NOVEMBER 10, 1957

electronics

business edition

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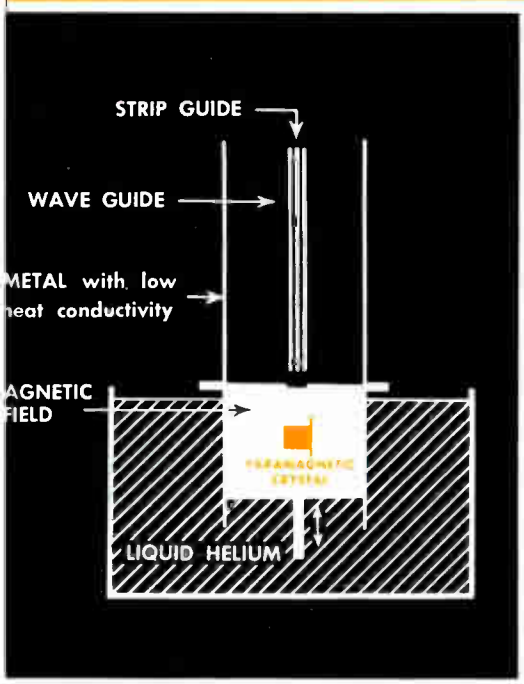
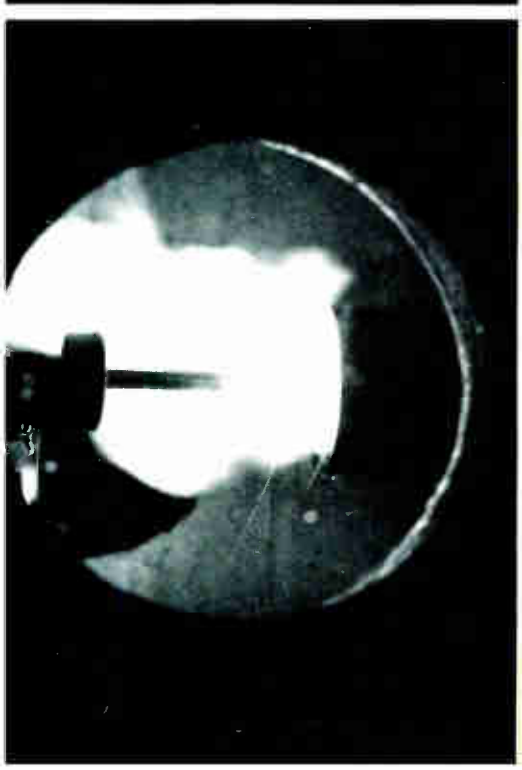


Cold Crystals Improve Radar

Paramagnetic crystals immersed in liquid helium reduce thermal noise . . . p 32



Ions May Take Men To Mars

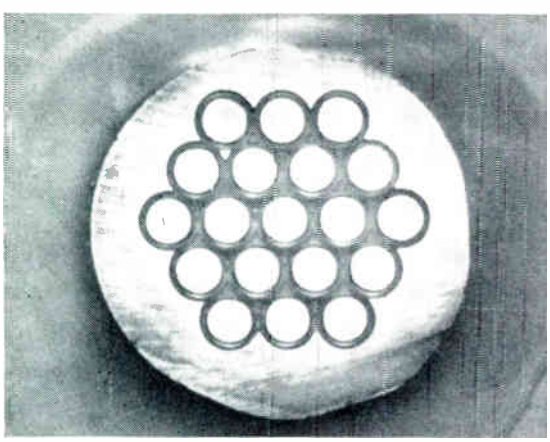
Ionic-propulsion motors could be one of the keys to space travel . . . p 19

NEW LOW-COST RAYTHEON IMPACT GRINDER—$2790*

Ultrasonic machine cuts, slices, drills, shapes germanium, silicon, ferrites, ceramics with speed and precision

New low-cost Raytheon Impact Grinder uses ultrasonic power to drive abrasive particles at 25,000 cps between the tool and the work. An exact counterpart of the tool is reproduced with speed and precision.

Holes and slots for this ceramic tube spacer are easily cut with the Raytheon Impact Grinder. Use of ceramic, rather than mica, for this tube more than doubles its life. (Pnoto courtesy C-Mar Corp., Manasquan, N. J.)



Simultaneous cutting of circular pieces from germanium wafer. Any shape can be cut with speed and precision in hard or brittle materials such as germanium, silicon or ferrite. (Photo twice actual size)

Low-cost version of $7100 machine cuts limitless variety of shapes in hard or brittle materials. Design engineers welcome new freedom of design it makes possible. Great variety of production and cost problems solved by this versatile new machine.

FREEDOM OF DESIGN

In impact grinding an exact counterpart of the tool is reproduced in the work piece, tool pressure is extremely low and no heat or stress is involved. A limitless variety of shapes can be produced in virtually all hard and brittle materials. To the design engineer, this means that new substances can be used, or that familiar materials can be produced in shapes that formerly were impossible.

For example, the use of a ceramic rather than a mica spacer in the tube shown at left permits much higher tube operating temperatures, better degassing, reduced noise and doubles tube life. Without impact grinding, it is impossible to produce the ceramic spacer with slots and holes sized and positioned with sufficient accuracy.

Square holes can be accurately cut in ferrites. Too brittle to be readily processed by any other means, ferrites are easily drilled or cut with the Raytheon Impact Grinder without disturbing the crystalline structure.

Semiconductors are diced with great ease and can be produced in entirely new shapes. Round, square, delta, oval—any shape that can be fabricated in a soft metal tool can be exactly reproduced in semiconductors.

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From the production engineer's standpoint, the Raytheon Impact Grinder offers decided cost and time saving advantages. In many instances it vastly simplifies jobs which would otherwise be extremely difficult, time-consuming and costly. In some cases it will even do work formerly considered "impossible". The machine lends itself to economical manufacture of prototypes or full production runs. This compact unit is built to the most exacting electrical and mechanical standards and can be operated by semi-skilled personnel.

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Find out how Raytheon's Impact Grinder can help solve your design and production problems. A Raytheon representative will be happy to demonstrate the machine *in your plant on your own material*, without cost or obligation. For free catalog or to arrange for demonstration, please write Dept. 6120F.

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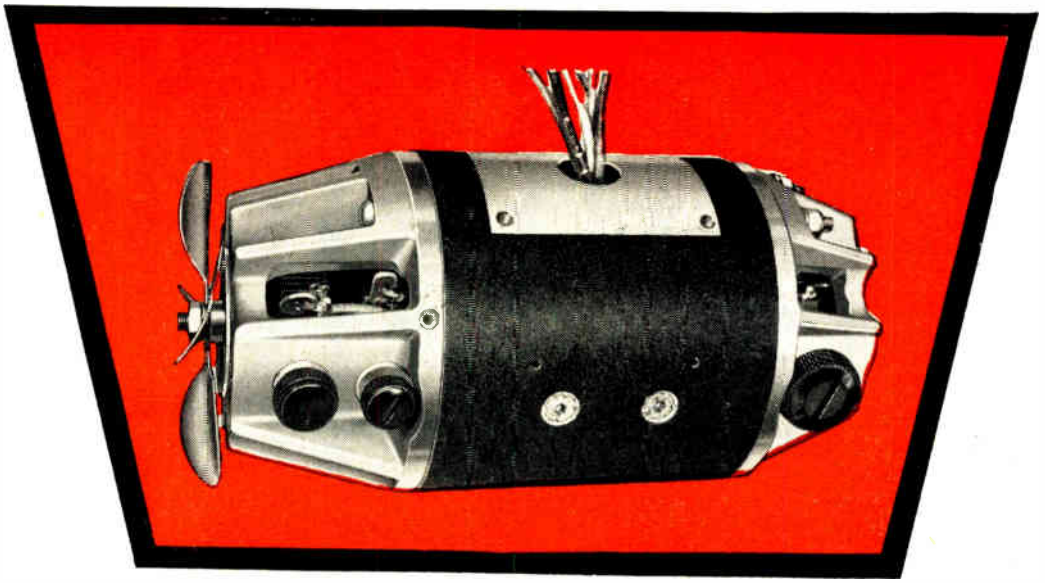
problem: PROVIDE FAULTLESS POWER TO GUIDE A FAMOUS MISSILE



All the engineering ingenuity built into a famous missile was threatened by a reliability problem in the guidance power supply.

Acceleration and vibration had produced shock that "unsettled" electronic components on which the missile relied for zeroing unerringly onto the target. Wincharger's Research and Engineering Group, well-known in the industry for problem-solving resourcefulness, was asked to tackle the power supply problem.

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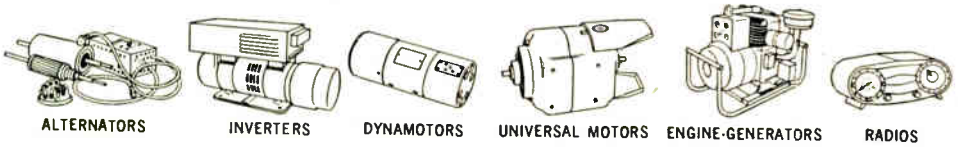

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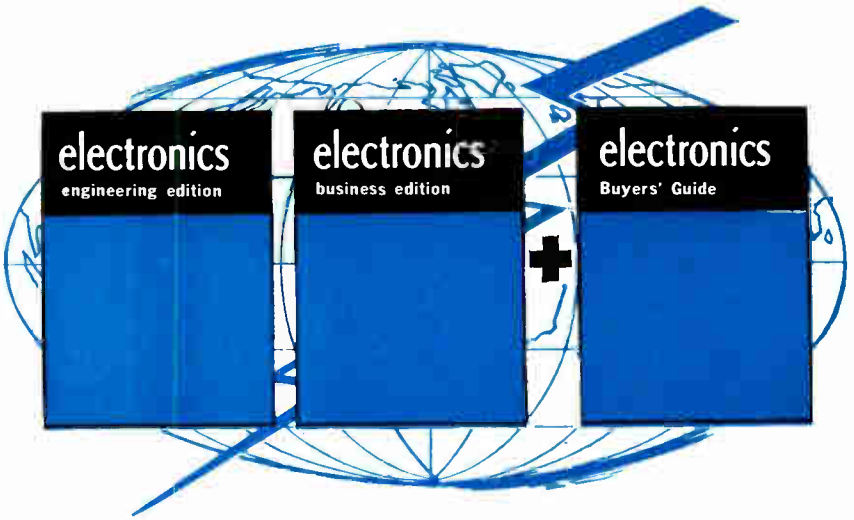

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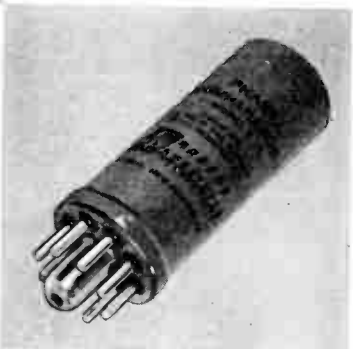

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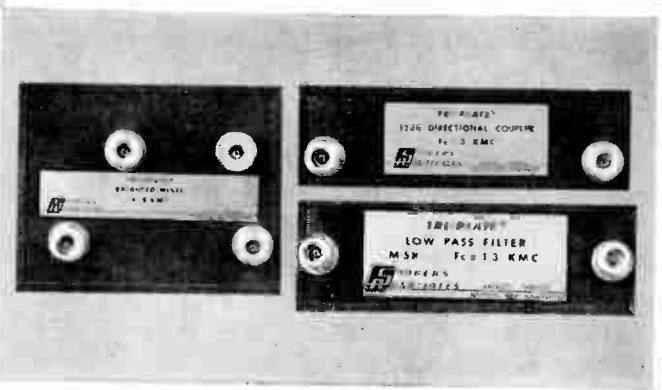

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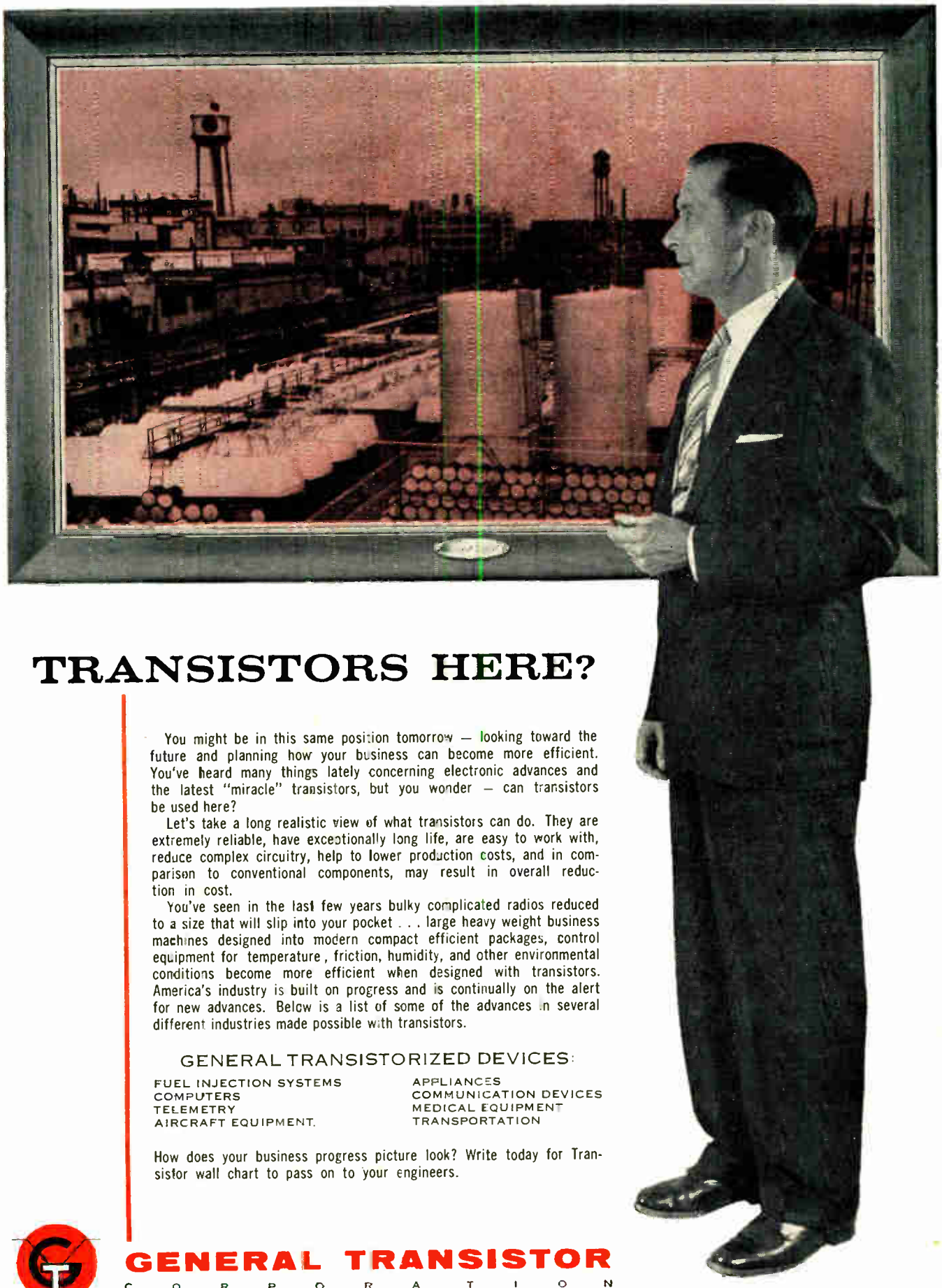

TRANSISTORS HERE?

You might be in this same position tomorrow — looking toward the future and planning how your business can become more efficient. You've heard many things lately concerning electronic advances and the latest "miracle" transistors, but you wonder — can transistors be used here?

