from a historical perspective ...

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

January, 1969:

Cover: Apollo capsules have been in space several times already; the artist conceptually shows one on its way to the Moon. One will deploy a Lunar Lander in the upcoming summer to land on the Moon. I remember watching the landing "live" on TV. See more on page 15.

Page 9: The EMB chapter will host a discussion of the heart transplants being conducted by Norman Shumway, a surgeon at the Stanford Hospital. My wife had encouraged her Toronto roommate to come to California, where she applied to work at the hospital; she was an operating room nurse for Shumway on these surgeries.

Page 9: We get an update on the electronics museum that is being built at Foothill College to house the Perham Foundation's collection of early developments at Federal Telegraph, plus artifacts of Lee de Forest, inventor of the vacuum tube and the oscillator and amplifier circuits. I cover this early history in my talk, "The Origins of Silicon Valley" (available on YouTube).

Page 14: Gordon Moore of Fairchild (and of "Moore's Law") speaks on "Trends in Silicon Device Technology", along with a talk on III-V compounds by John Moll, one of my professors at Stanford (who developed the Ebers-Moll model of the transistor). The talk is at the "Physics Tank" lecture hall.



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.

April, 2025

Contact p.wesling@ieee.org



1969 **FELLOW AWARDS**

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Grid
JANUARY 1969

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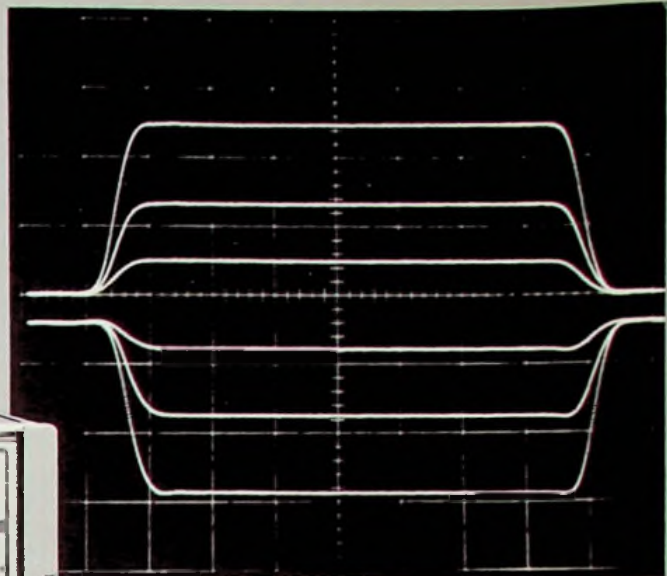
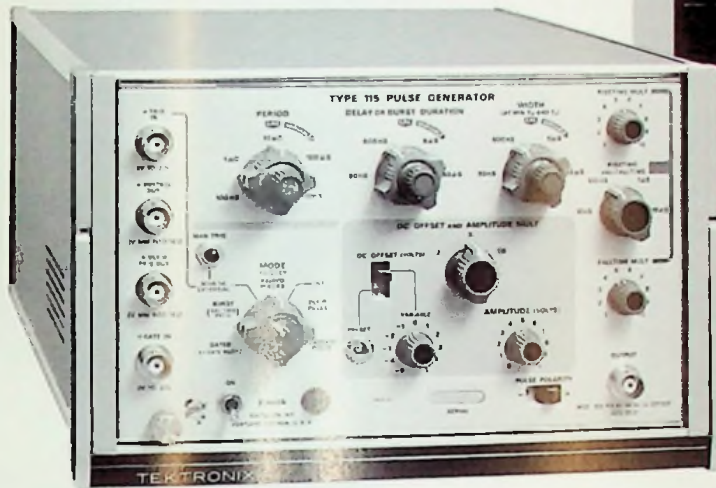
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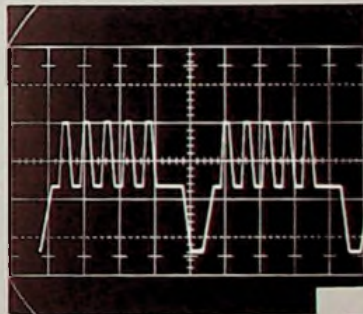
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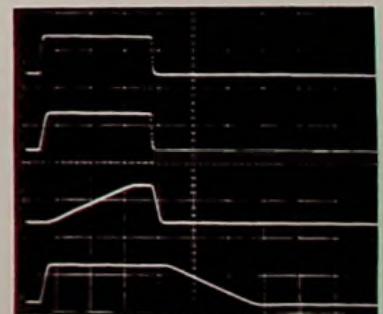
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ON THE COVER

Artist Peter D. Yue has designed the cover picture depicting a Project Apollo Capsule on its journey to the moon. The joint meeting of the East Bay Subsection and the San Francisco Section on January 27 will feature Bradford A. Evans, Public Affairs Officer for National Aeronautic Space Administration's Ames Research Center at Moffett Field as speaker. His subject will be Project Apollo from orbital flight to lunar landing. Story on Page 15.

Grid

volume 15
number 5

JANUARY, 1969

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Meeting

AEROSPACE & ELECTRONIC SYSTEMS JAN. 23

Story on
page 9

REPORT ON PROGRESS OF THE PERHAM FOUNDATION ELECTRONICS MUSEUM AND THE DE FOR-EST REPOSITORY. Earl Goddard, Chairman of IEEE Historical Committee and member of the Board of Directors of the Douglas Perham Foundation.

JAN. 23, Thursday, 8:00 p.m., Lockheed Auditorium, Bldg. 202, 3251 Hanover St. Palo Alto. No dinner. For information call Joe Shrock, 743-2012 or Al Hastings, 742-0372.

AUTOMATIC CONTROL JAN. 21

Story on
page 6

COMPUTER CONTROL OF CEMENT PROCESSES. Dr. Kwan Y. Wong, IBM Research Division, San Jose.

JAN. 21, Tuesday, 8:00 p.m., University of Santa Clara, Engineering Center, Room 551. Dinner: 6:30 p.m., Le Boeuf, across from the University. No reservations required.

CIRCUIT THEORY JAN. 15

DESIGN AND APPLICATIONS OF HYBRID INTEGRATED CIRCUIT ACTIVE FILTERS. Gunnar Hurtig, III, Vice President, Operations, Kinetic Technology Inc.

JAN. 15, Wednesday, 8:00 p.m., 134 McCullough Bldg., Stanford. Dinner: 6:00 p.m., Red Cottage, 1706 El Camino Real, Menlo Park; Reservations: Mrs. Janet DeLaney, 642-3705 by Jan. 14th.

COMMUNICATION TECHNOLOGY JAN. 22

Story on
page 14

A SURVEY OF COMMUNICATIONS TECHNOLOGY. A ONE-DAY SEMINAR.

JAN. 22, Wednesday, 9 a.m., University of Santa Clara. Registration - \$4.50 (\$2.50 for full-time students). For information and registration call Milt Seymour at 593-8491 or Paul Ahern (408) 291-4415.

COMPUTER JAN. 28

Story on
page 6

SEMICONDUCTOR MEMORY CIRCUITS AND SYSTEMS. Dr. Wendell B. Sander, Fairchild Semiconductor, Palo Alto.

JAN. 28, Tuesday, 8 p.m., Room 134 McCullough Bldg., Stanford. Dinner: 6:15 p.m., Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto. Reservations: Tom Whitney, 326-7000, Ext. 3112 or 2707 by Jan. 27th.

ELECTROMAGNETIC COMPATIBILITY JAN. 20

Story on
page 8

SIMPLIFIED RF ELECTROMAGNETIC SHIELDING. Fred J. Nichols, President, LectroMagnetics, Inc., Los Angeles.