Let's take a long realistic view of what transistors can do. They are extremely reliable, have exceptionally long life, are easy to work with, reduce complex circuitry, help to lower production costs, and in comparison to conventional components, may result in overall reduction in cost.

You've seen in the last few years bulky complicated radios reduced to a size that will slip into your pocket . . . large heavy weight business machines designed into modern compact efficient packages, control equipment for temperature, friction, humidity, and other environmental conditions become more efficient when designed with transistors. America's industry is built on progress and is continually on the alert for new advances. Below is a list of some of the advances in several different industries made possible with transistors.

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cut operating costs with a plant in Iowa

according to **FANTUS AREA RESEARCH, INC.***

Why the Fantus Study was conducted

Fantus Area Research, Inc. was commissioned by the State of Iowa to pinpoint those industries particularly suited to an Iowa location. And to provide specific information for those industrial executives considering new plant locations now or in the future. This realistic, detailed information is now available to assist those potential industries in evaluating their profit possibilities in Iowa.

How the industries were determined

Fantus found the electronics-electrical equipment industries to have outstanding profit potentials with an Iowa location. They were recommended on an evaluation of such factors as: proximity to markets, raw materials, basic and parts supplies; operating costs, wage and freight rates; quality, aptitude and supply of labor; transportation and utilities; tax structures and government attitudes.

ELECTRONICS PRODUCTS

SURPLUS OF LABOR AT COMPETITIVE RATES — Fantus estimates that 66,000 people could be encouraged to enter Iowa's labor force if job opportunities were available. Of this number, 60,000 are females. In many Iowa communities, this labor would be available at average hourly rates of $1.20. An electronics firm employing 300 female assembly workers could save an estimated $187,000 a year in Iowa as compared to present centers of production.

NEARBY SOURCES OF RAW MATERIALS — Iowa is well oriented to sources of raw materials and electronics components such as capacitors, receiving tubes, resistors and coils. Good delivery schedules could be economically maintained from these convenient sources.

DISTRIBUTION TRANSFORMERS

LOWER DISTRIBUTION COSTS — The North Central states make up the most important market for transformers today. This region leads all others in new dwelling construction, sales of electricity, and capital spending by utilities. An Iowa plant would reach this market and realize important savings in outbound freight costs.

INSULATED WIRE AND CABLE

REDUCED FREIGHT COSTS — Again the leading building construction and electrical utilities expansion in the North Central states create an important market which insulated wire and cable manufacturers can reach more economically from a plant in Iowa.

PAYROLL SAVINGS — Iowa's gross hourly earnings differential compared with existing manufacturing centers indicate substantial payroll savings for a wire and cable manufacturer. A 300 worker plant could hope to reduce payroll by $249,600 a year by locating in Iowa.

MECHANICAL MEASURING AND SCIENTIFIC INSTRUMENTS

IMPROVED SERVICE TO MAJOR MARKETS — The centers of important instrument markets are located in states near or bordering on Iowa. The electronics industry is rapidly expanding in this area. An instrument plant in Iowa would provide better service at less cost in these markets and improve their competitive position.

Quality labor at competitive rates

An advantage to all new industry in Iowa is her exceptionally stable, well educated labor force. The percentage of high school graduates is unusually high (38.5%). Their stability is indicated by the low average unemployment compensation rate paid by Iowa industries in 1955 (0.8% — 5th lowest in the nation). Anticipated median wage rates for production workers in Iowa as compared to median rates in the North Eastern states represent a significant differential to electronics products and electrical equipment manufacturers.

PERFORMANCE PROVES CAPABILITY

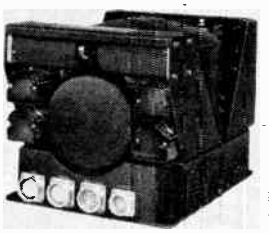
INERTIAL GUIDANCE

KEARFOTT has been engaged in the development, production and flight testing of Inertial Systems and their components for over 7 years. Their leadership in the field of lightweight, high precision Inertial Guidance Systems for aircraft and missiles has been proved by performance. The instrument shown here is a typical KEARFOTT inertial platform.

CENTRAL GYRO REFERENCE SYSTEMS

Based on this 3 gyro, 3 gimbal stable platform weighing only 25 pounds, precise vertical reference (2 milliradians) under all dynamic conditions is guaranteed. This system also serves as an all-latitude compass system with 1° per hour random drift rate. Its performance is substantiated by the hundreds of systems in operation today.

LIGHTWEIGHT ALL ATTITUDE COMPASS AND VERTICAL REFERENCE SYSTEMS



Based on a 29.5 pound 3 gyro, 4 gimbal platform, Kearfott All Attitude Compass Systems provide continuous steering signals throughout a LABS maneuver. In addition to the compass features of the U.S.A.F. J4 System, precise vertical reference for fire control, autopilot and radar stabilization is available. Proved by 2 years' service in the field. Total system weight—57 pounds.

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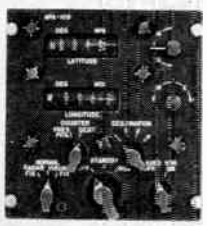

Kearfott's great circle dead reckoning computer systems, continuously compute and display present position, course and distance to a primary and 3 alternate destinations, latitude and longitude of the destination points. Ground track is also indicated. Range: 2000 miles, speed range: 2000 knots. Extensive flight tests have confirmed the following accuracies: Present position—1 mile or ½% of distance traveled; Distance—1 mile or ½%; Course: ½°.

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Urge Joint Bidding

Owners see one bid by group of small firms as best way of boosting use of system procurement

JOINT BIDDING is the best answer small firms have for increasing their use of weapons system procurement practices. This view, aired last month, is held by J. D. McLean, president of Hoffman Labs, and Homer R. Denius, president of Radiation, Inc.

Present military procurement methods favor awarding contracts for a complete system to one prime contractor, small firms say. The previous practice had been to award prime contracts for each key item in the system.

"Alone the small firm is unable to win system prime contracts," said Denius, speaking before the New York Society of Security Analysts.

"But, if five or ten firms, each outstanding in a particular field, team their abilities and make a joint contract proposal, the package bid will be difficult for procurement officials to refuse."

The joint bidding method meets procurement officials' desire for centralized system responsibility, the reason behind the new procurement practices. When members of the bidding pool submit their bid, they must select one member as the contract manager, McLean and Denius explain.

Hoffman Labs and Radiation, Inc. are leading exponents of the team bidding philosophy. Both are members of joint contract bidding groups now in the midst of negotiations for specific contracts.

McLean sees joint bidding as the only way small firms can lick the tremendous problem created for them by the trend toward system contracts.

He also sees a big future for joint contract bidding. "The tremendous technical problems now facing the nation are just too difficult for any one firm to handle, no matter how large," says McLean. "These technical problems can be licked only by a team of individual experts."

Contract consultant William H. Bisnoff, head of Bisnoff-Arnoff Associates, thinks pool bidding, if properly organized, should win a lot of systems contracts for teams of small electronic firms. However, one problem they must face is the necessity of subordinating themselves to the contract manager, Bisnoff adds.

He points out that provision for small firms to arrange to work together has been part of armed service procurement regulations since World War II.

In other industries there have been many cases where small contractors have joined efforts to win large military contracts, Bisnoff says. Until recently electronic firms have given very little attention to this method of bidding.

Reason why these firms are increasingly interested in joint contract proposals was supplied by Henry Blackstone, president of Servo Corp. of America, in his recent speech before the National Security Industrial Association.

Blackstone said that under the new weapons system concept the large prime contractor is able to sub-contract various items as he chooses. When cutbacks occur, the prime contractor pulls back sub-contract work and competes with small electronic firms for the declining number of small military prime contracts, he said.

He doubted the military's ability to direct a fair share of the prime contractor's sub-contracting work to small business.

SHARES and PRICES

Telemetering manufacturers draw increased attention today because of Sputnik's ascent and prospects of increased spending on missile-related items. Used primarily in development of missiles and their guidance systems, telemetering gear may be in increasing demand because of the expected drive to step up our missile program.

Typical Manufacturers of Telemetering Equipment	Recent Price	Dividend Rate[2]	Percent Yield	Earned per Common Share 1957	Earned per Common Share 1956	Traded	1957 Price Range
Ampex Corp.	41[1]	....	....	1.51 (yr)[5]	0.58[5]	OTC	.....
Applied Science of Princeton	12[1]	0.10[3]	0.8	0.33 (6 mos)	0.42	OTC	.....
Bendix Aviation	44¾	2.40	5.4	3.97 (9 mos)	5.04	NYSE	44¾–66¾
Epsco, Inc.	11½[1]	....	....	0.05 (3 mos)	0.64	OTC	.....
Giannini (G.M.)	11¾[1]	....	....	0.58 (6 mos)	1.05	OTC	.....
Minneapolis-Honeywell	81¼	1.60[4]	2.0	1.56 (6 mos)	3.40	NYSE	73½–131
Radiation Inc. (Class A)	11½[1]	0.15	1.3	0.64[6]	0.39[6]	OTC	.....
RCA	28⅞	1.00[4]	3.4	1.35 (6 mos)	2.65	NYSE	29⅞–40
Raytheon	18⅜	....	....	1.75 (6 mos)	0.23	NYSE	16⅜–22¾
Westinghouse Air Brake	22⅛	1.20	5.4	1.59 (6 mos)	2.86	NYSE	22⅛–33⅛

[1] bid [2] indicated [3] plus stock [4] plus extras [5] April 30 fiscal [6] Aug. 31 fiscal

Sell to Peg Value

Founders of West Coast firm offer 300,000 shares in first public sale

FIRST PUBLIC offering of Hewlett-Packard common stock is being made this month. Three hundred thousand shares are being sold by a syndicate of 30 underwriters headed by Blyth & Co.

None of the sale proceeds will go to the San Francisco area firm. They will go to the present share owners, founders David Packard and William R. Hewlett.

Desire to establish a market value of stock for estate purposes influenced the decision to sell part of their holdings. It is easier to raise money to pay stiff inheritance taxes, which must be paid in cash, if a market for stock exists. Problem of arriving at a fair valuation of stock is simplified, if stock is publicly traded.

Completion of the stock sale will leave Hewlett and Packard holding most of the company stock. Portion being sold to the public represents only 10 percent of the total outstanding.

An additional 50,000 shares are being issued to employees by the company under a restricted stock option plan. Proceeds from the sale of these shares will be added to the firm's working capital.

Outsiders got their first look at company sales and earning data from the stock registration statement filed with the Securities and Exchange Commission.

Sales grew from $2.2 million in the first year of corporate existence (ended October 31, 1948) to $20.1 million for the year which ended October 31, 1956.

Sales of $28 million are indicated for the year which ended 10 days ago. Sales for the nine-month period finished last July were $20.8 million. Net profits were $1.8 million, or 59 cents a share.

Only 23 percent of Hewlett-Packard's sales are made to the government. Remainder is sold to more than 2,000 customers. Largest of these accounts for less than six percent of the total.

MERGERS, ACQUISITIONS and FINANCE

• **Litton Industries** and **Monroe Calculating Machine** announce merger plans. An offer to purchase Monroe's outstanding stock by the Litton board has already been accepted by 80 percent of Monroe stock holders. Monroe shareholders have been offered the choice of 1¼ shares of Litton common for each share of Monroe common or one half share of Litton $100 par 5% cumulative convertible preferred.

Annual sales of the combined company should be in the neighborhood of $100 million. Litton's sales are estimated to be running at the rate of more than $45 million. Monroe's sales for this year are estimated at more than $40 million. Litton previously announced plans to acquire Aircraft Radio of Boonton, N. J. and Maryland Electronic of College Park., Md.

• **Siegler Corp.** sells 320,000 shares of common stock at $15 a share. Net proceeds of $4.4 million, plus $5.25 million to be borrowed from banks and insurance companies, will be used to retire $4.7 million of long term debt and to pay off obligations incurred in the acquisition of Unitronics and Hufford. A balance of $737,150 will be left. This will be added to company's working capital. William R. Staats & Co. of Los Angeles headed the underwriting group.

• **Perkin-Elmer Corp.**, Norwalk, Conn. plans to sell 100,000 shares of common stock. Funds from the public sale will go for new plant facilities and to boost working capital. Blyth & Co. will head the underwriting group.

• **American Electronics**, Los Angeles, agrees to acquire **Cal-Air Engineering** of Compton, Calif. American Electronics would exchange 7,854 shares of common stock and pay $35,000 in cash and $123,500 in notes for all of Cal-Air's outstanding stock, according to agreement terms. Over half of Cal-Air's sales of $750,000 annually are in electronic sub-systems for missiles. American Electronics' sales, exclusive of Cal-Air, are estimated at $17.5 million.

• **Savage Arms** of Chicopee Falls, Mass. plans purchase of Aircraft Armaments of Cockeysville, Md. through exchange of stock. Aircraft Armaments, situated near Baltimore, is engaged in research, design and manufacturing. Savage Arms makes sporting firearms, lawn mowers and refrigeration equipment.

• **Nader Manufacturing Co.** and **Motordyne, Inc.**, both of Monrovia, Calif., announce completion of merger through exchange of stock. Nader, formerly a research firm in transistor applications, will become one of two Motordyne, Inc., divisions. The other division will manufacture rotary electric equipment, small motors, blowers and governors.

• **P. R. Mallory & Co.** declares a two percent stock dividend on outstanding common stock. The usual cash dividend of 35 cents a share was also declared. The company plans to pay a two percent stock dividend annually over a five year period in addition to the regular cash dividend, subject to future earnings. Possibility of a stock dividend in the future will not be affected by the stock payment.

PROOF
UNIVERSITY SPEAKERS STAY SOLD!

To insure valid statistics, this tabulation covers the largest selling brands, based on a four-year survey (April 1953 to March 1957) of classified and "Swap or Sell" ads for used high fidelity loudspeakers. All ads authenticated as placed by private individuals in Audio, High Fidelity and Music At Home

PERCENTAGE OF TOTAL INSERTIONS IN "SWAP OR SELL" COLUMNS			
SPEAKER "A"	SPEAKER "B"	SPEAKER "C"	UNIVERSITY
46½%	23¼%	16¼%	13%

Fewest number of ads offer University equipment . . . outstanding testimonial of user satisfaction.

We have always believed that the tremendous volume of University speakers sold in the past to hi-fi enthusiasts attested to the genuine listening satisfaction designed into all our products.

We think that all legitimate hi-fi loudspeakers sound pleasing, but the acid test of listening satisfaction is a speaker's "staying power". Does it grow with your hi-fi tastes, continue to please year after year . . . or is it obsolete before its time . . . ready for swap, sale or discard?

Yes, in the "Swap or Sell" columns of the leading audiophile magazines, you soon know which of the prominent brands of loudspeakers readers outgrow . . . and, *by the absence of such ads*, which of these leading loudspeakers remain in the home!

The record speaks for itself. This accurate survey, taken over a span of four years, shows that speaker "B" has almost 50% more "for sale" listings than University . . . while speaker "A" is offered more than three times as often! Here is indisputable unsolicited testimony from average hi-fi users themselves that University *stays sold*, continues to serve year after year as a source of rich musical pleasure.

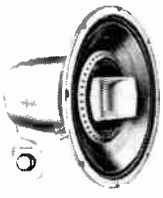
University offers the largest selection of loudspeakers to gratify every need and budget

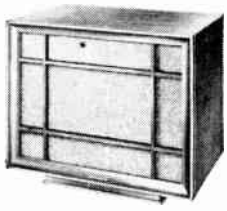

WOOFERS

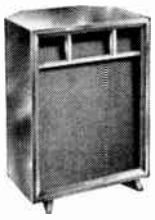

TWEETERS

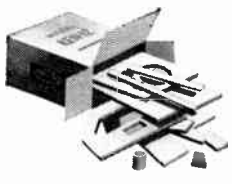

MID-RANGE


NETWORKS


DIFFAXIALS


SYSTEMS


ENCLOSURES


KWIKITS

Only University, the world's largest manufacturer of custom loudspeakers, offers you this unrivalled selection. Only University has the engineering and production facilities that assure you of quality and performance unmatched at each price level.

MAIL COUPON FOR FREE LITERATURE

Desk E-1, University Loudspeakers, Inc.,
80 So. Kensico Ave., White Plains, N. Y.

I would like your free literature. I am checking the subject(s) of interest to me.

- ☐ Complete Speaker Systems
- ☐ Speaker Enclosure Kits
- ☐ Speaker Components

Name.....

Address.....

City.....Zone..... State.....

LISTEN *University® sounds better*

UNIVERSITY LOUDSPEAKERS, INC., 80 SOUTH KENSICO AVENUE, WHITE PLAINS, N. Y.

WASHINGTON OUTLOOK

A NEW DRIVE to combine U.S.-British research and development of advanced weapons is one of the most direct—and important—results of Sputnik. (See British story, p. 50.)

Only a few months back, the U.S. agreed to help out the British, promising U.S. missiles (when available) so that the British could cut some of their defense costs by dropping, as quickly as possible, production of fighter and bomber planes.

Top administration officials continue to insist that we are on a par, technologically, with the Soviets—that, across-the-board, our position on advanced weapons is as good and probably much better than that of the Russians.

But Sputnik—with its message of Soviet success in the all-important missile field—has put the administration on the defensive. To the public, at least, the U.S. has come in second in one race where finishing second means not finishing at all.

This doesn't mean that those direct military research and development projects can now have all the money they want for the asking. But morale and hopes of the scientists are higher than they've been. It's expected quickly that many research and development projects will get out from under the strict budget-cutting ceilings imposed to bring total military spending down to $38 billion. R&D contracts and the like had been getting cuts of 8 to 10 percent, just as all other Pentagon activities had been cut to greater or less degree.

But there's no likelihood of a major turn-around in research and development; so far, one of the biggest moves has been Defense Secretary McElroy's order to underlings to give him a carbon of all reports on the progress—or lack of it—in the missile field.

- Amidst all the hullaballoo over Sputnik—and its implications of Soviet superiority over U.S. rocket technology—there's still no sign that the administration plans to relax its military economy drive much. This means a continuation of stretchouts, cutbacks, and even cancellations in defense production.

  For instance, most major plane makers are now negotiating new Air Force stretchouts. The contractors say they can not stick to current delivery schedules under recently-imposed limitations on monthly payments. The problem is this: total anticipated billings by the contractors over the next nine months exceed—by some $1 billion—the Air Force's procurement expenditure ceiling.

  The Navy is in a similar bind. It has just dropped $21-million worth of contracts with Lockheed for production of 100 jet trainers and 15 radar-warning planes.

  But the holddown on new contract awards and renewal of projects about to expire—pending settlement of monthly payment restrictions and spending ceilings on individual projects—is loosening up. The Air Force has announced $183 million worth of new Titan ICBM contracts, including awards to Western Electric for radio inertial guidance gear and Remington Rand for Univac computers. Presumably the companies have moved into the production stage with their subsystem projects.

New from Clevite!

SILICON JUNCTION DIODES

These latest additions to Clevite's complete line of computer and general-purpose diodes offer you the advantages of:

ULTRA FAST RECOVERY TIME . . . (JAN-256)
(Typical: from +5.0 ma to −40v
. . . 400K in 0.3μs)

HIGH FORWARD CONDUCTANCE
(Typical: 50 ma at 1.5v)

EXTREMELY LOW REVERSE CURRENT

FREEDOM FROM THERMAL RUNAWAY
at high voltage and up to 150°C

RUGGED, HERMETICALLY SEALED GLASS PACKAGE

OTHER CLEVITE DIVISIONS:

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CLEVITE
TRANSISTOR PRODUCTS
241 Crescent St., Waltham 54, Mass.
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A Division of
CLEVITE CORPORATION

EXECUTIVES IN THE NEWS

Stearns*: for researchers, scholarship . . .

Light of the silvery *Sputnik* illuminates industry executives concerned with America's *Vanguard* project. Myrl Stearns, for the last five months president of Varian Associates, is one of these—Varian's 3-lb magnetometer will be one of the instruments taking the Earth's measure when *Vanguard* satellites go aloft.

Mild and genial westerner Stearns was born in Kiesling, Wash., in 1916, took a BSEE at the University of Idaho in 1937, got his master's from Stanford two years later. A 7-year stint with Sperry Gyro constituted his one foray to the East. It was while he was heading Sperry's klystron research program that he first worked with the Varian brothers (Sperry backed work the Varians were doing on velocity-modulated tubes).

Accolade for the way he managed the klystron program came to Stearns when the Secretary of the Navy awarded him a commendation. Then in 1948 he went to California to become v-p and general manager of Varian, moved up to the chief executive's office five months ago.

Associates find Stearns easygoing most of the time, forceful and definite when the chips are down. Like many scientists-turned-executive, he keeps an eagle eye on scholarship, recently launched an advanced study program. Plan is to let key researchers widen and deepen their technical understanding through full-time study off the job.

Punster Stearns helps keep his sense of humor by taking time off for golf or for water-skiing at his big summer place. He says he's more proficient on the aquaslats than on the links. He also enjoys "just relaxing" at home with wife Ruth, a matched quartet of children and the inevitable hi-fi.

*At left, with microwave researcher R. L. Jepsen

LETTERS

Library for the Blind

The SHARC Radio Library for the Blind is sponsored by the South East Amateur Radio Club of Cleveland, O., and operated in part as a division of the Blind Services Committee of Tape Respondents International. This library is filling a gap in services to blind people in the U. S. and Canada. The blind population who are radio and electronics enthusiasts will hear of the establishment of this library only

through sighted readers of such magazines as ELECTRONICS.

SRLB services are available to any blind person in the U. S. or Canada. The library acts as a clearing house for receiving and circulating electronics literature in Braille or tape-recorded form. We have many other ideas for related projects which we hope to add.

WARREN SLADKY
SEARC RADIO LIBRARY
CLEVELAND 4, OHIO

Sputnik: The sound . . .

Station WERE Cleveland claims to be the first independent station to put on the air its own sounds of the Russian satellite as it passed over here.

The signal was recorded by me on tape and rushed to WERE studios for rebroadcast at 12:35 a.m. Saturday Oct. 5.

JOSEPH ZELLE
CLEVELAND, OHIO

. . . and the Fury

Well, we've done it again!

By low-rating the sciences and browbeating the scientists, by silting up channels of communication (for security's sake, of course!) and forbidding the sharing of experimental knowledge, by permitting fatheads to run military research and Babbitts to control the extent of other research efforts—by being simultaneously arrogant, frightened, parsimonious and wilfully unenlightened, we've handed over the moon to Russia.

Perhaps we'll hand over the earth next.

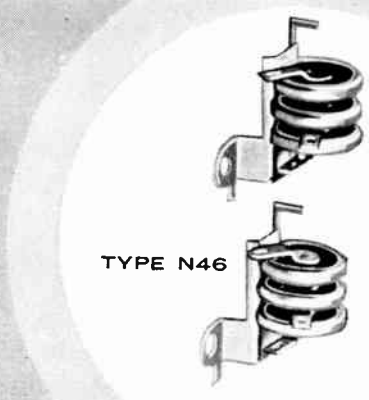
History will record the fact that America decerebrated itself and so died headless.

GENE G. MACAULAY
PHILADELPHIA, PA.

Reader Macaulay, perhaps justifiably furious over Sputnik and the pitiful spectacle of governmental disunity that permitted it to get thar fust, overlooks one important fact in quoting P. Wylie: many things we may be, but we ain't dead yet!

for your miniaturized equipment . . .

SANGAMO pre-mounted Button® Capacitor Assemblies



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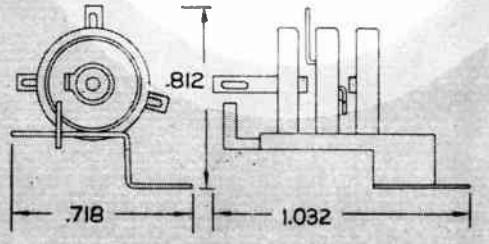
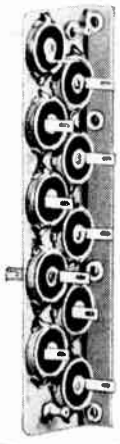


simplify circuits . . .
save space . . .
solve mounting problems!



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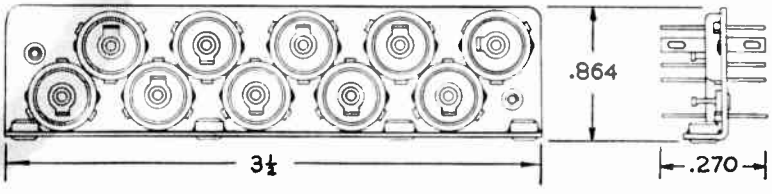


Sangamo Multi-section Button Assemblies are silvered mica button capacitors, pre-mounted in silver-plated non-ferrous brackets. They are easy and inexpensive to mount in miniaturized equipment where many buttons must be installed in a small space. These multiple assemblies supply their own common circuitry—retain the low inductive design advantages of conventional button mica capacitors—are ideal for use in VHF and UHF circuitry.

Two types and dimensions of assemblies in the Sangamo series are shown above. Any suitable combination of buttons may be selected for mounting. All Sangamo button type mica capacitors used in these assemblies conform to military specification MIL-C-10950B.

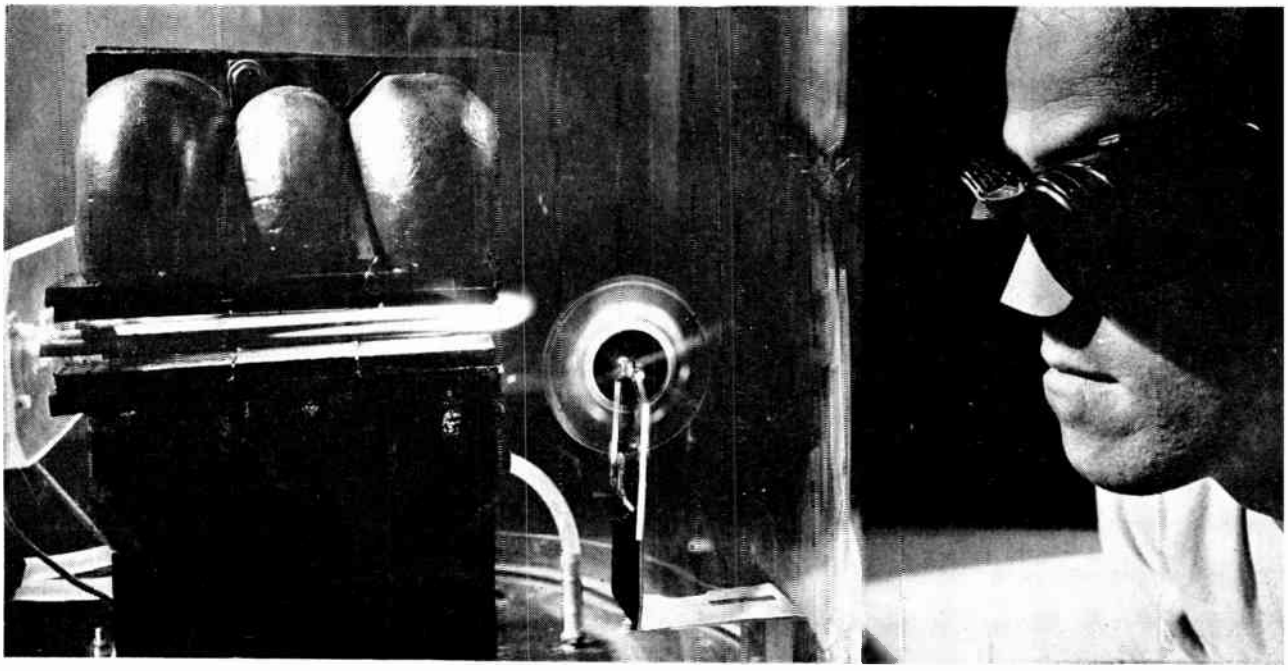
Write for complete information and prices.

SANGAMO *Electric Company*
SPRINGFIELD, ILLINOIS

SC57-12

electronics
business edition

NOVEMBER 10, 1957



A wheel turns by ions at NACA lab. Someday . . .

Ions May Take Men to Mars

• Scientists are nibbling around edges of ionic propulsion with jets of ionized gas and research into electromagnetic propulsion

• Air Force efforts to give rockets an extra boost electrically may lead electronics into a new kind of aerodynamic instrumentation

IN THE WAKE of *Sputnik*, while jubilant Russians predicted moon rockets in a few years, came the first solid indication that a United States government agency is giving more than theoretical consideration to interplanetary flight.

National Advisory Committee for Aeronautics unveiled on October 7 a toy-like model of an ion-propelled rocket ship. Big version could go 25,000 mph.

Ion motors, which would convert electrical energy into thrust, are considered the key to space flight. Chemical rockets are not efficient enough.

Experimental ion devices indicate an efficiency of 98 percent. It is believed that an ion rocket, with electricity provided by a stripped down nuclear reactor, can be built and flown using today's technology.

The military avoids any public statements inferring interest in space flight. But it has already begun switching rocket science into ionic propulsion. It's considering it as a way to better chemical rockets without adding to heat, mechanical complications.

Air Force Office of Scientific Research has this year placed near $500,000 in research contracts on electromagnetic propulsion of charged gases.

Contractors include Giannini Research, Rocketdyne, Avco, University of Utah and Armour Research. Queried about possible instrumentation for ionic propulsion, Gabriel M. Giannini replied:

"If electrical propulsion becomes practical it will constitute an interesting field where the electronic and aerodynamic disciplines will meet."

Applications may range from systems using slight-

ly ionized high density gases to those using streams of ions. The first would be used in atmospheric flight and the latter at "extra-satellite heights".

Giannini predicts instrumentation would "vary greatly and in any event it is likely to be complex". Instrumentation would be of "predominating importance" in a fully ionized system, principally to measure the electromagnetic momentum given the ions.

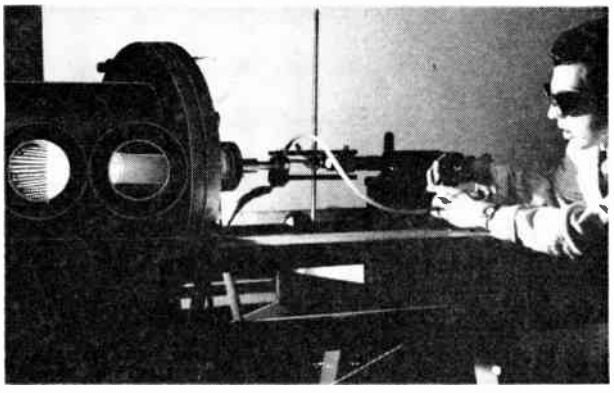
Ion motors would run "cold", at about 1,300 F, the boiling point of the alkaline metals used as fuel. A design suggested by Ernest Stuhlinger, guidance control chief at Redstone Arsenal, illustrates how.

Cesium or rubidium is vaporized and then ionized by flowing over a heated tungsten or platinum plate. The gas is accelerated backwards towards a high negative potential cathode, thrusting the rocket forward. Afterwards, a thermionic emitter neutralizes the gas to prevent counter-thrust.

Acceleration is only 0.0001 G, insufficient to counteract gravity. Chemical rockets would have to place the ion rocket in a satellite orbit where it could pick up speed for its journey.