JAN. 20, Monday, 8:00 p.m., Hewlett-Packard Auditorium, 1501 Page Mill Road, Palo Alto. Dinner: 6:00 p.m., Rick's Swiss Chalet, Palo Alto. Reservations: Bill Swift, 326-7000, ext. 3088 by Jan. 20th.

ELECTRON DEVICES JAN. 8

Story on
page 14

TRENDS IN SILICON DEVICE TECHNOLOGY. Gordon E. Moore, Intel Corp., Mountain View, and III-V COMPOUNDS AND THEIR APPLICATIONS. John L. Moll, Professor, Stanford Univ.

JAN. 8, Wednesday, 8:00 p.m., Physics Lecture Hall, PH 101, Stanford. Meet at 6:00 p.m. Dinner at 6:30 p.m., Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto. Reservations: Glenna Morris, 327-7800, ext. 360 by Jan. 6th.

ENGINEERING IN MEDICINE AND BIOLOGY JAN. 21

Story on
page 9

PRIMARY RESPONSIBILITIES INVOLVED IN THE METHODOLOGY OF THE CLINICAL AND RESEARCH ACTIVITIES OF THE CARDIOLOGY SERVICES. John M. Shroeder, M.D. and Harry A. Miller, B.S., Stanford University School of Medicine, Division of Cardiology.

JAN. 21, Tuesday, 8:00 p.m., Stanford Medical School, Room M-112. Dinner: 6:30 p.m., Red Cottage, 1706 El Camino Real, Menlo Park. No reservations required.

INDUSTRY & GENERAL APPLICATIONS JAN. 16

Story on
page 16

CABLES! INDUSTRIAL AND GENERAL APPLICATION. James L. Clark, Power and Industrial Division, Bechtel Corp. and Robert B. Zane, Manager, Western Region, Okonite Co.,

JAN. 16, Thursday, 7:30 p.m. Place to be announced. Watch for IGA mailing.

INDUSTRIAL ELECTRONICS & CONTROL INSTRUMENTATION

(This Chapter plans to have a meeting in January, but no information is obtainable as yet. Watch for mailing.)

Calendar

INFORMATION THEORY JAN. 16

Story on
page 16

LOGICAL DESIGN WITH ONE "NOT" — ELEMENT.
Prof. D. A. Huffman, University of California, Santa Cruz.

JAN. 16, Thursday, 8:30 p.m., SRI Conference Room B, Bldg. 1, 333 Ravenswood Ave., Menlo Park. Dinner: 6:15 p.m., Ming's of Palo Alto, 1700 Embarcadero Road, East Palo Alto. Reservations: Mrs. Mary Rodimon, 966-3217.

MAGNETICS JAN. 14

Story on
page 15

DETERMINATION OF IMPERFECTIONS IN MAGNETIC MATERIALS USING MICROWAVE RESONANCE TECHNIQUES. Dr. Ronald F. Soohoo, Professor and Chairman, EE Dept., University of California, Davis.

JAN. 14, Tuesday, 8:00 p.m., Engineering Center, University of Santa Clara. Dinner: 6:30 p.m., Mariani's, 2500 El Camino, Santa Clara. Reservations: R. B. Yarbrough or Miss Alvarado, 246-3200, ext. 226 by Jan. 10th.

MICROWAVE THEORY & TECHNIQUES JAN. 8

Story on
page 18

SHOULD YOU START YOUR OWN MICROWAVE COMPANY? Manfield W. Meisels, Editor, MicroWave Magazine.

JAN. 8, Wednesday, 8:00 p.m., Hewlett-Packard Auditorium, Bldg. 5M, 1501 Page Mill Road, Palo Alto. No dinner.

PARTS, MATERIALS & PACKAGING JAN. 28

PRACTICAL APPLICATION OF MONOLITHIC ANALOG CIRCUITS. THIRD LECTURE IN SERIES OF FIVE ON 8 ASPECTS OF MICRO-ELECTRONICS. Dr. Don MacWilliams, Moderator.

JAN. 28, Tuesday, 7:30 p.m., Conference Room, Bldg. 5M, Hewlett-Packard, 1501 Page Mill Road, Palo Alto. No dinner.

POWER JAN. 14

Story on
page 18

CONVERSION OF OVERHEAD TO UNDERGROUND DISTRIBUTION IN COMMERCIAL AREAS. C. D. McAtee and R. L. Capra, PG&E Co.

JAN. 14, Tuesday, 7:30 p.m., Engineers' Club of San Francisco, 160 Sansome St., S.F. Cocktails: 5:30 p.m. Dinner 6:30 p.m. Reservations, Engineers' Club, 421-3184 by noon, Jan. 13th.

RELIABILITY JAN. 16

Story on
page 18

IS THERE A PAYOFF FOR RELIABILITY? Panel discussion. R. B. Allan, P-100 Program Manager, LMSC, Sunnyvale, and E. V. Bersinger, Manager, Reliability & Systems Integration Program 949, Aerospace Corp., El Segundo. (A third speaker will be announced later.)

JAN. 16, Thursday, 8:00 p.m., PH 101, Stanford. Social 6:00 p.m. Dinner 6:45 p.m., Stanford View Restaurant, 1921 El Camino, Palo Alto. Barbeque steak \$3.00 including tax and tip. Reservations: Fran Hamada (408) 743-1577 by Jan. 14th.

SSF SECTION/EAST BAY SUBSECTION JAN. 27

Story on
page 15

THE APOLLO EFFORT. Bradford A. Evans, Public Affairs Officer, NASA.

JAN. 27, Monday, 7:30 p.m., Engineers' Club of San Francisco, 160 Sansome St., San Francisco. Cocktails 5:30 p.m. Dinner 6:30 p.m. Ladies and guests invited. Reservations: Oakland: Florence Wanser, 835-8500, ext. 53; San Francisco: Mary Vilter, 399-4974; San Jose: Linda Jarrett, 291-4567, (408). Palo Alto: Section Office, 327-6622 by Jan. 24th.

SANTA CLARA VALLEY SUBSECTION FEB. 19

Story on
page 6

JOINT MEETING WITH STUDENT BRANCHES. ENGINEERING EDUCATION OF THE FUTURE: CONTENT AND METHODS. Prof. Timothy Healy, Santa Clara University and Dr. Glenn Keitel, San Jose State College.

FEB. 19, Wednesday, 8:00 p.m., Santa Clara University Poly Science Room 206, Engineering School. No dinner.

VEHICULAR TECHNOLOGY JAN. 20

Story on
page 16

FIELD TRIP TO S.F. HALL OF JUSTICE RADIO COMMUNICATION ROOM, 4th floor, 850 Bryant St., San Francisco and to Central Radio Station, Christmas Tree Point, NE slope of Twin Peaks. Speaker at dinner: Burton H. Dougherty, General Manager, Dept. of Electricity, S.F. At Hall of Justice: Lt. Harrison Williams; at Christmas Tree Point, Frank Garkus.

JAN. 20, Monday, 8:00 p.m., tours as listed above. Dinner: Rickey's Red Chimney, 19th & Junipero Serra, San Francisco Stonestown. Cocktails at 6:30 and dinner at 7:00 p.m. For reservations call 433-3800 or 349-3111.