Stuhlinger believes a 730-ton rocket could get to Mars in 400 days.

For over a year, a group of West Coast rocketeers have sought funds to build an unmanned Martian reconnaisance rocket powered by twin ion motors and a nuclear reactor.

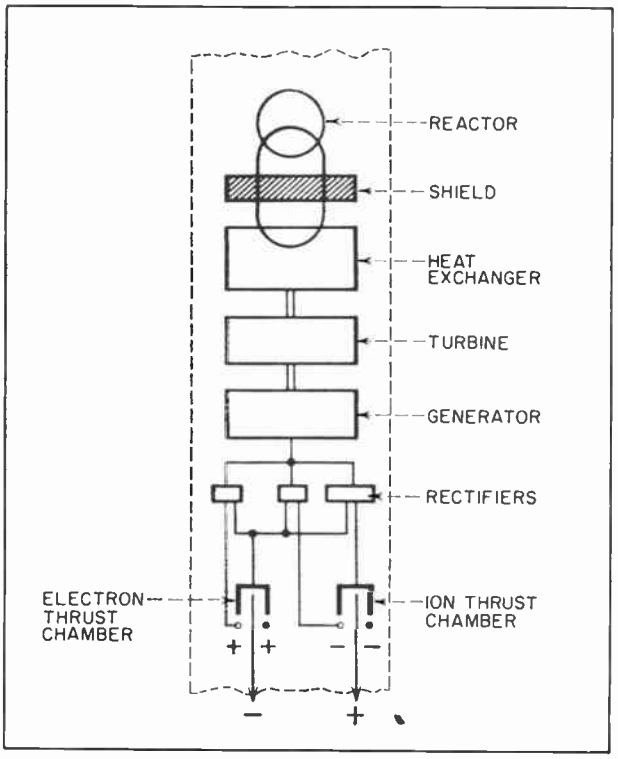


GE uses hot ionized gas to test missile noses

The rocket, nicknamed Snooper, would weigh 3,300 pounds and carry a 1,500-pound electronics payload. The weight, they think, can be lofted into an orbit by ICBM rockets.

"About a dozen of us are trying to push it," says M. I. Willinski, a Rocketdyne engineer. "This is no mental exercise, but an actual proposal."

Military needs to solve missile atmosphere reentry heat problems have resulted in a high intensity arc device known as plasma jets. Some experts think these may prove the bridge between chemical and ionic propulsion.



Block diagram of nuclear-powered ion rocket motor proposed by Ernst Stuhlinger, of Redstone Arsenal

Yusuf Yoler, astrophysicist at a GE missile lab in Philadelphia, demonstrated how one works. He discharged 250 kw into a plastic drum containing water vortexing around an arc.

The blast of thermal energy, at 25,000 F, flowed over a nose cone model. It can melt any natural substance, yet the plastic container was unharmed. Let loose and properly controlled, it would make a fair ramjet.

The jet is ionized gas. Thermal pressure is the driving force in this case, but acceleration could be achieved electromagnetically. Yoler warns, however, that it could not lift the weighty hardware required.

Other plasma jet testing setups are in use at Chicago Midway Labs, NACA and Giannini. GE is also building a 5,000 kw model for its aircraft nuclear propulsion work.

The ultimate propulsion possibility, perhaps unattainable, is photonic. Photon propulsion would enable acceleration to the speed of light by the conversion of mass into lightwaves. Power conversion would be 100 billion times over chemical fuels.

The theory holds water on paper, but the practical problems are so immense, according to Yoler, that it is "still only an elegant possibility". Operating temperature would be 100,000 to 200,000 C, probably requiring a magnetic "bottle" and a huge power source similar to those proposed for thermonuclear reactors.

Spending Holds Up for Us

Capital expenditures generally are down. Yet industries' spending for electronic equipment is holding up well. And because of Sputnik, government military spending may rise, meaning more purchasing of electronic control and test equipment by defense suppliers

RECENT accounts of cutbacks in manufacturer's capital expenditure plans will have little affect on planned spending for electronic equipment, according to the McGraw-Hill Economics Department.

Lower capital expenditure plans have been news ever since the Securities and Exchange Commission report of last month which indicated a downturn in capital expenditure plans by business.

The SEC reported that plant and equipment spending by business would rise little in the third quarter and would decline slightly in the fourth quarter.

The electronics industry will be little affected by this drop, say the makers of McGraw-Hill's Annual Survey of Business Plans for New Plants and Equipments because the lower spending estimates primarily reflect changes in plans to increase productive capacity. Spending plans to achieve savings in labor expense and greater plant efficiency, in which electronic equipment is vital, are not being changed.

Preliminary results of a survey by ELECTRONICS of manufacturers' plans for electronic equipment spending substantiate this opinion. There is no indication of a drop in electronics spending.

The SEC report on plant expenditures in September said 1957 expenditures are expected to amount to $37.03 billion. This prediction is quite close to the initial estimates for the year made six months ago, comments the SEC.

However, the government report showed that the annual rate of plant and equipment spending would rise little in the third quarter of this year and would decline slightly in the fourth quarter. Expenditures at the rate of $37.23 billion are expected in the third quarter of this year, compared with rates of $37.03 billion in the second quarter and $37.17 billion in the fourth quarter.

The planned expenditures of $37.03 billion for

TECHNICAL DIGEST

• **Space suits** allow engineers to work inside vacuum chamber pumped down enough so tubes can operate without envelopes, in lab of Litton Industries. Electrodes of tube can thus be moved while tube is in operation, to find optimum positions. Chief use to date is for work on Chromatron color tv tube.

• **Dry x-ray images** for nondestructive industrial inspection are ready for viewing in about 30 seconds at half the cost of wet-develop films, in GE's xeroradiograph process. Conventional x-ray tube forms latent image on electrically charged coating of plate. Chalky dust carrying opposite charge makes image visible. Plates can be erased like blackboard and reused, opening way to economical continuous production-line inspection of castings or sealed electronic components.

• **Rocket recovery** on firing ranges is made easier by radioactive recovery technique of Era Engineering Corp. About 10 minutes before launching, capsule with 2 curies of cobalt 60 or 4 curies of antimony 124 is dropped into rocket. After firing, helicopter or light plane carrying airborne scintillometer flies parallel grid lines about 3,000 feet apart over impact area. Recovery time is therefore reduced to an average of 30 minutes, even in rough terrain.

• **Dielectric coating** a few mils thick on inner wall of circular waveguide minimizes losses at intentional bends and eases straightness requirements for normally straight sections, according to Bell Labs. Thickness is critical but optimum value can be computed for any desired mode and bend radius. Polystyrene is one dielectric used.

• **Three-heat** German soldering iron has bifilar arrangement of two resistance wires, with switch giving choice of 40, 60 or 100 watts. Lowest heat can be used for standby without scaling of tip.

• **Electronic fruit machine** uses flashing neon lamps, each driven by pulse generator set to different frequency, to replace the three fruit-decorated rotating drums of mechanical one-armed bandits. Design by G. L. Swaffield of England is jackpot-only machine providing element of skill; pushbutton controls fourth lamp flashing at still different frequency, connected to put out other lamps one by one when flashes coincide. Three lamps out in 10 seconds corresponds to three lemons.

1957, which include actual outlays for the first half and expectations for the second half, will be six percent higher than the $35.08 billion spent in 1956. A comparison of actual 1956 and estimated 1957 expenditures by industry divisions follows:

	$ Billion		% Change
	1956	1957	
Manufacturing	14.95	16.19	8
Durable goods	7.62	8.22	8
Nondurable goods	7.33	7.97	9
Mining	1.24	1.24	..
Railroad	1.23	1.46	18
Other Transportation	1.71	1.75	2
Public Utilities	4.90	6.25	28
Commercial and Other	11.05	10.14	–8
Total	35.08	37.03	6

The McGraw-Hill survey of 1957 capital expenditures indicated business planned to spend $40.98 billion this year. However, its results cannot be exactly compared with the SEC figures. Differences in data collected on petroleum industry expenditures account for about $2 billion of the variation between the two reports.

Preliminary plans on expenditures for 1958 made during the 1957 McGraw-Hill survey pointed to capital expenditures of $38.40 billion in the coming year.

Dexter Keezer, McGraw-Hill director of economics, expects to have additional information on 1958 capital spending plans in a few days when results of the preliminary survey of 1958 spending plans will become available.

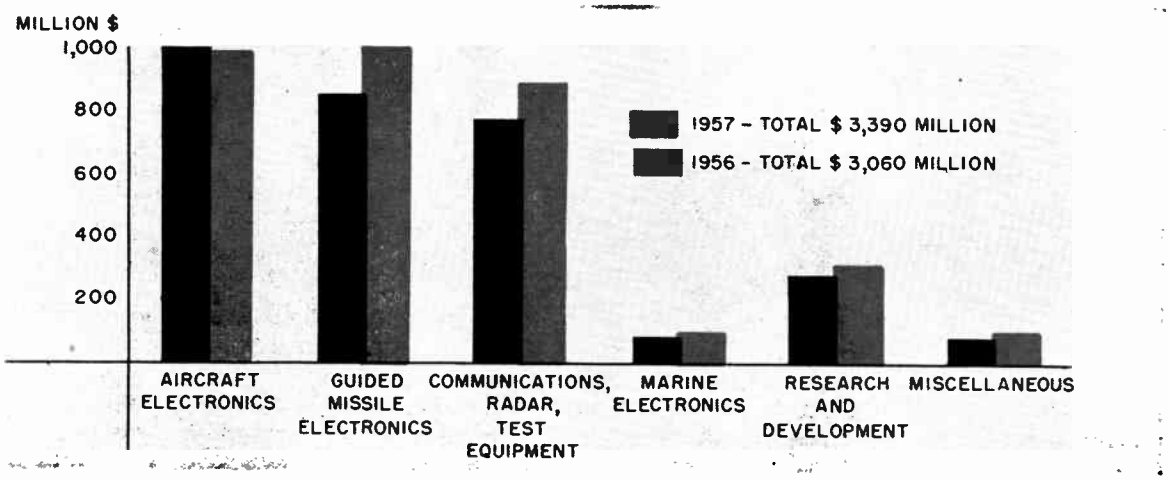
Because of Sputnik, government military spending may rise next year. But today it appears:

Sputnik won't immediately turn loose a flood of new U.S money for defense. At least, not until Congress reconvenes in January.

It won't cause a relaxing of current military economy measures. But funds already available will probably be invested in missiles—this means more business for electronics.

This picture can shift quicker than the speed of satel-light.

PRODUCTION and SALES



Military Sales of $3.4 Billion Expected

Military sales of electronic equipment and parts should total nearly $3.4 billion in 1957, according to latest estimates of military spending for the calendar year. This compares with about $3.1 billion spent last year.

This estimate is based on actual military procurement for the first six months of the year plus the military's recently released estimates of spending in the remainder of the year.

Guided missiles should account for almost one third of all electronics spending by the military in the current year. The 1957 estimate for guided missiles is $1 billion, an 18-percent increase from the $850 million spent on missile electronics last year.

Aircraft should drop to second place in the order of military electronics spending this year. Expenditures are slated to drop to a total of $990 million for calendar 1957. Last year aircraft electronics spending amounted to $1 billion.

Communications, radar and test-equipment spending is not far behind these two leaders. Expenditures of $890 million are estimated for the current year, up $115 million from last year's $775 million.

Estimated research and development expenditures for 1957 are $310 million, a 13-percent increase from expenditures of $275 million last year. Marine electronics is scheduled for a 25-percent increase with $100 million of sales estimated for 1957 compared $80 million in 1956. The same figures apply to the group of ammunition weapons, combat and support vehicles.

EE Schools Update Curricula

• NSF-supported workshop brings together 100 professors at MIT to get a close look at new 'core curricula,' including textbooks

• Many schools revising curricula, some rapidly, as they aim to lead industry and prevent new EE's obsolescence

FIVE YEARS AGO equipment covering half an acre in MIT's electrical engineering department was junked and replaced with one simple machine. That signaled twenty-five man-years of work in revising courses and writing new textbooks.

Last month more than 100 electrical engineering professors attended an Electrical Engineering Curriculum Workshop at MIT to exchange ideas and "bone up" on what goes into MIT's new "core curricula" for EE's. The workshop received financial support from the National Science Foundation.

The EE professors, from engineering schools all over the U.S., were given information on the MIT courses, including a foot-high set of as-yet-unpublished MIT textbooks. They spent 10 days in conferences that will help chart the future course of EE education.

What many top EE educators seem to agree on is that electrical engineering has broadened so much in the last decade that schools must "run fast to keep up with it."

Most of the schools represented at the workshop are in the process of revising their curricula. Some are not able to change from traditional teaching concepts as rapidly as others. Many are making shifts in senior and graduate courses.

"The engineer's role is to exploit science," says Gordon S. Brown, head of MIT's Department of Electrical Engineering. "The aims of our new curriculum are to prevent the EE from becoming obsolete in five years and to train him to solve the unsolved problems of the future—not the solved problems of the past."

Dr. Brown adds that "an engineer with the basic tools to keep learning is OK; but if he must unlearn and then learn anew—he's lost. . . Universities can't teach practice which changes with different industries."

To get a better idea of what the MIT curricula changes mean to the EE student, ELECTRONICS asked several MIT professors. Here are a few representative comments:

Thomas F. Jones, Jr.: "Courses are open-ended to treat devices not yet heard of. One to two years of math and physics were OK in the past. In the future, two and a half years of them will be required—and 3-4 years recommended."

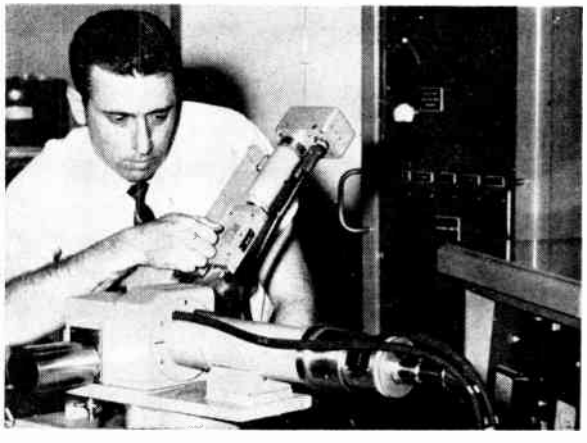
Samuel J. Mason: "Students still do lots of problems and lab work. But we don't try to cover the entire area. . . There's more future in learning ideas than specific techniques."

Weekly reports have been cut down. In 1934 an MIT student wrote three 20-page reports a week. Now he "spends more time working out problems, and writes only one weekly report of 1-2 pages."

The University of California at Berkeley is another school making changes in its EE curricula. Comments R. M. Saunders:

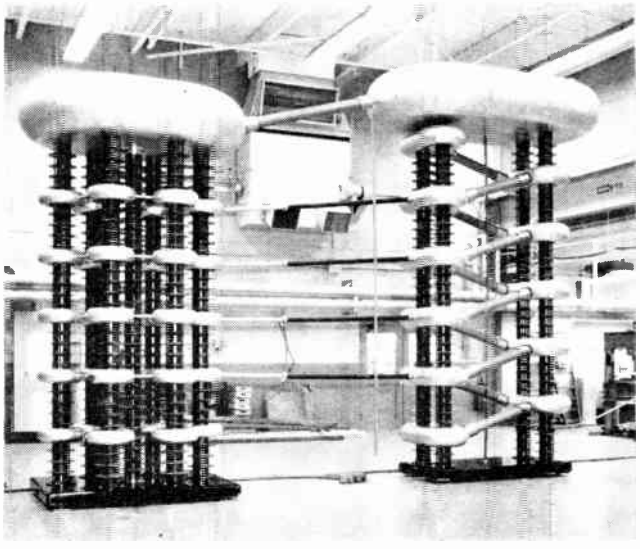
"We are experimenting course by course. EE's are now studying the nature of things rather than specific pieces of hardware. We study a system rather than a component." He adds:

"Schools should lead, not follow industry, as has been happening. Schools that are teaching 1937 engineering in 1957 are selling everyone short. About 50 percent of them fall into this bracket. What is most serious is that they are not only doing it, but they are also content."



Automatic X-Ray

Special x-ray spectrograph made for Kodak by Philips Electronics will be used to detect silver concentration in film emulsion. After setting, unattended instrument prints out quality control data on tape



An 850-ft tunnel, 800-kv accelerator help make . . .

Atomic Lab Good Customer

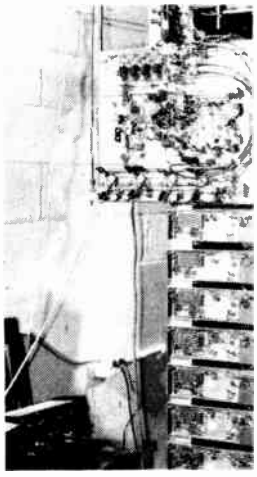
- **Visit to Brookhaven National Laboratory shows importance of electronic equipment in development of peaceful uses of atomics**
- **Lab spent $¾ million last year on electronic apparatus and parts, will put $3.5 million of electronics into new synchrotron**

BROOKHAVEN National Laboratory's two-day open-house this fall put the peaceful atom on view and publicly emphasized the nuclear future's dependency on electronics.

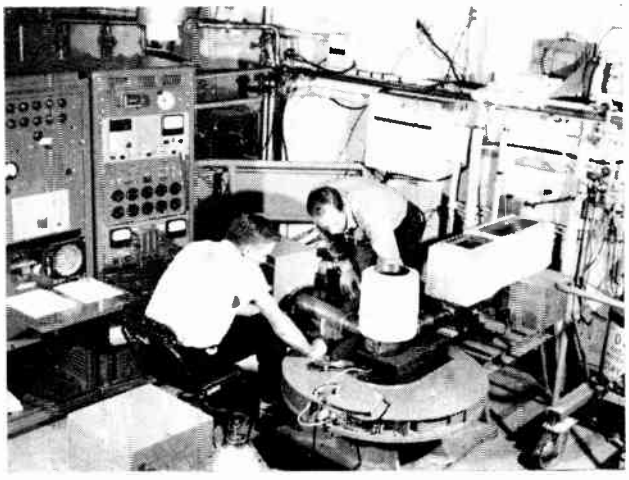
Instruments cover the seven-year-old reactor like barnacles. Up to 80 experiments are in operation at once. Some firms renting space have the equivalent of a radiation laboratory at the reactor.

Other buildings house additional research in nuclear medicine, physics, reactor design, chemistry, biology and agriculture. Much of the work requires electronic equipment for radiation production, control, analysis or protection.

New construction includes a $26 million alternat-



Neutron sorter stores 10 million pulses



Neutron spectrometer at reactor's side

Controls for neutron chopper

Medical technician handles radioisotope

ing gradient synchrotron (AGS) for 1960. A $6 million medical research center and a $350,000 computer are nearing completion.

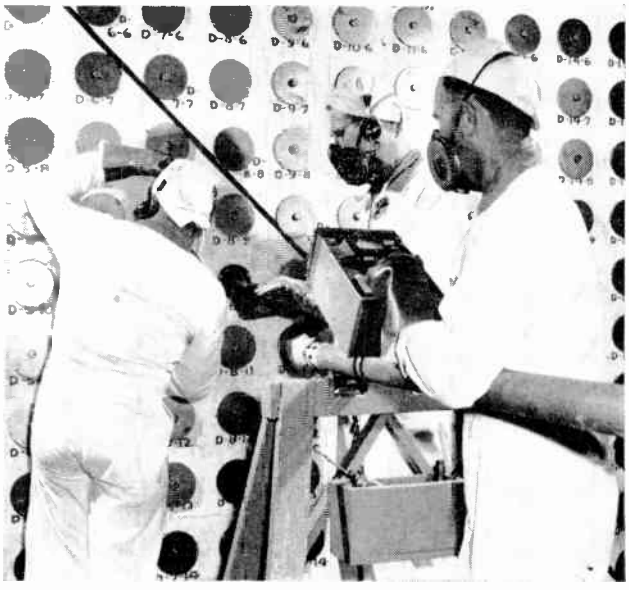
The AGS's 850-foot diameter dwarfs the lab's $7 million cosmotron. The medical center will have its own nuclear reactor, the first designed specifically for medical theraphy.

The Long Island, N. Y., laboratory, now almost completely declassified, is one of six major AEC research centers. Together they represent a $500 million investment and a major electronics marketplace.

Brookhaven spent roughly $525,000 last fiscal year on electronic equipment, not including AGS. Another $174,000 went for components and electronic hardware.

AGS is getting: a $1.3 million accelerator, already delivered; $1 million power supply, $600,000 r-f system and $50,000 worth of instruments. A $500,000 electronic analog was built during design.

Geiger tube looks at thyroid



Removing spent fuel from reactor

for increased design freedom, economy and reliability

select from the industry's widest line...

available to you on rapid delivery in mass-production quantities, for the complete transistorization of scores of commercial and military circuits.

T/I SILICON TRANSISTORS

	1.	2.	3.	Dissipation at 25°C W	Small Signal Current Transfer Ratio h_{fe} (min.)	Small Signal Current Transfer Ratio h_{fe} (max.)	Collector Current I_C mA (except as noted max.)	DC Current Transfer Ratio h_{FE} (min.)	DC Current Transfer Ratio h_{FE} (max.)	Collector Breakdown Voltage-V BV_{CBO} (min.)	Saturation Resistance R_{cs} Ohms (max.)	Alpha Cutoff Frequency $f_{\alpha b}$ mc (min.)
small signal		2N117										1
	903	USN2N117	2N332	0.150	9	20	25			30 45	300	1
		2N118										2
	904	USN2N118	2N333	0.150	18	40	25			30 45	300	2
	904A	2N118A	2N334	0.150	18	90	25			30 45	300	8
		2N119										2
	905	USN2N119	2N335	0.150	36	90	25			30 45	300	2
	910		2N336	0.150	76	333	25			30 45	300	
switching			2N337	0.125			20	20	55	40	300	10
			2N338	0.125			20	45	150	40	300	20
high frequency			3N32	0.125			10			Power Gain: 20 db (min.) at 4.3 mc		
			3N33	0.125			10			Power Gain: 18db (min.) at 12.5 mc		
			3N34	0.125			10			Power Gain:16db (min.) at 30 mc		
			3N35	0.125	8 (typ)		10			Power Gain: 20db (typ.) at 70 mc		
medium power	951		2N339	0.750 1	9		60			50 55	300	
	952		2N340	0.750 1	9		50			80 85	350	
	953		2N341	0.750 1	9		40			120 125	400	
	2N243		2N342	0.750 1	9	32	60			60	350	
	2N244		2N343	0.750 1	28	90	60			60	350	
power	970			8.75			140	3		120	200	
high power	2N424			37.5	10 (large signal)		2A	8		60	10	
	2N389			37.5	10 (large signal)		2A	10		60	6	

T/I GERMANIUM TRANSISTORS

		Former Designation	Dissipation at 25°C mW (except as noted)	Collector Voltage-V (max.)	Collector Current mA (max.)	Beta (min.)	Beta (max.)	Conversion Gain db (min.)	Conversion Gain db (max.)	IF Gain db (min.)	IF Gain db (max.)	Audio Gain db (min.)	Audio Gain db (max.)	Power Gain db (min.)	Alpha Cutoff Frequency mc (avg.)
VHF tetrode (pnp)	3N25	501	25	—15	—2	65 (des. cen.)								10@ 100mc	200
high frequency (pnp)	2N248		30	—25	—5	20 (des. cen.)								10@ 18mc	50
radio converter and IF	2N253		55	12	5					28	32 at 455 kc				
	2N254		65	20	5					32	36 at 455 kc				
npn	2N172	830	65	16	5			22	28						
	2N145		65	20	5					30	33 at 455 kc				
	2N146		65	20	5					33	36 at 455 kc				
	2N147		65	20	5					36	39 at 455 kc				
	2N252		30	—16	—5			30							
pnp	2N308	375	30	—20	—5					39	42 at 455 kc				
	2N309	376	30	—20	—5					41	44 at 455 kc				
	2N310	377	30	—30	—5					37		28*			
audio output (pnp)	2N185	352	150	—20	—150							Class A: 39 Class B: 26			
	2N238	310	50	—20								37	42		
	2N291	357	300	—25	—200							Class A: 31 Class B: 22			
general purpose	2N364	200A	150	30	50	9	19								2.5
npn	2N365	201A	150	30	50	19	49								3
	2N366	202A	150	30	50	49									3.5
	2N367	300	150	—30	—50	9	19								0.7
pnp	2N368	301	150	—30	—50	19	49								1
	2N369	302	150	—30	—50	49									1.3
power (pnp)	2N250	356	25W	—30	—3A	30	Class B Power Output: 10W					Class A 30			
	2N251	356A	25W	—60	—3A	30	Class B Power Output: 40W					Class A 30			
	2N456		35W	—40	—5A	30						Class A 34 Avg.			
	2N457		35W	—60	—5A	30						Class A 34 Avg.			
phototransistor (npn)	800		65	20	5										

*Audio voltage gain = $\frac{E\ Out}{E\ In}$ in recommended circuit

Also general purpose, computer and voltage reference diodes plus high performance (400 mA at 600 V PIV) diode/rectifier. . . complete range of rectifiers as well as super-miniaturized rectifier stacks.

2 New silicon medium power transistors. 4 W at 25°C; 1 W at 150°C; stabilized at 215°C. Bulletin DL-5 840.

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What's Behind Sputnik?

• Satellite's beeps underlined Soviet advances in information theory that can pay off for all types of electronic communication

• Soviets have been spurred on by U. S. developments since 1953, but an 11-year-old basic Russian theory has just become known here

'ROUND AND 'round it goes but what it beeped nobody knows for sure—except the Russians. There is even some belief that Sputnik's signals changed radically over the Soviet Union.

What is pretty clear is that the Russians have been able to transmit data from Sputnik based in large part on recent advances in information theory—if not on the most sophisticated miniature electronic equipment (by U. S. standards).

Electronic engineers who have studied Sputnik's signals told ELECTRONICS that if the satellite is sending information, it is at a slow rate—"the way information theory tells you to send signals in the presence of noise."

Information might be sent by the rate of switching the carrier on and off; amplitude variation between backwave and full carrier; slow amplitude variation of the carrier.

Only last August was the full significance of one Soviet information theory fully realized by a few U. S. mathematicians—11 years after it was formulated in the Soviet Union. A Russian scientist made the paper available at WESCON.

Information theories have contributed greatly to improving the efficiency and quality of communications. The gap between theory and radio engineering is narrowing. As this goes on in Russia, competition with the U. S. gets keener.

Now out is a paper, "Information Theory in the USSR," by Paul E. Green, Jr., of MIT's Lincoln Lab. See: '57 WESCON Convention Record.

By 1955 the most prominent paper at the Leningrad Conference on the Theory of Probability and Its Applications was one by the mathematician Kolmogorov dealing with C. E. Shannon's "A Mathematical Theory of Communications."

Of equal importance to the Russian work stemming from Shannon's theory, Green reveals, is the 1946 theory of potential interference immunity by V. A. Kotelnikov, the significance of which was realized only this year.

Kotelnikov became more closely associated with radio communications R&D after this work, Green says, although he had received Stalin prizes in 1942 and 1944 in that field. In 1953 he was made an Academician, highest rank in the Academy of Sciences. He is now director of the Academy's Institute of Radio Engineering and Electronics, Moscow.

Engineers entered the information theory picture in 1954 when Shannon's work was brought to the attention of the radio society (NTORIE). And cybernetics was "reappraised."

In 1955, Green reports, the Academy of Science, a powerful organization with the status of a Ministry, recommended more research in "radio propagation, h.f. electronics, antenna and feeder systems, and communications theory. And the magazine "Radio" called for "extension of the usable frequency spectrum, semiconductor applications, and a general theory of communications."

Green gives this year-by-year total of articles and references to information theory in Russian electronics journals: 1953:0—1954:1—1955:6—1956:12. In 1957, with about one-third of the total number of issues so far received, there have already been nine articles pertaining to information theory.

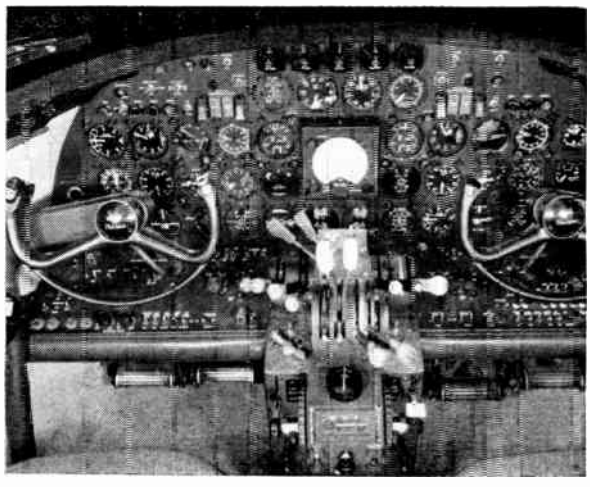
Dope On Its Signals

HERE'S the box score on Sputnik's signals kept by a group of electronic engineers in the New York area:

Transmission is pure c-w, with no trace of 400 cps tone some people have reported. When carrier is switched on and off, switching rate varies slowly, from 140 to 180 times a minute.

At the 140/min. rate carrier is off 0.23 sec. and on for 0.19 sec. during each on-off period. Carrier is apparently switched on and off by a shorting switch and backwave is between 14 and 16 db down from full carrier.

There's an apparent amplitude modulation of the carrier with a period varying from 4.3 to 4.6 sec. One period of 8.5 sec. was noted. Period of amplitude variation is constant during each pass of the satellite but varies from pass to pass.



From cabin tv to weather radar . . .

Exec-Plane Business Booms

Expanding fleet of business planes (23,000 to date) is providing an expanding market for electronic instruments. Present equipment costs range from $3,000 for single-engine planes to over $100,000 for multiengine craft

One day last week at New York's La Guardia airport, 15 executives boarded Sylvania Electric's converted DC-3, now painted a sleek silver and white, and sank down into brown leather chairs directed toward the 21-in tv screen mounted up front by the door.

The flight to Radio Tube division headquarters at Emporium, Pa., where they would attend a meeting at 11:15 a.m., required ten minutes longer than usual for the pilot to detour comfortably around a rough patch of air he'd spotted in advance on his radar.

The letdown by ILS at Bradford airport, near Emporium, came off without a bobble, and the 15 executives arrived at their meeting on time.

Electronic equipment needed to carry off this feat costs an initial $80,000 to $100,000. Installation fees may run it up $25,000 more. Even small single-engine planes need an average of $3,000 worth of electronics.

There are 57,579 air-worthy planes in the general aviation category of which 23,000 are classified for business transportation. Out of 4,183 multiengine planes, 70 percent are in the business class.

Experts in the field predict a fleet of 70,000 to 80,000 general aviation planes by 1966 with an increasing proportion of them multiengine.

At present the large multiengine planes are fully equipped for instrument-flight-rules operations. More than 80 percent of the smaller twin-engine, and over half of the single-engine private planes of three or more places, are similarly fitted.

All planes are expected eventually to install IFR instrumentation as well as two-way radios and autopilots.