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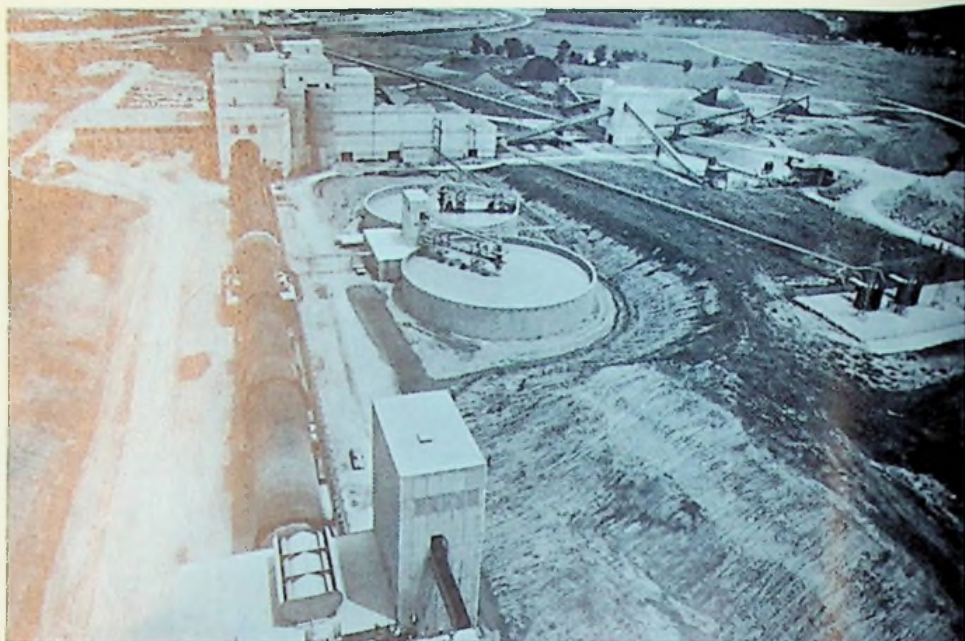
Computer Control of Cement Processes

Dr. Kwan Y. Wong of IBM Research will discuss the application of linear multivariable control theory to cement kiln and cooler control at the January 21, Automatic Control meeting. He has spent two years in implementing the computer control of the Dundee Cement plant at Clarksville, Missouri, which is the largest existing cement kiln in the world. The computer control system has been fully operational since May, 1968.

A review will be made of the basic principles of cement manufacture, followed by a description of control problems associated with this process. Good control of the temperature profile of the kiln and temperature and pressure points in the cooler is needed to assure uniform cement clinker quality. Thus the first objective of computer control is regulation.

The approach taken was to collect input-output data from the process and use this data to develop a dynamic multi-variable linear model using regression analysis techniques. Using this model, a feedback control law is generated to minimize a quadratic performance criteria.

Results, benefits, and interesting features that arise from the application of computer control as well as the mathematical techniques used will be discussed.



Dundee Cement Plant at Clarksville, Missouri with 750 foot length, 25 foot, diameter kiln.



Dr. Wong

Dr. Wong received his B.E. and M.E. degrees from the University of New South Wales, Sydney, Australia in 1960 and 1963, respectively. He completed his Ph.D. degree in 1966 from the University of California, Berkeley, and since then has been working with the Systems Department at IBM Research Division, San Jose, California. He is the author of several technical papers.

The meeting will be held Tuesday at 8:00 PM in the Engineering Center, Room 551, at the University of Santa Clara, preceded by dinner at 6:30 PM, Le Boeuf's, across from the University. No reservations.

Semiconductor Memory Circuits and Systems

The Tuesday, January 28 meeting of the Computer Chapter will feature Dr. Wendell B. Sander as speaker. His topic will be "Semiconductor Memory Circuits & Systems."

Various types of semiconductor memories will be discussed including standard read/write memories, read-only memories, associative memories, shift registers, and multi-port memories. The general timing and logic characteristics of these memories in system applications will be described. Logic and circuit techniques used within the memory structures to achieve low cost and interconnection simplicity will be discussed to provide insight into the trade-offs and constraints of semiconductor memory.

Dr. Wendell B. Sander received his B.S., M.S., and Ph.D. in Electrical En-

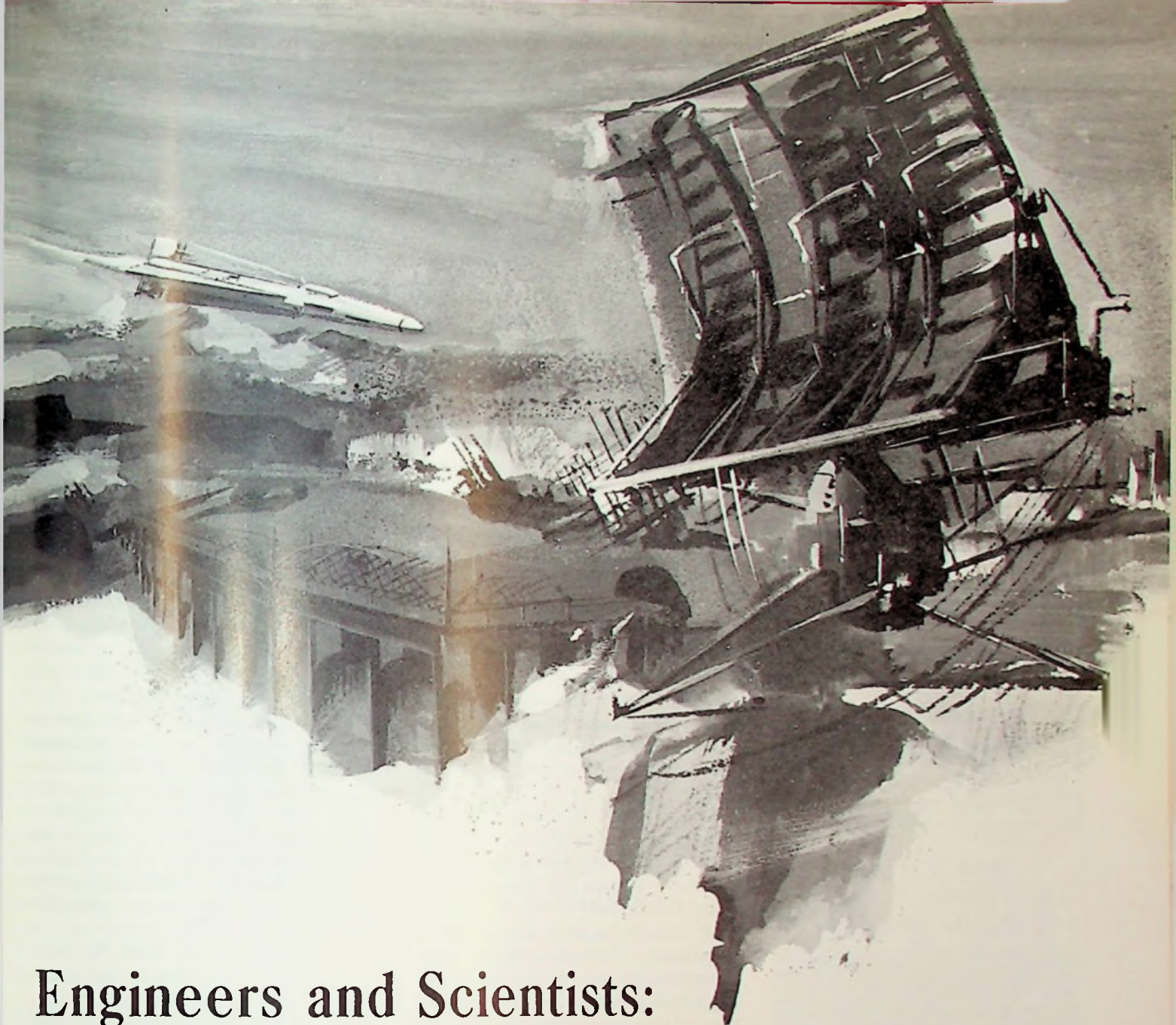
gineering from Iowa State University in 1956, 1962, and 1963 respectively. His background includes missile telemetry circuits and systems at Gilfillan Bros. (now ITTT Gilfillan) and special purpose hybrid computer and display system design at Tasker Industries prior to joining Fairchild Semiconductor R&D Laboratories in 1964. He is presently head of the Memory System Engineering section of the Digital Systems Research Department. Dr. Sander has presented numerous papers on LSI techniques and is chairman of the Computer Group of the San Francisco Section of the IEEE.

Meeting time: 8:00 PM, the place: McCullough Building, Room 134, Stanford. Dinner at 6:15 PM, Rick's Swiss Chalet. Reservations. See calendar.

SCVSS Hosts Student Branches

"Engineering Education of the future: Content and Methods" is the topic of the February 19th joint meeting of the Santa Clara Valley Subsection and the Student Branches. The meeting is scheduled for 8:00 PM in the Political Science Room 206, Engineering School, University of Santa Clara. No dinner.

Professor Timothy Healy, of the University of Santa Clara Electrical Engineering department, and Dr. Glenn Keitel, chairman of the Electrical Engineering Department at San Jose State College, will discuss the direction which the academic world feels the engineering education of the future will take, will the systems approach prevail in the future and what are the special educational facilities which will be used to aid the professor. The talks will include some demonstrations.



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NEW MEMBERS

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Simplified Electromagnetic Shielding

There are numerous applications in the use of electronic instrumentation systems, communications, computers, military specifications etc. that require RF electromagnetic shielded enclosures. This applies to simple component cases up through RF shielded rooms. The topic will be limited to large cabinets and shielded rooms to be presented by the EMC Chapter at their January 20 meeting. The speaker will be Fred J. Nichols.

A general review will be given in semi technical language of the fundamental equations necessary to have a basic understanding of how RF shielding is obtained.

The use of these fundamentals will be shown in graphic form in order to clearly show their effects on obtaining a suitable RF shielded enclosure.

Use of various materials, assembly techniques, doors, ventilation, power line filters etc. will be briefly described in order to show the end result of a given RF enclosure compared to its design objective. Audience participation by questions and answers will be invited.

Fred J. Nichols is founder and President of LectroMagnetics, Inc., and former President and General Manager of Genistron, Division of Genisco Technology Corporation.

Mr. Nichols has more than 25 years experience in Engineering and Management in the fields of Electronics and Aircraft Control Systems. The past 17 years of this experience have been exclusively devoted to Engineering and Management of Radio Frequency Con-



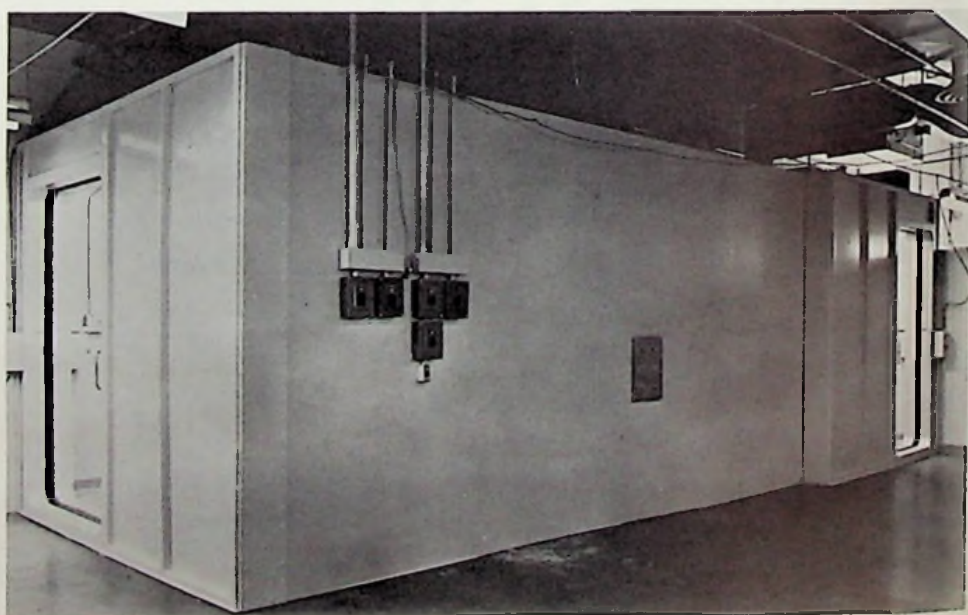
Mr. Nichols

trol through measurements, studies, correction of spurious radiation, CW and Broadband interference. These control programs include project direction on components and systems, as well as complete responsibility of RF control on Aircraft and Missile Systems.

As well as a noted consultant to various Government agencies on electromagnetic capability, Mr. Nichols is also a lecturer and the author of many technical publications. He is a California Professional Engineer, Register No. E2915. He has numerous professional affiliations and is an IEEE Committee man and past Vice President and Chairman of the RFI Group.

Dinner will be at 6:00 PM, Rick's Swiss Chalet, followed by the meeting at 8:00 PM, Hewlett Packard Auditorium. Call Bill Swift, 326-7000 by January 20 for reservations. See Calendar for details.

Class AA - 3/16" Shields - dual RF shielding room with sliding doors - all welded construction.



Experience with Cardiac Transplantation

Heart transplantation has been performed on nine patients over the past ten months at Stanford University Hospital Center. The surgical technique employed was developed by Dr. N. E. Shumway and associates in 1959-60, however, its application to humans did not occur until December of 1967.

Clinical research has concentrated on the detection of early rejection of the transplanted heart so that it can be reversed by immunosuppressive drugs and therapy. Early in the rejection process, the electrical properties of the heart show decrease in voltage as measured by the electrocardiogram and vectorcardiogram. The mechanical properties of the heart show a decreased compliance and decreased contractility as measured by cardiac output, ballistocardiography and intravascular blood pressure derivatives (dp/dT) in the peripheral arteries. Reflected ultrasound techniques are found to be valuable maneuvers to assess heart volume, wall thickness, and valvular function.

This will be the topic for discussion at the Tuesday, January 12 meeting of the Engineering in Medicine and Biology Chapter.

The discussion will encompass the medical experiences involved in heart transplantation as well as the role of the present medical electronic technology utilized to monitor and assess cardiac function in these patients.



Dr. Schroeder

Dr. John S. Schroeder and Harry A. Miller will be the speakers. Dr. Schroeder, a post-doctoral Fellow in the Division of Cardiology at the Stanford University School of Medicine, is a member of the cardiac transplant team and responsible for selection of recipients and evaluation of cardiac function of transplanted patients.



Mr. Miller

Mr. Miller, Laboratory manager of the Cardiology Division at Stanford, has the primary responsibilities involving organizing the technology and laboratory methodology of the clinical and research activities of the Cardiology services.

The meeting will be held in the Stanford University Medical School lecture room M-112, in the Medical Center complex, at 8:00 PM. Dinner at 6:30 PM at the Red Cottage, 1706 El Camino Real, Menlo Park. Call the Red Cottage, 322-7384, for reservations.

Progress Report - Electronic Museum

In the fast-moving, dynamic discipline of Electronics and Systems Engineering, an occasional backward glance is sometimes helpful in maintaining proper perspective, in gaining a better appreciation of where we are, and for getting a bearing on which way we are headed. Such a backward glance is being made available to all those interested, at the January 23 meeting of the San Francisco Chapter of Aerospace and Electronics Systems Group, scheduled for 8:00 PM, Lockheed Auditorium, Bldg. 202, Hanover Street, Palo Alto.

Mr. Earl Goddard, Chairman of the IEEE Historical Committee and a member of the Board of Directors of the Perham Foundation, will present a status report on the progress of the Electronics Museum being constructed on the Campus of Foothill College. Photographs and charts will augment a talk which should prove highly interesting to all IEEE members and their guests. As a special treat, it is planned to play tape recorded interviews with some of the early Bay Area electronics pioneers. No dinner. For further information, see Calendar.



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IEEE 1969 FELLOW AWARDS

Astrahan, Morton M. — For leadership, organization, and management of professional society activities in the computer field, and for contributions to computer system design.