Businesses engaged in airplane electronics fall largely into three types: firms which specialize in installing, servicing and overhauling electronic equipment; aircraft overhaul firms which also install, service and overhaul electronic equipment as part of their overall service; and aircraft overhaul firms which only install the equipment.

D. U. Howard, president of Howard Aero, Inc., San Antonio, which converts surplus World War II Lockheed Ventura PV-1 patrol bombers into 300-mph-plus executive airplanes, says the executive plane is one of the best equipped aircraft in the world.

Firms buying executive planes are willing to go all the way for safety and comfort. Frequently they will buy new instruments which are not even found

in airline planes. In some instances such instruments are later adopted for airline use.

Considered of prime importance in buying electronics for airplanes are weight, size, performance, environmental stability and ease of installation.

Lee Langford, secretary-treasurer of Associated Radio Company, Dallas, foresees a steadily increasing business keeping pace with the general upward trend of the aviation business itself.

Langford points out that most electronic equipment for airplanes is being made with tubes built especially for heavy vibration. Other trends include the use of the modular concept of packaging, printed circuitry and the increasing use of transistors which makes electronic equipment easier to maintain, lighter and smaller.

Due to the many variables—size of plane, use of plane, performance requirements and taste of owners—cost of electronics in the executive aircraft covers a wide range.

Heavier twin-engine planes will have electronic instruments costing about $80,000 while typical instrumentation in the lighter twins will cost from $20,000 to $30,000.

For instance, a recent job by Dallas Aero Service, which they describe as typical, included $29,000 of electronic equipment on a light twin.

The installation on a Lockheed Lodestar included:

One transmitter (vhf communications), one receiver (vhf communications), 1 transceiver (vhf communications), dual visual omni-range (vor) receivers, 1 automatic-direction-finder (adf) receiver, dual glide path receivers, 1 marker receiver, isolation amplifier and integrated flight system.

An installation of this type would require 150 electron tubes and approximately four miles of wire. The total weight is 278 pounds and the total current drain on the system is 56 amperes.

In addition to the equipment used in a typical installation, an extremely well equipped aircraft might contain airborne radar, autopilot, approach beam coupler, altitude control, cabin hi fi, and tv.

Howard Aero estimates that they put an average of $82,000 into their Super Ventura.

One electronicized executive transport turned out by Howard included a dual adf system, autopilot system, h-f communications system, vhf navigation system, dual compass system, engine analyzer system, dual inverter system, marker system, vhf communications system, cabin amplifier system, cockpit audio system, distance-measuring-equipment (dme) system, speed-control system and radar system. (See table.) Electronics in this plane ran to $102,000.

New equipment expected for executive aircraft of the future are transponders, Selcal (selective calling), proximity warning indicators, doppler navigation systems, and air traffic clearance given flight crews visually over television type viewers.

Electronic Equipment in Typical Multiengine Executive Plane (Super Ventura)

Cost: plane— $500,000; electronic equipment—$100,000; installation—$25,000

Dual Adf System (automatic direction finder)
- 2 adf receivers
- 2 control units
- 2 loop antennas

Autopilot System (including flight director)
- 2 rate gyros
- 1 pedestal control
- 1 mechanical disconnect
- 1 computer amplifier
- 1 altitude control
- 1 sensing unit
- 2 primary servos
- 1 trim tab servo
- 1 trim indicator
- 1 vertical gyro
- 1 steering computer
- 1 course indicator
- 1 approach horizon
- 1 gyro monitor

H-f Communications System
- 1 h-f transmitter/receiver
- 1 antenna loading unit
- 1 power supply

Vhf Navigation System
- 2 navigation receivers
- 1 accessory unit
- 2 glide-slope receivers
- 1 glide-slope antenna
- 1 course indicator
- 1 crosspointer
- 2 omni bearing indicators
- 2 gyrosyn indicators

Dual Compass System
- 2 amplifiers
- 2 flux valves
- 2 directional gyros

Engine Analyzer System
- 1 portable engine analyzer
- 36 vibration pickups
- 1 condition switch
- 1 vibration selector switch
- 2 sync generators

Marker System
- 1 marker receiver
- 1 marker antenna

Vhf Communications
- 2 transmitters
- 1 vhf receiver
- 2 antennas

DME System (distance measuring equipment)
- 1 interrogator
- 1 indicator
- 2 antennas

Speed-Control System
- 1 indicator
- 1 lift transducer
- 1 flap potentiometer
- 1 lift computer

C-Band Radar System
- 1 transmitter/receiver
- 1 synchronizer
- 1 indicator
- 1 antenna
- 1 control unit

Miscellaneous
- 2 dual inverters
- 1 cabin amplifier
- 1 handset
- 1 isolation amplifier for cockpit

Patent Accords Cut Headaches

Cross-licensing agreements save wear and tear on both engineers and corporation legal departments. Bitter litigations may be stopped by growing trend toward pooling patent know-how. Engineers need not waste time "designing around" patents

LAST month, Radio Corporation of America and International Business Machines Corporation signed a nonexclusive agreement to exchange licenses for their computer patents. Each firm can now use the other's patents freely, without danger of unintentional infringement. The agreement swings a spotlight on the patent picture, illustrates an easy solution to one of industry's tackier problems.

Industrial researchers, working within the confines of corporate security, every once in a while tread on each other's toes. Cross-license agreements cover the cases of duplicated research: each firm licenses the other automatically, and nobody gets hurt.

One obvious result: avoidance of legal tangles like the one just unsnarled between Zenith on the one hand and RCA, General Electric and the Bell System on the other. Zenith stands to recover $10 million from the settlement of its 11-year-old suit, in annual payments of $1 million. The judgment also gives Zenith royalty-free licensing agreements with the three defendants.

IBM already has a cross-licensing agreement with Sperry Rand, executed in January, 1956. IBM then consented to the entry of a judgment settling the issues raised by the Justice Department's antitrust suit. There is a clearly defined trend in the electronics industry toward such nonexclusive agreements. (A nonexclusive agreement gives each company the freedom to license other applicants under its own patents.)

These agreements will of course keep down the number of infringements, suits and countersuits. They can also save valuable research effort: engineers don't have to worry about accidental infringement, don't have to "design around" a competitor's patent.

An IBM spokesman told ELECTRONICS "this kind of pooling doesn't cut competition; it beefs it up. The engineers are free to work at their best—and the results show it."

To the increasing number of small electronics firms who use patents to carve out a place in industry, the trend toward pooling of patented knowledge may have other significance.

Big industrial research labs come up with a major share of new technological developments. Nonexclusive agreements do not seem, on the surface, to freeze out individual inventors, but they may have this effect. Greater freedom of action on the part of big-time research teams will increase the possibility that the small company or individual inventor will find himself walking on somebody's patent-hallowed ground.

In the computer technology, many computer users are praying that IBM's agreement with RCA and Sperry Rand—and possible future pacts with other computermakers—will produce one accidental result: greater standardization of equipment types. Users would like to see the day when the various systems and subsystems will work together without expensive translating gear.

Of this possibility, a spokesman for one computer firm had a terse comment: "Unlikely." Even so, the wish was something to ponder.

No Pings, No Pongs

Spectrum analyzer and recorder built by Brush Electronics tests Carrier room air conditioners at the end of assembly line. In 50 seconds, analyzer checks 24 points in the 8 octaves audible to human ear

100-VOLT TRANSISTOR...

New high power type available

Typical Characteristics at 25° C	DT100
Maximum Collector Current	13 amps
Collector Voltage, Emitter Open	100 volts
Saturatian Voltage (12 amps)	0.7 volts
Power Dissipation	55 watts
Thermal Gradient from Junction to Mounting Base	1.2° °C/watt
Nominal Base Current I_B (V_{EC} = —2 volts, I_C = —1.2 amp.)	-19 ma
Distortion (Class A_1, 10 watts)	5%

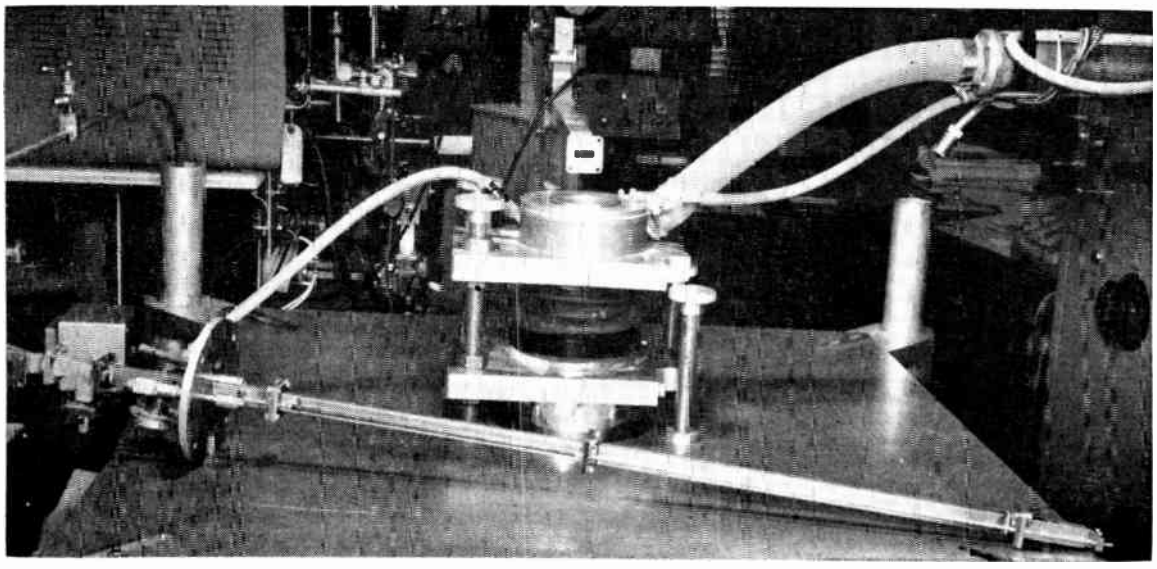
DELCO HIGH POWER TRANSISTORS

The electronics industry asked for a transistor to handle higher voltage—and here it is—Delco Radio's DT100 with maximum collector diode voltage of 100 volts. This is the highest yet, and it paves the way for a wide range of new applications. The new DT100 is an alloy junction germanium PNP transistor—normalized to retain its performance characteristics regardless of age. You can depend on the uniformity, reliability and high current handling capacity of the DT100, just as you have in the past on all of Delco Radio's High Power transistors. Write today for complete engineering data.

DELCO RADIO

Division of General Motors
Kokomo, Indiana

Circle 14 Readers Service Card



Tests in waveguide setup help . . . .

Cold Crystals Improve Radar

- **Elimination of thermal noise by operating microwave amplifiers at liquid helium temperatures may vastly increase radar range**
- **Researchers say that prototypes of paramagnetic crystal amplifiers will be ready in a year, production to begin in 2 or 3 years**

CRYOGENIC quantum mechanical amplifiers—believed by researchers to be a cheap and effective cure for microwave sensitivity and range problems—are almost ready to leave the laboratory for production development.

Using paramagnetic crystals operating on extremely low temperature, the new amplifiers would greatly reduce thermal noise in the receiver's first stage. This could, for example, increase radar range manyfold.

One researcher, Malcolm Strandberg, of MIT, thinks prototypes will be available in a year. Commercial models would follow by a year or two. About $1 or $2 million is spent annually on low-temperature amplifier research.

Engineers at Hycon Eastern agree with Strandberg. Hycon is investigating suitable materials and configurations under Air Force and Navy research contracts.

Advanced Electronics of Cambridge, Mass., (formerly Ultrasonics) has submitted a development proposal to the Air Force. Its preliminary designs are the result of more than two years research.

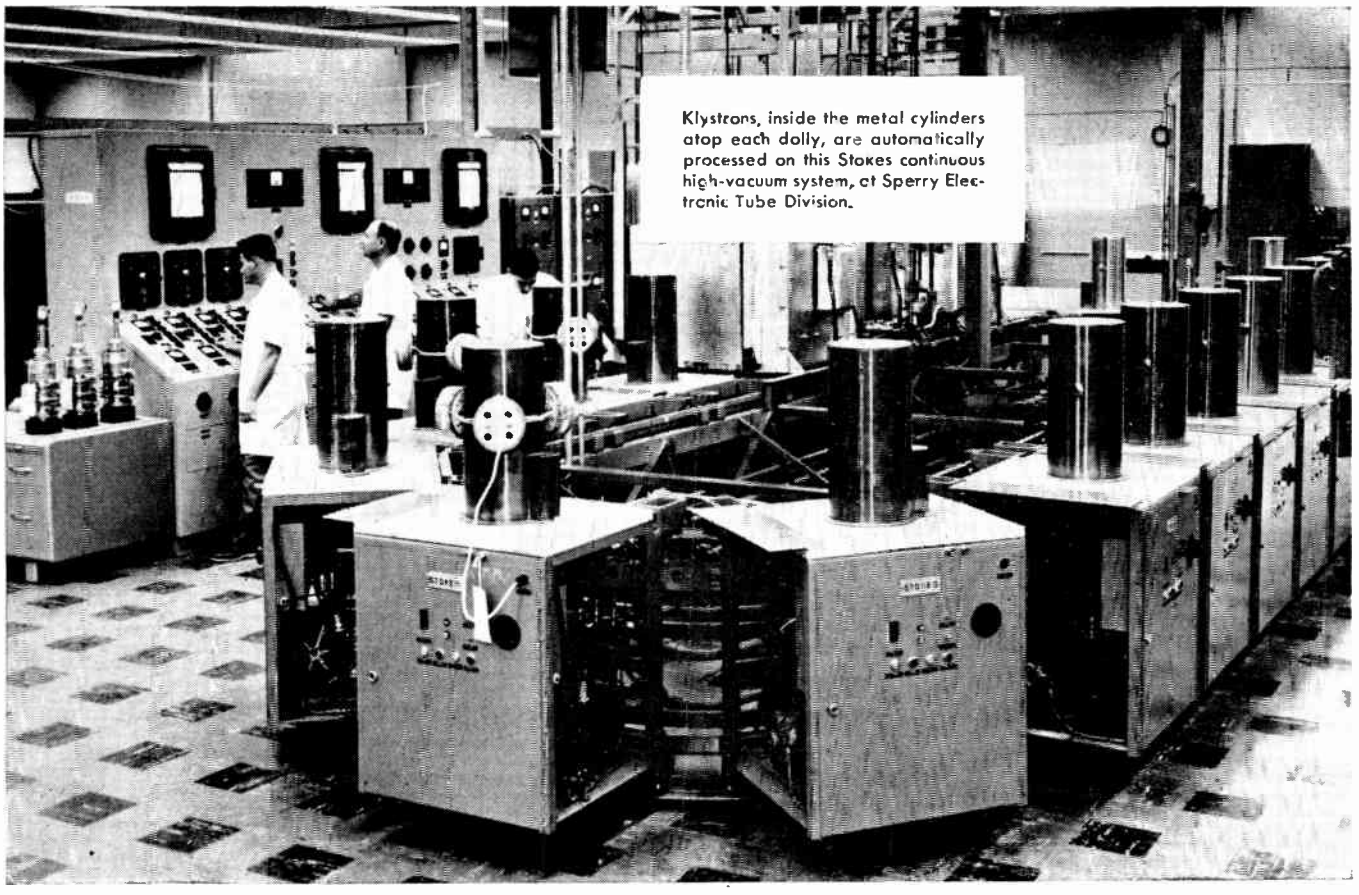
Bell Labs has put aside the paramagnetic oscillator it worked with last winter. The theory tested out satisfactorily. Now Bell is studying configuration of crystals and waveguides.

Predictions made about the impact paramagnetic amplifiers can have on microwave reception include:

- Strandberg: freedom from thermal noise at liquid helium temperatures can make useful sensitivity 1,000 times that of conventional amplifiers.
- Bell Labs: may amplify signals several hundred times weaker than signals usable now, could lead to new transcontinental communications and tv systems.
- Hycon Eastern: eventual improvement of at least several hundred times is indicated.
- Advanced Electronics: initially, 70 percent improvment in radar range and lock-on; eventually, 300 percent improvement.

Strandberg calls paramagnetic amplifiers versitrons, or spin-tools. Using the gyroscopic motion of certain electrons in paramagnetic crystals, the crystals will emit energy when placed in radio and magnetic fields. Heat is not needed for electron motion, unlike conventional amplifiers.

Probable applications run from thermal detection and radio astronomy to tv. But radar will probably get first crack at it, as an alternative to so-called "brute force" improvements or complicated system refinements.



Klystrons, inside the metal cylinders atop each dolly, are automatically processed on this Stokes continuous high-vacuum system, at Sperry Electronic Tube Division.

Klystron production automated with Stokes high-vacuum system

THESE Sperry Klystrons have *got* to be rugged and stable . . . they're the heart of transmitters for precision, all-weather navigation systems. Producing Klystrons requires extremely high vacuum and elevated temperatures to completely de-gas and dry the tubes internally. These conditions must be attained on a high-production, automatic basis.

Stokes, pioneer in high-vacuum processing equipment for the electronic industry, designed and built a continuous evacuating and conditioning system that performs these functions and eliminates the need for duplicate accessory equipment for each of the separate units formerly used. The system consists of an endless loop of evacuating stations, each housed in an individual dolly. As the dollies index around the loop, the tubes are successively degassed, evacuated, aged, conditioned and sealed.

Each Klystron is enclosed in a stainless steel bell in which a reducing atmosphere is maintained to prevent oxidation of the copper tube body during the heating cycle. All operations are automatically sequenced and controlled, with interlocking circuits and limit switches giving added protection. Any dolly can be removed and replaced without shutting down the system.

This Klystron production system is an example of how another major manufacturer is benefiting from Stokes' long experience in high vacuum engineering and automatic production techniques. For a consultation on your specific needs, call your nearest Stokes office.

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VSWR	Less than 1.2
Response	Flat .0 to 250 MC
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Isolation	Cable to Cable, at least 80 DB. Either Cable to Set, from Open Position, at least 65 DB.
Connections	Coaxial Cable RG-59/U Solderless
Mounting	Two Single Hole Clip Brackets

TMS-500 Coaxial Switch.....$9.50

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WIDE BAND, LOW VSWR
VERSATILE APPLICATION

TWO MATCHING TRANSFORMERS for TMS 500

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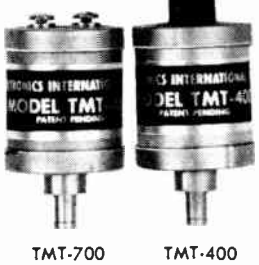
Band Pass	20 MC to 250 MC
Impedance	75 Ohm Cable/300 Ohm Set
VSWR	Less than 1.2
Fittings	RG-59/U Solderless Connectors
Transfarmer Dimensians	1" dia. x 1¼" lang

HOW TO ORDER: Electronics Coaxiol Switches, Cable Taps, Printed Circuit Units, etc. are sald direct for fastest service . . . shipped prepaid when cash accompanies order. Otherwise C.O.D.



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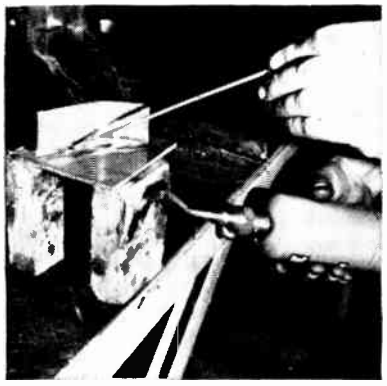

Chemically-fused aluminum, one way . . .

Oxide Problem Solved

Chlorides bond nonferrous metals by ion exchange. Pure zinc solders aluminum through oxides without flux and abrasion

ELIMINATING oxide coatings before soldering aluminum has been an expensive problem. Electronics manufacturers now have available two new joining methods unaffected by oxides. One does the trick chemically. The other employs a pure zinc solder.

A combination of chlorides developed by Intertectics, Inc., of Bedford, Ohio, causes similar or dissimilar nonferrous metals to bond by ion exchange. It works with aluminum, copper, magnesium, titanium, brass, zinc, silver and gold.

The chlorides react instantly on metals heated to 810 F, eliminating surface oxides while causing the metals to flow together. The material is suited to hand or automatic production techniques.

Joints produced in aluminum are stronger than the metal. Joints between dissimilar metals are reportedly stronger than either.

Reaction fumes are toxic. Fumes and residue are water-soluble. The packaged chemical has indefinite shelf life, but must be used quickly after exposure to air.

Bell Laboratories metallurgists report that inexpensive zinc solder will bond aluminum, aluminum alloys and galvanized metals without flux or vigorous abrasion. Oxides and milling oils need not be removed from the metals.

The solder stick is merely wiped across the heated surfaces. The solder penetrates the oxide and wets the metal. The raised oxide coating can be peeled off.

A trace of magnesium and a few percent of aluminum may be added to the solder. It must be free of lead, tin, bismuth, cadmium or other substances which cause intergranular corrosion.

Wax Batteries Look Promising

NATIONAL Bureau of Standards is investigating chemical and electrical properties of inexpensive miniature batteries made with solid wax electrolytes.

Wax batteries appear to provide fairly high voltage with extremely low current and small size. They could be used to maintain a charge on a capacitor or supply grid-bias voltage for electron tubes.

Cells are punched from a three-layer sandwich, stacked 25 cells high and lacquered, to produce a battery only 0.3 inch long.

The cell exteriors are conductive vinyl film and zinc. The separator is impregnated filter paper.

Cells of 0.25 or 0.5 in. diameter are punched out. The smaller cell provides a battery weighing 0.05 ounce and with a short-circuit current of 0.03 microamps. The half-inch battery weighs 0.2 ounce and delivers 0.3 microamp. Both have an emf of about 37.5 volts.

Rhenium Toughens Tubes

Research shows rhenium licks vapor cycle and carbonization harmful to tungsten filaments. Also a good hot contact, thermocouple material

RHENIUM, until recently a laboratory curiosity, may become an important basic material for the electronics industry. Tube filaments will last longer, contacts improved and thermocouple measurement of high temperature aided.

Rhenium's chief shortcomings are high cost—prices start around $700 a pound for powder—fabrication difficulty and scarcity. These limit early use to high cost tubes and critical needs.

Some tentative conclusions reached in a four-year study of the metal by Batelle Memorial Institute for the Air Force are:

- Rhenium is very strong dense and hard. It melts at 4,750 F, ductility decreases with temperature rise and its resistivity-to-temperature plot is a smoothly rising curve.

- Unlike tungsten, rhenium blocks tube vapor cycle and transfer of metal to tube envelopes. It is far superior in resistance to carbonization and withstands shock well.

- Tungsten alloyed with rhenium is easier to fabricate and may become competitive in price with straight tungsten filaments.

- Its high melting point and ability to form a conductive oxide make it a superior contact material. It is an efficient hardener of platinum but is costlier than nickel.

- Rhenium - tungsten thermocouples may be useful to 2,800 C. Couples made with rhenium and tungsten have 15 times the electromotive force of tungsten-molybdenum couples at 1,600 C.

- Its thermionic emission is lower than thoriated tungsten, but rhenium may give a clearer pattern and is preferable to tungsten when vapor is unavoidable or getters cannot be used.

Rhenium is never expected to be abundant. No rhenium ores are known and it is presently a scarce by-product of the refining of certain copper ores. It is available from Chase Brass and Copper Company, which furnished the material used by Batelle. Chase is in developmental production.

New Gear Aids Color-tv

NEW TECHNICAL developments last week brought full-scale color-tv a step closer to reality.

RCA announced a color videotape recorder-player. The firm predicts it will give a big shove to the heretofore snail-like growth of color-tv.

Prototypes of the new unit will be available for network use in early 1958. Production models for stations are planned for delivery late next year. Price is estimated at "under $100,000."

Mechanically compatible with the Ampex black-white unit now in use, RCA's recorder has four heads mounted on a wheel which revolves at 14,400 rpm. This brings the heads in lateral contact with a two-inch tape moving at 15 inches per second.

Both the RCA color and Ampex b-w recorders have resolution powers of up to 4 mc.

Meanwhile, in another newsbreak, it was claimed the problem of insufficient brightness of color video images for film recording has been solved. The claim was made by Telechrome Mfg. Corp., Amityville, N. Y.

Updating one of the earliest electronic tv processes, company engineers have developed a 3-tube, dichroic-mirror system displaying a composite picture on a 5¼ by 7 in. raster.

A prototype of the equipment has been in use for several months at Walter Reed Army Medical Center in Washington. There it was originally designed for use in a closed-circuit system.

The Walter Reed installation has used mostly Kodachrome type A film for the color kinescopes. But engineers there feel any of the available color materials could be used as well.

The equipment is expected to appeal to small broadcasters not yet prepared to invest in video tape.

Other applications may be in military reconnaissance and film processing. Cost will be within $15,000, with delivery in 30-60 days.

Magnet Wire Hits 500C

Magnet wire makers are cracking the heat barrier. Firms are producing insulations that withstand 500 C; experimental products are good up to 800 C. Such extremely high temperatures are encountered in some military and industrial equipment.

One firm, Potter Aeronautical is making coils stable from −198 C to 454 C, with 510 C achieved experimentally. Coils were developed for an aircraft firm for missiles, flowmeters and possibly nuclear installations.

The company winds coils with a glass-wrapped, silicone-bonded wire rated at 316 C, adding a non-organic material. Then the silicone binder is volatilized and driven off to raise the coil's heat stability.

For its internal use GE has developed a 500 C magnet wire. Clad copper or stainless steel tube with a copper core drawn to desired thickness is dipped in a ceramic frit. The frit is applied thinly so the wire may be bent after baking.

Corning Glass has developed glass good up to 800 C. It has wound coils which will withstand 400 C using high-temperature glass and a hot-wind technique.

Premade teflon film has been fused over wire by Adams Consolidated Industries.

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Welding Cable • Electrical Household Cords • Electronic Wires • Automotive Wire and Cable

Navy Shifts to Missiles

Arsenal of 15 known missile models reflects tactically balanced force. Five are operational

LAST WEEK, Navy spokesmen revealed that within five years 35 to 40 percent of Navy's aeronautical spending will go for missiles. About 40 percent of this missile spending will, in turn, go for electronic equipment.

For fiscal 1958 Navy asked for authority to obligate $704 million for missiles. $100 million of this, requested by the Marine Corps, has already been denied. Results of BuAer's request for $237 million and BuOrd's for $198 million are not yet available. A total of $169 million for R&D has, however, been approved. Total possible for 1958 is $604 million—$38 million less than that authorized for missiles in 1957.

Navy's growing arsenal of tactical guided missiles and rockets currently totals a known fifteen. Five are operational (although Sparrow I and Petrel are being phased out), six are near operational and four are still developmental.

Breakdown into categories reveals Navy's planning for a tactically balanced force. Four are air-to-air, five are air-to-surface, three are surface-to-air, and three are surface-to-surface.

OPERATIONAL

Name	Category	Range (Mi)	Prime Contract	Guidance Contract	Type Guidance	Remarks
Sidewinder	Air-to-air	3½	Philco	GE Philco	Infrared	Used by USAF & Marines
Sparrow I	Air-to-air	8	Sperry	Sperry	Beam rider	Being phased out
Regulus I	Surface-to-surface	500	Chance-Vought	Sperry	Command	Surface & sub launched
Terrier	Surface-to-air	20	Convair	Sperry	Beam rider	
Petrel	Air-to-underwater	50	Fairchild	Fairchild	Radar homing	Being phased out

NEAR OPERATIONAL

Name	Category	Range (Mi)	Prime Contract	Guidance Contract	Type Guidance	Remarks
Talos	Surface-to-air	40	Bendix	Sperry	Beam rider/ homing head	Operational early '58
Sparrow III	Air-to-air		Raytheon	Raytheon	Radar homing	Production soon
Regulus II	Surface-to-surface	1,000	Chance-Vought	Stavid AC Spark Plug	Command	Surface & sub launched
Tartar	Surface-to-air	20	Convair	Bendix Philco	Beam rider	Improved Terrier
Dove	Air-to-surface					
Corvus	Air-to-surface		Temco			

DEVELOPMENTAL

Name	Category	Range (Mi)	Prime Contract	Guidance Contract	Type Guidance	Remarks
Polaris	IRBM	1,500	Lockheed	GE, MIT	Stell, inertial	
Bullpup	Air-to-surface	3	Martin			USAF will use
Bulldog	Air-to-surface					Improved Bullpup
Diamondback	Air-to-air					Improved Sidewinder

MILITARY ELECTRONICS

• **Pilots** can now glance at a simplified cathode ray tube that shows the attitude of the aircraft, the altitude, ground speed and compass heading. Described as an all-electronic Contact Analog Generator, the system was developed by Du Mont under contract with Bell Helicopter and Douglas as part of the joint Army-Navy Instrumentation Program.

• **U.S. Chamber of Commerce** president Philip M. Talbott says that while only $1.6 billion in the current defense budget is earmarked for R & D, defense officials concede that actual spending for this purpose will exceed $6 billion. (3 billion of this goes for missiles.) The additional comes from money scattered among other appropriations.

• **Amount spent** on Navy's Triton before it was cancelled hit $24 million. Plans are to continue "modest support" of the existing R&D team to incorporate the most desirable of Triton's design features into future missile systems.

CONTRACTS AWARDED

Autonetics division of North American gets $1,760,000 contract with BuAer for pilot-line procurement of an airborne magnetic tape recorder, called Nadar VIII, to be installed in a Navy interceptor. Automatically recording the attack display information of the fire-control system, the device is also capable of recording voice.

Federal Electric will maintain and operate White Alice (Integrated Communication System, Alaska) under $2,630,000 letter contract

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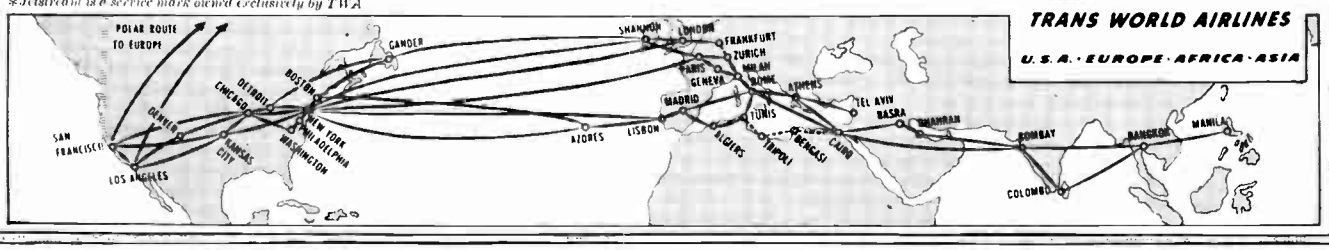


with AMC. Later definitive contract amounting to $15,922,365 is expected.

GE's computer division at Phoenix gets two contracts totaling $630,000. One for $400,000 is from GE's heavy military electronics equipment department for computer analysis and programming research. It will be handled by the Arizona State College computer center, operated by GE through the college. The other contract, for $230,000, is from USAF for an electronic heat-rate computer to be used in high-temperature test facilities at Wright Field.

Radiation announces $2 million in contracts. $1 million for airborne navigation radar and the rest for missile test equipment and telemetry systems.

Admiral will produce radar equipment for BuAer under $1,196,000 contract.

Motorola gets $460,915 contract with AMC for pulse-generators.