Ayer, William E. — For creative research, inspirational leadership, and sound engineering in the development and production of sophisticated electronic countermeasure systems.

Bettsworth, Thomas A. — For pioneering leadership in the field of electric power distribution.

Brown, David R. — For leadership in the development of digital-computer components and the design and operation of large-scale information processing systems.

Everhart, Thomas E. — For inspiring teaching, and contributions to scanning electron beam devices.

McMurtry, Burton J. — For contributions to the development of lasers and photodetectors and for technical leadership in electro-optic research.

Nash, John P. — For contributions to the design and programming of computers, and leadership in industrial applications of information processing.

Rice, Rex — For contributions to the organization and applications of digital systems.

Smith, Bob H. — For pioneering contributions to large radio-frequency-type particle accelerators, and for developing unique methods of resonator analysis in the accelerator field.

Smith, Ralph J. — For eminent work in the advancement of engineering education, including excellent teaching, highly responsible administration, and effective writing that has guided, inspired, and aided scores of thousands of young men.



Morton M. Astrahan

Dr. Morton M. Astrahan joined IBM in 1949 as a Technical Engineer at the Endicott Laboratory. He transferred to Poughkeepsie the following year where he worked on planning and logic design for the IBM 701 computer. From 1952 to 1956 he was in charge of IBM's system planning, input/output development, and finally prototype testing for the AN/FSQ-7 computer system for the SAGE Air Defense System. At the peak of this work, he supervised several departments containing 250 people. Dr. Astrahan moved to the San Jose Research Laboratory in 1956 and worked on data communication based and time-shared systems. From 1962 to 1964 he was located in France as Manager of Technology for the IBM European Labs, reporting to the Director of the European Labs. Returning to San Jose, Dr. Astrahan spent a year as Manager of the Instructional Systems Department at San Jose. After working on

The grade of Fellow is one of unusual professional distinction and is conferred only by invitation of the Board of Directors upon a person of outstanding and extraordinary qualifications and experience in the fields of electrical engineering, electronics, radio, allied branches of engineering, or related arts and sciences.

information handling and financial data systems, he assumed his present duties in February 1968. He is currently manager of a project concerned with on-line management of a large data base.

Dr. Astrahan organized the IRE Professional Group on Electronics Computers (now the IEEE Computer Group), and served as its first chairman in 1952-53. He was chairman of the National Joint Computer Committee, forerunner of AFIPS, from 1956 to 1958. He organized and participated in an exchange of visits in the computer field with the USSR in 1959. Currently he is chairman of the AFIPS Joint Computer Conference Committee, responsible for initiating and guiding the Conferences.

Dr. Astrahan received a BSEE from Northwestern University in 1945, an MSEE from the California Institute of Technology in 1946, and a Ph.D. in Electrical Engineering from Northwestern University in 1949.



William E. Ayer

Dr. William E. Ayer received his B.A., M.A., E.E., and Ph.D. from Stanford in 1943, 1944, 1948, and 1951 respectively.

From 1946-51 he started as a design engineer for MacKay Radio and Telegraph Company, becoming the head of antenna systems development in 1948. From 1951-57 he was in the Applied Electronics Program at Stanford University, serving successively as project engineer, group leader and head of the systems development section. His work was principally in the fields of radar intercept receivers and deceptive countermeasures devices. He was responsible for advances in the application of traveling wave and related beam tubes to military problems and for development of specialized microwave, video, and display circuitry capitalizing on the inherent characteristics of these tubes. From 1957-59 he became Vice President and Engineering Director for Granger Asso-

ciates, establishing their capability in the development and manufacture of reconnaissance receiving systems and countermeasures equipment.

In 1959 he founded and served as President and director of Applied Technology in Palo Alto until September of 1967, when the company became a division of Itek Corporation of Lexington, Massachusetts. At that time Dr. Ayer was elected Vice President and Director of Itek. He continues as President of Applied Technology.

Dr. Ayer is a member of Tau Beta Pi and Sigma Xi.

He has several patented video circuitry inventions, and has several unclassified, secret and confidential publications, including "Characteristics of Crystal-Video Receivers Employing R-F Preamplification," "The S-440 Repeater Jammer," and a chapter in *ELECTRONIC COUNTERMEASURES* entitled "Radar ECM Repeaters and Transponders."



Thomas A. Bettersworth

Thomas A. Bettersworth received his B.S. in Electrical Engineering from the University of California, Berkeley, in May 1934, and is a Registered Professional Engineer, State of California.

From 1935-36 he was testing electrical apparatus for General Electric Company in Schenectady, Pittsfield and Philadelphia. From 1936-45 he was an Electric Distribution Engineer for San Joaquin Light & Power Corporation and Pacific Gas and Electric Company, in Fresno. From 1945-59 he was in the General Office Department of Electric Distribution Engineering with Pacific Gas and Electric Company in San Francisco. In 1959 he became Chief Electric Distribution Engineer there.

Mr. Bettersworth is a member of the San Francisco Electric Club, the San Francisco Engineers Club, and the Pacific Coast Electrical Association. He also serves on the Transmission & Distribution Committee of Edison Electric Institute, the U.S.A. Standards Committee C84, Voltage Ratings for AC Systems and Equipment, and the Distribution Technical Advisory Committee for updating the Federal Power Commission's National Power Survey.

Mr. Bettersworth is also the author of many technical papers and articles in the field of electric power distribution.



David R. Brown

As Director of the Information Science Laboratory of Stanford Research Institute, Mr. Brown is concerned with research in computer design, artificial intelligence, man-computer techniques, programming, control theory, and system engineering.

Mr. Brown received a B.S. degree in Electrical Engineering from the University of Washington in 1944 and an M.S. degree in Electrical Engineering from M.I.T. in 1947.

From 1944 to 1946, Mr. Brown was a member of the Applied Physics Laboratory of the University of Washington. From 1946 to 1948, he worked at the Servomechanisms Laboratory, M.I.T., on the design of the Whirlwind I Computer. From 1948 to 1951, he was a Lecturer in Electrical Engineering at the University of California, where he contributed to the design of the CALDIC (California Digital Computer). In 1951 he returned to M.I.T. to become leader of the Magnetic Materials Group of Lincoln Laboratory, where he was responsible for the development of the ferrite memory core. There he subsequently became leader of the Advanced Development Group, which designed and built the TX-0 and TX-2 computers; he was also the head of the SAGE System Office. In 1958 he joined the Mitre Corporation as head of the SAGE System Office, serving as the first head of the Component Department, as a member of the ONR Pacific Command Study Group (1959 - 1960), as head of the Theater Operations Department, and as Associate Technical Director.

Mr. Brown is a Member of the IEEE and the Association for Computing Machinery. He is Chairman of the IEEE Computer Standards Committee and the AFIPS Technical Program Committee.



Thomas E. Everhart

Thomas E. Everhart received the B.A. degree in Physics from Harvard University, Cambridge, Massachusetts, in 1953, the M.Sc. degree in applied physics from the University of California, Los Angeles, in 1955, and the Ph.D. degree in Engineering from Cambridge University, England, in 1958.

He was engaged in traveling-wave tube research at the Hughes Research Laboratories from 1953 to 1955, and performed research related to scanning electron microscopy at Cambridge University from 1955 to 1958, when he joined the faculty of the University of California at Berkeley. Parametric amplification and wave-propagation in plasmas were two subjects of early research at Berkeley. He spent the 1962-63 academic year at Westinghouse Research Laboratories, Pittsburgh, Pennsylvania, investigating the evaluation of semiconductor integrated circuits using scanning electron-beam techniques. Upon returning to Berkeley, he designed and constructed a scanning electron microscope to continue this work, emphasizing quantitative measurements on semiconductor devices. He spent the 1966-67 academic year as National Science Foundation Senior Postdoctoral Fellow and Guest Professor in the Institute for Applied Physics, University of Tuebingen, West Germany, studying electron optics and point cathodes. He is presently Professor of Electrical Engineering and Computer Sciences at the University of California, Berkeley.

Dr. Everhart is a member of Phi Beta Kappa, Sigma Xi, and Eta Kappa Nu.



(Continued on page 12)

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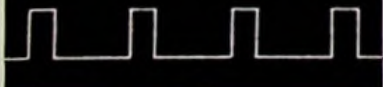
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FELLOW AWARDS



Burton J. McMurtry

Dr. Burton J. McMurtry is Director of the new Electro-Optics Organization of Sylvania Electronic Systems in Mountain View, California. This organization is the focal point within General Telephone & Electronics for corporate-wide effort in electro-optic systems, devices, and research.

He was educated at Rice University (B.A., 1956 and BSEE in 1957) and at Stanford University (MSEE in 1959 and Ph.D. EE in 1962).

Dr. McMurtry joined Sylvania in 1957 and has held various technical and management positions in microwave devices and electronic systems organizations. Author of a number of papers on microwave and optical devices, one of these papers led to his selection as recipient of the Alfred Nobel Prize in 1963.

He has served as Group Coordinator of the San Francisco Section of the IEEE and has served in several positions on IEEE conference committees.

Dr. McMurtry is a member of Tau Beta Pi, Sigma Xi, Sigma Tau, The Scientific Research Society of America, the IEEE, The American Physical Society, The Optical Society of America, The American Association for the Advancement of Science, and the New York Academy of Sciences.



John P. Nash

After graduation in Mathematics from the University of California, Berkeley, John P. Nash pursued advanced

degrees at Rice University, culminating in the Ph.D. in 1940, following which he was Assistant Professor of Mathematics at Notre Dame. A leave of absence during the war years took him to M.I.T. Radiation Laboratory as staff member for Radar Systems Research. For four years he was with Kimberly Clark Corporation as a Research Physicist in acoustics, elasticity and fluid flow. From 1950-1957, as Research Professor of Applied Mathematics at the University of Illinois, his work was in design of control circuits for ORDVAC and ILLIAC computers and in the programming of digital computers. Joining Lockheed in 1957 as Manager of the Information Processing Division, he directed an integrated program of computer development and utilization, and as Associate Director of Communications and Controls Research, directed Research & Development activities in electronics, mathematics and information processing. During this period, he was also Editor of the IRE Transactions on Electronic Computers. In 1959 he was put in charge of all LMSC research as Director and later Vice President, Research and Engineering, guiding the company's scientific and engineering programs appropriate to the Agena and Polaris programs and commercial developments. In 1963 he was made Vice President and Assistant General Manager for the newly established Research & Development Division, and in 1968 took on his present position of Vice President and Assistant General Manager, Space Systems Division, in an exchange of executive department heads. Aside from his editorial work, he has published papers in the radar and computer fields, and contributed a section on Computers in American Peoples Encyclopedia Yearbooks.



Rex Rice

Rex Rice received a B.A. degree in mechanical engineering at Stanford University in 1940.

He was with Douglas Aircraft, Santa Monica, from 1940 to 1946, as a project tooling engineer. He joined Northrop Aircraft in 1946 to do research on methods of structural analysis. This work involved complex computations which led to an interest in computers, and in 1951, he was appointed Assistant Chief of Computer Services.

In 1955, he joined IBM as a Senior Engineer and Manager in charge of a major machine program, transferring to IBM Research in 1958 on the Technical Staff and Manager of the Cost Oriented Systems Section to exploit inter-technological work in computer languages, programming, logic, circuits and packaging.

In March, 1963, he joined Fairchild Semiconductor and established the Digital Systems Research Department. He is presently directing study programs to investigate the interactions between integrated circuits, system packaging and information processing systems.

He is the recipient of an Outstanding Paper Award for a presentation at the 1964 ISSCC. The work reported in the paper resulted in the dual in-line component package which is now an industry standard. He is a Past Chairman of the San Francisco Computer Chapter.

The numerous technical papers he has presented on computer oriented subjects since 1953 have been interdisciplinary and include discussions on components, component packaging, system packaging, logical design methods, system architecture, LSI and the impact of advancing technology on engineering.

Mr. Rice has six issued U.S. patents and seven applications pending in the computer field plus a number of issued foreign patents.



Bob Hugh Smith

Bob Hugh Smith currently directs the research and development of the electronic systems of a new-type heavy-ion particle accelerator — the Omnitron — at the Lawrence Radiation Laboratory. This accelerator, of which he is co-inventor, is intended to open new fields of research in biology and medicine, and in super-heavy-element chemistry. Previous projects include the original work on three-phase rf systems and panel-tuned resonators for variable-energy cyclotrons. He has served widely as a consultant on design and construction of particle accelerators and associated research equipment. His interests include the fields of nonlinear magnetics, solid-state instrumentation, automatic control, and high voltage phenomena. He has published many research papers in the particle-accelerator field and sev-

eral in electroacoustics. For the latter work he was elected to the grade of Fellow of the Audio Engineering Society in 1959.

Dr. Smith received his B.S., M.S., and Ph.D. in electrical engineering at the University of California, Berkeley.



Ralph J. Smith

Ralph J. Smith graduated from the University of California in 1938, earned the M.S. in 1940, and then began teaching at San Jose State College. He completed his graduate study at Stanford University in 1945 and returned to San Jose State to establish an engineering department. Under his leadership the department flourished; curricula were

developed and new buildings constructed, and ultimately the programs were accredited by the Engineers' Council for Professional Development.

In 1957 he was appointed Professor of Electrical Engineering at Stanford, and his first assignment was as an adviser on electronics to the Republic of the Philippines under an AID-Stanford contract. Eight years later he returned to the Orient as a consultant on engineering education to the Republic of South Vietnam in the summer of 1965.

Since 1958 Professor Smith has been concerned with the undergraduate engineering program at Stanford. At present he is Associate Head of the Department of Electrical Engineering with responsibility for courses and curricula. His most recent assignment was as Chairman of the task force for "The Study of Engineering Education at Stanford." The major recommendations of this study have been approved by the Engineering faculty.

His freshman orientation text, **ENGINEERING AS A CAREER**, has been widely used and a third edition is in press. He is also author of **CIRCUITS, DEVICES, AND SYSTEMS**, a basic text in electrical engineering that is used in this country and abroad; it has recently been translated into Spanish and Portuguese.



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Anticipating the demands for long range surveillance radar that the Supersonic Transport planes of the 70's will bring, English Electric has developed a compact L-Band, vapor cooled 2 MW magnetron that is likely to knock power klystrons from their present hold of that market.

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Electron Devices Features Two Speakers, Two Topics

At the January 8 meeting of the Electron Devices Chapter, Dr. John L. Moll will discuss "III-V Compounds and Their Applications" and Dr. Gordon E. Moore will review "TRENDS IN Silicon Device Technology."

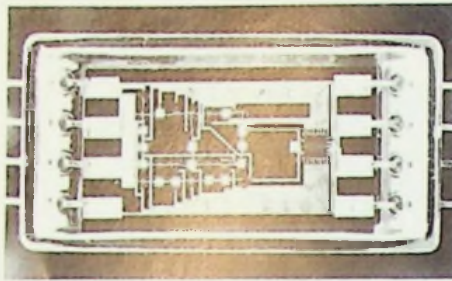
The present status of silicon device technology is reviewed in order to point out its limitations. The combination of melt-doping, epitaxial growth, and oxide-masked diffusion allows, at least in principle, the construction of about any desired impurity configuration within the silicon crystal. Our present understanding of the silicon-silicon oxide surface allows the design and control of the important surface properties and makes available such important devices as MOS transistors. The limitations of most concern in these areas of wafer fabrication technology are those associated with improving process control and minimizing defects. Effort in this area takes the form of relating cause to effect followed by appropriate detailed process changes. It represents a direction of extreme importance in maximizing the impact of silicon devices through greatly reduced cost.

Interconnection flexibility for complex structures is being expanded through the incorporation of multi-layer metal and the associated insulators. Device metallurgy is receiving much attention in this connection as are a variety of insulator films.

Making the structure more useful through effective assembly and packaging represent a major direction. Ambient protection and new assembly techniques are principal areas receiving attention. Design and testing techniques are extremely important with the new levels of functional complexity that are becoming practical. It may well prove that these aspects of making useful structures are more limiting than is the process of technology.

As a co-founder of Fairchild Semiconductor Corporation, Dr. Gordon E. Moore was initially responsible for establishing the processing technology and the first product design in the semiconductor industry. Upon transfer of the first few products to full manufacturing status, he assumed the post of Director of Research and Development in 1959.

His personal contributions are primarily in the area of processing technology and device structures, metalizing diffusion, metalization, bonding and



A Ga As P Numeric Display using p-n junction electroluminescence. This display represents one of the uses of III-V compounds. packaging.

Dr. Moore holds several patents on semiconductor techniques and device structures and has written some twenty technical publications including the semiconductor integrated circuit chapter of "Microelectronics." He is a Fellow of the IEEE and a member of the American Physical Society, Electrochemical Society and Sigma Xi.

The III-V compounds and their alloys offer a unique combination of new electrical and optical properties. The available variety of band structure allows these materials to compete for electronic and optical functions not accessible to the elemental semiconductors. Some of the more unusual possible applications include photoemitters of high quantum efficiency almost to the threshold of photoemission, secondary electron surfaces of very high and stable gain, and cold electron emitters. In addition to the two terminal microwave applications, some possible future three terminal amplifiers and oscillators will be discussed.

Since the fall of 1958, Dr. Moll has been at Stanford University, where is is Professor of Electrical Engineering.

He is the author of approximately 25 papers on the subject of solid state devices and physics of solids as well as the graduate-level textbook PHYSICS OF SEMICONDUCTORS. In addition, he has patents in the subjects of electron devices and circuits.

Dr. Moll is a member of Sigma Xi and APS and a fellow of IEEE. He is also an honorary editor of the International Journal - Solid State Electronics. He was the recipient of the Howard N. Potts Medal of The Franklin Institute in 1967.

The meeting is called for 8:00 PM, Wednesday, January 8 in the Physics Lecture Hall, PH 101, Stanford University. Cocktails 6:00 PM at Rick's Swiss Chalet with dinner at 6:30 PM. Reservations. See Calendar.

Survey of Communications Technology

The ComTech Group, after a successful one-day seminar last year on "Digital Data Communications," has decided again to present a one-day seminar entitled "A Survey of Communications Technology." The one-day session will be held January 22 at the University of Santa Clara and will cover the aspects of Communications Technology.

Whether you are a manufacturer, planner, user (military, space or commercial) or student we will be presenting something of interest for you. There will be speakers from Philco-Ford, PG&E, Lenkurt, The Bell Labs, and from the military. Subjects will include new technology and the future of the communications industry, manufacturing aspects, applications and military and space aspects of communications. Each speaker will speak from thirty to forty minutes with a question and answer period following.

The day will begin with registration at 9 AM with our first speaker starting at 9:30. For the registration fee of \$4.50 (\$2.50 for full-time students) you will enjoy a very informative day and a luncheon.

For more details call Milt Seymour (415) 593-8491 or Paul Ahern (408) 291-4415. Also watch your mail. We will be mailing more details.

Granger 69 Vice-President



IEEE Directors announced the election by the voting members of Dr. John V. N. Granger as Vice President, 1969. For his achievements, Dr. Granger received

the honor of being named "The Outstanding Young Electrical Engineer of 1952" by Eta Kappa Nu, national honor society of electrical engineers. In 1955 he received the IRE Seventh Region Achievement Award for his contributions to aircraft antenna development, organizational leadership in engineering and in the affairs of Stanford Research Institute.

He is a Fellow of the IEEE and has served on the board of directors of the San Francisco Section. He has also been a trustee of his alma mater, Cornell College, and a member of the Board of Governors of the Committee for Art at Stanford.

Nasa's Project Apollo



The prime crew for the National Aeronautics and Space Administration's Apollo 8 Moon Orbital Flight astronauts (L to R) William A. Anders, Lunar Module (LM) Pilot, James A. Lovell, Jr., Command Module (CM) Pilot, and Frank Borman, Commander are shown inside the Apollo mission simulator.

Project Apollo, America's attempt to put a man on the moon will be the subject of the joint meeting of the East Bay Subsection and the San Francisco Section, on Monday, January 27. The speaker will be Mr. Bradford A. Evans, Public Affairs Officer for the National Aeronautic Space Administration's Ames Research Center at Moffett Field.

Mr. Evans' talk will cover Project Apollo from the current orbital flight to the lunar landing mission. The lunar landing mission will be covered in detail from launching through moon landing and return and will include pictures. Slides of previous Apollo Flights will also be shown.

The second part of the talk will center on the benefits that are resulting from the U.S. space exploration efforts, including some examples. This will be followed by a question and answer period.

Mr. Evans received his BS and MS degrees from Boston University. He started in the missiles and space program in 1948. Following an assignment in Washington, D.C., where he was in charge of public information matters for the U.S. Air Force, aircraft, engine and missile developments, Mr. Evans went to Cape Canaveral in 1949 to organize and operate the public information program for the country's first long-range missile launching facility. He is a member of the American Institute of Aeronautics and Astronautics.

Mr. Evans



Wives and guests are invited. A large attendance is expected, so make reservations early. See calendar for details.

Those members who have not seen the new quarters of the Engineers' Club are in for a treat. The Club is located in the Hong Kong Bank Building in the heart of San Francisco's financial district. The surroundings are elegant and the cuisine excellent. The view of the city is also very pleasant.

Determination of Imperfections in Magnetic Materials

By subjecting small areas of ferromagnetic material to microwave radiation sequentially and observing the resulting resonance absorption spectra, it has been possible to determine the spatial distribution of a number of pertinent magnetic parameters. These include the Landé g-factor, magnetization, magnetic anisotropy, and resonance linewidth. The term "Microwave Magnetic Microscope" has been coined for this specialized but high-resolution version of a microwave magnetic spectrometer. In contrast to other forms of microscopes, the Microwave Magnetic Microscope determines the magnetic (and not physical) properties of the material directly. It is estimated that an ultimate resolution of about one micron for this instrument is possible, i.e., the magnetic properties of a volume of magnetic material with a linear dimension of about one micron is observable. The best resolution obtained to date is about 10 microns.

of the Magnetics Chapter, the theory and method of determining directly the distribution of magnetic imperfections in materials will be discussed. Results for some typical magnetic materials using the apparatus described above will be presented.

The speaker, Dr. Ronald F. Soohoo, is a professor and the Chairman of the EE Department, University of California, Davis, with a Ph.D. from Stanford. His research is in resonance and solid state physics, particularly magnetism and thin films. He is a senior member of IEEE and a member of the American Institute of Physics, the author of "Theory and Applications of Ferrites" (Prentice Hall Electrical Engineering Series) and "Magnetic Thin Films" (Harper & Row Physics Series) as well as over 40 journal articles.

The meeting place is the Engineering Center, University of Santa Clara 8:00 PM. Dinner at Mariani's 6:30 PM. Reservations by January 10. See calendar for details.

Notice

An excursion trip has been organized for attendees of the 1969 InterMag who wish to travel from the West Coast. Round trip fare Oakland-Amsterdam is \$305 or less. Travel dates are April 11 and return May 4. Conference dates are April 15-18. Since fare is only slightly more than for an east coast trip it is possible that many additional scientists and engineers may attend. If interested please contact Phil Smaller at Memorex Corporation, 1180 Shulman Avenue, Santa Clara, (408) 248-3344, or Irv Wolf, Ampex Corporation, 401 Broadway, Redwood City, (415) 367-3103, by JANUARY 10TH.

At the Tuesday, January 14 meeting

Two Field Trips

The Vehicular Technology meeting on Monday, January 20 will be devoted to two field trips to inspect the radio communication facilities at the San Francisco Hall of Justice and the Central Radio Station on Christmas Tree Point.

Following dinner at the Red Chimney in Stonestown and prior to the tour, Burton H. Dougherty, General Manager of the San Francisco Department of Electricity will describe the history of Radio Communications for all of the major city departments. The group will then divide to visit the Hall of Justice and Christmas Tree Point facilities.

Lt. Harrison Williams will be host at the Radio Communications Room in the Hall of Justice, 850 Bryant Street.

Frank L. Garkus will be host at Christmas Tree Point to show the transmitting facilities which serve police, fire, municipal railways, public works, water department, local Government and Civil Defense. Christmas Tree Point is on the northeast side of Twin Peaks where two 150-foot towers support the arrays of communication antennas. Maps will be distributed to those attending the dinner. Reservations. See Calendar for details.

Logical Design With One "not" Element

It is "obvious" that the inversion of n independent logical variables requires n inverters, or "not" elements. Yet a now-classic result by Markoff is that as many as $n=2^k-1$ variables can be inverted with only k inverters. The result demonstrated in this paper is that, in fact, the inversion of an arbitrarily large number of variables requires only ONE inverter. This is accomplished by replacing a portion of the logical network corresponding to Markoff's construction by a sequential circuit. At its input and output terminals the resulting circuit behaves exactly as would one containing just one inverter for each of the input lines.

A property of the single-inverter network derived in this paper to be discussed at Information Theory's meeting Thursday, January 16, is that (for $n \geq 3$) the circuit pressures unstable equilibria. It is proved that any single-inverter network necessarily has this characteristic.

The speaker is David A. Huffman, presently Chairman of the Board of Studies in Information and Computer Sciences, and the Board of Studies in Linguistics at the University of California at Santa Cruz.

He is a Fellow of IEEE, a member of the Association for Computing Machinery and other professional organizations, Sigma Xi, Tau Beta Pi and other scientific honorary societies. In 1965 he received a Distinguished Alumnus Award from The Ohio State University.

Professor Huffman's Sc.D. thesis, "The Synthesis of Sequential Switching Circuits," was awarded the Louis E. Levy Medal of the Franklin Institute (1955). A more recent paper, "The Generation of Impulse-Equivalent Pulse Trains," was given an award as the Best Paper of the Year (1962) by the Professional-Technical Group on Information Theory of the IEEE. A technique, now known as Huffman Coding, was the subject of an early paper: "A Method For The Construction of Minimum Redundancy Coding."

The meeting location is SRI, Building 1, Conference Room B at 8:30 PM. Dinner time is 6:15 PM at Ming's of Palo Alto. Reservations. See Calendar.

Cables! IGA Chapter Program

Manufacture and construction of cables are related to application engineering. The Industry and General Applications Chapter will learn about the Okonite Company's new cable manufacturing facility at Santa Maria, on Thursday, January 16, 1969 at 7:30 PM. The new plant encompasses the latest and most modern equipment for the manufacture of insulated power and control cables.

Mr. Clark



To discuss the construction of this new plant and how it was developed electrically, James L. Clark, Engineering Group Supervisor, Power and Industrial Division, Bechtel Corp., will talk about the plant electrical distribution system and the features of the major process equipment, including the high voltage test facility.

Mr. Zane



Construction of the cables themselves will be analyzed by Robert B. Zane, Manager, Western Region, the Okonite Company. Mr. Zane will discuss types of insulations, conductors, jackets, shields, among other aspects of cable. More importantly, the questions of applications of particular cables will be treated to suit audience reaction.

The program on cables will initiate the 1969 season for the Industry and General Applications Group. For further information about the program, the IGA Group itself, call Leon Glahn, Metals and Mining Division, Bechtel Corp., 433-4567.

Meeting place and time will be announced in a special bulletin to be mailed later in the month. Everyone is welcome. Get the details from an IGA member.

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Should You Start Your Own Microwave Company?

Mr. Manfred W. Meisels, Editor, Microwave Magazine, will address the Microwave Theory and Techniques chapter Wednesday, January 8, 1969 at 8:00 PM. The title of his talk will be "Should You Start Your Own Microwave Company?" It will be based on a survey now in progress of new microwave and laser companies and scheduled for publication in the January issue of MicroWaves. The talk will allow discussion of factors beyond those in the published article. For example: Why do engineers start new companies? How much does it take? Where does the money come from? What microwave technologies are most attractive for new companies? How does one minimize the risk?, etc.

The talk also will draw from the profile of microwave engineers published in April 1968 MicroWaves to give benchmarks of personal and professional career status for the microwave engineer.

Mr. Meisels holds the Bachelor of Science Degree from Purdue University, 1954. He was founding editor in 1962 of MicroWaves. Previous industrial experience includes Air Associates, Good-year Aerospace, and Ford Instrument Company. He is a member of IEEE and G-MTT.

The meeting will be held at the Hewlett-Packard auditorium, building 5M, 1501 Page Mill Road, Palo Alto. No dinner.

Is There a Payoff for Reliability?

R. B. Allan, P-100 Program Manager, Lockheed M & S Company; E. V. Bersinger, Manager of Reliability and Systems Integration Program 949, Aerospace Corp., El Segundo, and a third speaker to be announced, will lead a panel discussion on the subject "Is There a Payoff for Reliability?" at the January 16 Reliability Chapter meeting. There will be a brief talk by each of the panel members with a question and answer period following. Prior to the panel discussion, L. S. Barrett of Lockheed M & S Co. will give a brief review of the significant aspects of the Reliability Physics, Seventh Annual Symposium, Washington, D.C., held December 2-4, 1968.

Meeting time is scheduled for 8:00 PM at PH 101, Stanford. Dinner at Stanford View Restaurant. Reservations by January 14. See Calendar.

Conversion of Overhead Facilities to Underground.

In September, 1967, the California Public Utilities Commission approved a PG&E proposal to increase substantially the amount of capital budgeted each year for conversion of overhead facilities to underground. Underground techniques for new installations have been developing rapidly during the past 7 or 8 years and now many of these concepts will be applied on an expanding scale to conversion of overhead as well.



Mr. McAtee



Mr. Capra

The guest speakers, C. D. McAtee and R. L. Capra will present an informal review of the engineering aspects of this conversion, during the January 14 meeting of the Power Chapter. They will describe the kinds of systems involved, typical areas where conversion will be taking

place, types of components used and some of the construction techniques and programs. Of particular interest will be the need for new product developments.

The Engineers Club will be the scene of the meeting at 7:30 PM. Cocktails at 5:30, dinner at 6:30. Reservations by January 13. See Calendar.

Mr. J. H. Lawson will briefly explain the recent CPUC ruling and introduce the speakers.

Both speakers are members of the Department of Electric Distribution Engineering, Pacific Gas & Electric Company. Charles D. McAtee, Engineer, joined PG&E in 1951, shortly after receiving his BS degree in Electrical Engineering from the University of California. Prior to joining his present department, he was employed in the company's North Bay Division. Raymond L. Capra, EE, is a graduate of California State Polytechnic College. He joined PG&E in 1964. One of his major assignments has involved studies aimed at developing preferred designs for underground systems. He recently completed General Electric Company's 30-week Power System Engineering course in Schenectady, New York.

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