IBM gets $420,000 contract with AMC for repair and/or modification of MA-2 bombing navigation systems.

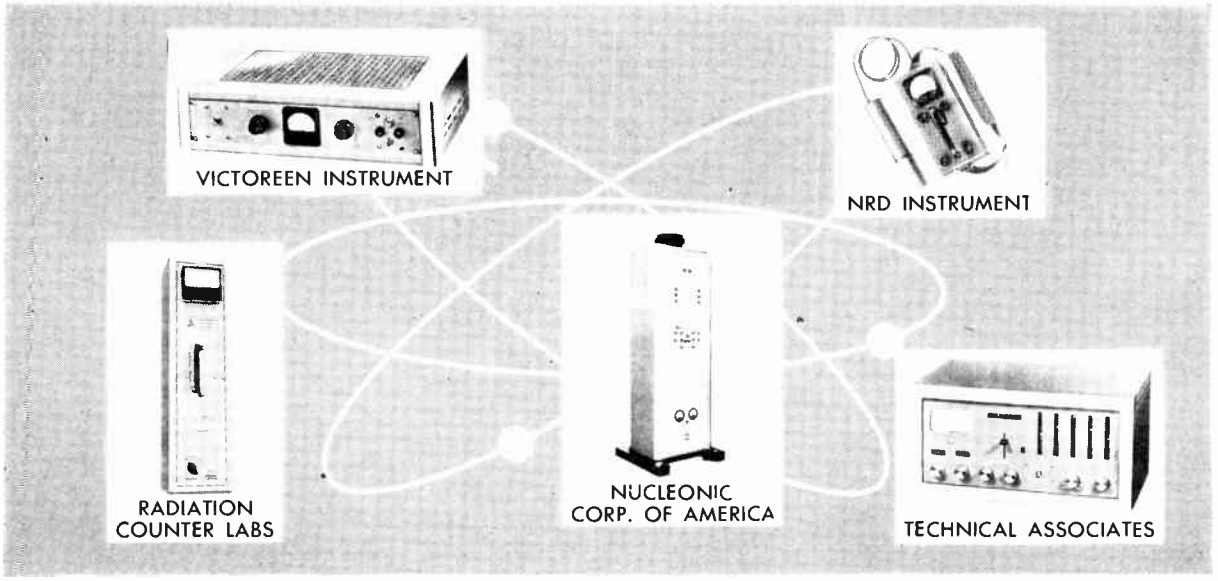
AC Spark Plug has systems responsibility for the MA-6 and MA-7 bombing navigational systems, design responsibility for the ME-5 bombing navigational computer and a field engineering service contract with AMC amounting to $470,261.

GPL will provide AMC with components for GPL's doppler radar navigation system, AN/APN-81, being used in a B-52 and a KC-135. Contract amounts to $1,678,460.

GPL sells doppler radar navigation sets, AN/APN-102 (military version of RADAN), to AMC for $639,271.

Systems Development gets $4,385,446 contract with AMC for product improvement of the universal and simplified camera control systems currently used in RB-47, RD-66 and RF-101 aircraft.

Atoms Accelerate Electronics



Instruments Get Big Push

THE FIELD of nuclear energy is creating new markets for conventional and special types of electronic equipment. Transistorized fast-slow neutron survey meters being marketed by **Radiation Counter Labs** (41) are insensitive to gamma rays below 100 roentgens per hour. Up to 1,400 volts is provided for precision scintillation counting by a power supply developed by **Victoreen Instrument** (42) with regulation of 0.35 percent from no load to full load.

A decade scaler produced by **Technical Associates** (43) for use in nuclear laboratories features five plug-in decade units permitting a direct count up to 199,999. One-hundred-channel pulse-height analyzers made in England are being distributed by **Nucleonic Corp. of America** (44). A portable monitor for fast neutron surveys has been announced by **NRD Instrument** (45).

Magnetostriction filters are being produced by **Raytheon** (46) in a variety of frequencies and bandwidths for use on spectrum analyzers, as narrow-band circuit filters, as the frequency-determining element for oscillators. . . . Accelerometers developed by **Ai Research Mfg.** (47) for operation in the temperature range from −65 to 350 F use the silicone-damped spring-mass system.

Called Teledata, a system by **Friden Calculating Machine** (48) communicates data encoded on punched paper tape over existing telegraph and telephone circuits. . . . **RCA** (49) announces the 2N274 type *pnp* drift transistor with a power gain of 24 db at 10.7 mc when used in a unilateralized common-emitter circuit with base input.

Continuous service at zero to 30 volts, 100 amps is provided by a power supply introduced by **Opad Electric** (50) for testing and operating aircraft electrical equipment. . . . A variety of industrial applications are expected for an electronic X-Y recorder developed by **The Bristol Co.** (51) to plot a continuous curve showing the relationship of one measured variable to another.

A complete series of plug-in circuits introduced by **Engineered Electronics** (52) includes pulse generators, amplifiers, cathode followers, gates. . . . The mirrored scale used on a multirange voltohmmeter developed by **Precision Apparatus** (53) is said to eliminate parallax to make more accurate readings possible.

Metal-film resistors introduced by **Ohmite** (54) can be used at full ¼-watt rating in ambient temperatures of 150 C. . . . Strain-gage pickups are used in a system developed by **Performance Measurements** (55) to provide a digital indication of the center of gravity of missiles. . . . Fully transistorized regulated power supplies announced by **Transistor Devices** (56) are available in units to cover the range from zero to 30 volts.

Electronic micrometers that provide digital readout are being produced by **J. W. Dice Co.** (57) for measurement of fragile or compressible nonconducting materials and parts. . . . Crossover or double-

For more information use READER SERVICE CARD

pole transfer switching or both is provided by a coaxial switch announced by **Transco Products** (58). . . . **Paco Electronics** (59) announces a vtvm in kit form with both d-c and rms a-c ranges up to 1,500 volts and resistance ranges up to 1,000 megohms.

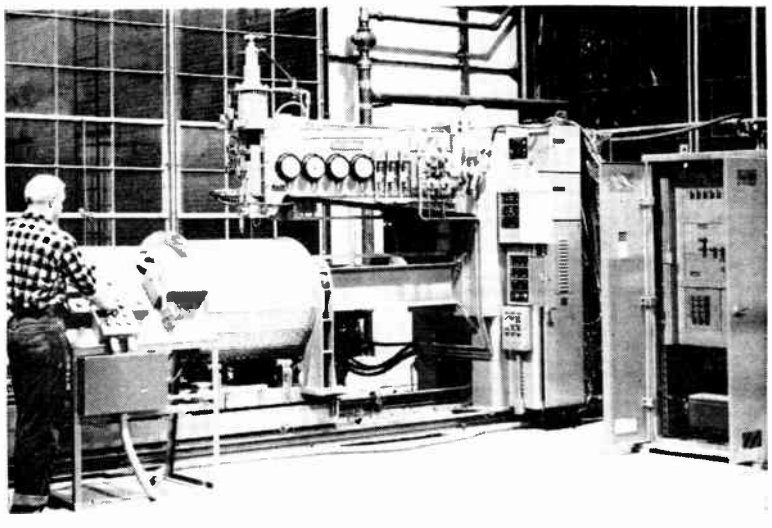
Direct-reading inductance bridges with an accuracy of 0.1 percent are being introduced in this country by **British Industries Corp.** (60) for use as standards. . . . A blower system announced by **Eastern Industries** (61) for use with airborne electronic equipment increases speed as air density decreases to provide constant cooling at varying altitudes.

A line of transistorized subcarrier oscillators have been developed by **Bendix** (62) for application in fm/fm telemetering systems. . . . High-power K_u-band ferrite isolators are available from **Raytheon** (63) covering a frequency range from 16,000 to 17,000 mc with a minimum isolation of 20 db and maximum insertion loss of 0.5 db over the full band.

Control (64) announces standard lines of saturable reactors featuring high-permeability magnetic cores that are said to give unusual sensitivity. . . . A flight programmer that provides desired variable voltages versus time outputs to perform linear and nonlinear functions in planned flight of missiles has been developed by **Western Design & Mfg.** (65).

All-transistor circuitry, printed wiring and self-contained power supply are featured in a test oscillator announced by **Consolidated Electrodynamics** (66) to supply eight preselected frequencies in the range from 15 cps to 150 kc. . . . Room-temperature-vulcanizing silicone rubber has been introduced by **Dow Corning** (67) for encapsulating electronic parts.

Reluctance-type pressure transducers announced by **Datran Electronics** (68) are said to produce high level d-c outputs and have high frequency response for telemetry, air data and guidance systems. . . . A crystal oscillator and frequency divider developed by **Etelco Ltd.** (69) produces a basic sine wave of 100 kc with an accuracy of 0.005 percent and in addition, square waves of 10 kc, 1 kc and cps to be employed



Tape-Controlled Welder

GE calls this nation's first resistance welder with numerical positioning control. It handles 1,600 welds on cylindrical jet engine liners. Electronic system reduces welding time from 9.5 hours to 1.5 hours

for calibration of oscilloscopes and standardization of oscillators.

Linear and nonlinear potentiometers are offered by **Waters Mfg.** (70) with resistance ranges from ½ to 350,000 ohms. . . . Electronic converters are announced by **Mark Simpson Mfg.** (71) to deliver 130 watts a-c power from both 6 and 12-volt batteries for operating public-address systems, radios, lights. . . . Applications in guided missiles, fire controls, radio and radar controls are seen for a line of time delays and program switches offered by **Automatic Timing & Controls** (72).

Size 11, 115-volt, 400-cps servomotors available from **Beckman Helipot** (73) are rated at 200 C unit temperature, continuous duty operation at stall. . . . Ferrite bead chokes ranging from 0.3 to 1.3 microhenrys are offered by **National Co.** (74) for use as filament chokes, parasitic suppressors and series elements of low-pass filters for frequencies from 5 to 200 mc.

No moving parts are used in filament transformers made by **Sola Electric** (75) for 6.3-volt tube filaments and regulation of one percent is provided with line voltage variations of 15 percent. . . . Phase-sensitive a-c vtvm's are available from **Trio Labs** (76) in both single-range and multirange models. . . . Integrating rate gyros announced by **GE** (77) feature self-contained temperature control said to have a tolerance of one-third degree Centigrade.

Toroidal winding machines developed by **Universal Mfg.** (78) handle both wire and tape on the same machine. . . . Instrument transformers offered by **James Vibrapower** (79) are said to operate with signal levels as low as 0.1 microvolt. . . . A flying-spot scanner is used in an instrument made by **Spar Engineering & Development** (80) to convert a curve into a voltage.

From 5 to 15-kv, d-c power supplies announced by **Sorensen & Co.** (81) feature air insulation for minimum weight and selenium rectifiers

for small size. . . . Precious metal wire for resistance windings are announced by **J. M. Ney Co.** (82) with resistivities of 80 and 20 ohms per circular mil foot. . . . Called a Statometer, a portable instrument developed by **United States Radium** (83) detects and measures static electrical charges.

Color intensity is determined photoelectrically in a sulfur titration determinator produced by **Lindberg Engineering** (84). . . . **James Vibrapower** (85) is now inserting dehydrator disks inside its vibrator cans to absorb any sealed in moisture that might adversely affect contact points. . . . A complete line of hermetically sealed subminiature relays for use in military aircraft is available from **Phillips Control Corp.** (86).

New Product Makers

41: Radiation Counter Labs., Nucleonic Park, Skokie, Ill.
42: Victoreen Instrument, 5806 Hough Ave., Cleveland 3, Ohio
43: Technical Associates, 140 W. Providencia Ave., Burbank, Calif.
44: Nucleonic Corp. of America, 196 Degraw St., Brooklyn 31, N. Y.
45: NRD Instrument, 6425 Etzel Ave., St. Louis 14, Mo.
46: Raytheon, Bedford, Mass.
47: AiResearch Mfg., 402 S. 36 St. Phoenix, Ariz.
48: Friden Calculating Machine, 1 Leighton Ave., Rochester 2, N. Y.
49: RCA Semiconductor Div., Somerville, N. J.
50: Opad Electric, 89 Murray St., New York 7, N. Y.
51: The Bristol Co., Waterbury 20, Conn.
52: Engineered Electronics, 505 E. 1 St., Santa Ana, Calif.
53: Precision Apparatus, 70-31 84 St., Glendale 27, N. Y.
54: Ohmite, 3657 Howard St., Skokie, Ill.
55: Performance Measurements, 15301 W. McNichols Rd., Detroit 35, Mich.
56: Transistor Devices, 730 Boulevard, Kenilworth, N. J.
57: J. W. Dice Co., Englewood, N. J.
58: Transco Products, 12210 Nebraska Ave., Los Angeles 25, Calif.
59: Paco Electronics, 70-31 84 St., Glendale 27, N. Y.
60: British Industries Corp., 80 Shore Rd., Port Washington, N. Y.
61: Eastern Industries, 100 Skiff St., Hamden, Conn.
62: Bendix, 11600 Sherman Way, North Hollywood, Calif.
63: Raytheon, Seyon Building, Waltham 54, Mass.
64: Control, Box 391, Butler, Pa.
65: Western Design & Mfg., Santa Barbara Airport, Goleta, Calif.
66: Consolidated Electrodynamics, 300 N. Sierra Madre Villa, Pasadena, Calif
67: Dow Corning, Midland, Mich.
68: Datran Electronics, 3615 Aviation Blvd., Manhattan Beach, Calif
69: Etelco Ltd., High Church St., New Basford, Nottingham, England
70: Waters Mfg., Boston Post Rd., Wayland, Mass.
71: Mark Simpson Mfg., 32-28 19 St., Long Island City 3, N. Y.
72: Automatic Timing & Controls, King of Prussia, Pa.
73: Beckman Helipot, Newport Beach, Calif.
74: National Co., 61 Sherman St., Malden 48, Mass.
75: Sola Electric, 1633 W. 16 St., Chicago 50, Ill.
76: Trio Labs, 1025 Merrick Rd., Seaford, N. Y.
77: GE, Schenectady 5, N. Y.
78: Universal Mfg., 110 Hillside Ave., Hillside, N. J.
79: James Vibrapower, 4050 N. Rockwell St., Chicago 18, Ill.
80: Spar Engineering & Development, Paxson and South Ave., Wyncote, Pa.
81: Sorensen & Co., 333 E. 103 St., New York 29, N. Y.
82: J. M. Ney Co., P.O. Drawer 990, Hartford 1, Conn.
83: United States Radium, Morristown, N. J.
84: Lindberg Engineering, 2450 W. Hubard St., Chicago 12, Ill.
85: James Vibrapower, 4050 N. Rockwell St., Chicago 18, Ill.
86: Phillips Control Corp., Joliet, Ill.

Pay-Tv Groups Go Cable

Scramble for cable franchises underway despite FCC invitation to experiment in toll broadcasting

Pay-tv groups are scrambling this month for closed-circuit franchises, paying little attention to the FCC's recent invitation to experiment in broadcast pay-tv.

Fearing congressional dabbling in subscription broadcasting come January, toll-tv interests are sticking to cable transmission, which so far seems to be beyond federal control.

In Los Angeles, Skiatron, Fox West Coast Theaters and Harriscope have submitted identical bids. These companies offer the city two percent of gross revenue, the minimum allowable under Los Angeles franchising rules.

In San Francisco, Skiatron and Telemeter have applications pending.

Houston, Texas authorities are considering franchise applications from seven hopeful companies: Custom TV, Austin Senators Baseball Club, Texas Bell Video, Trail Drive-In Theater, Interstate Circuit, Loew's State Theater and Bellaire Theater.

Washington, D. C. has an application from WOL Washington for a wire franchise. Accompanying the application is an offer by WOL to provide, without charge, a closed-circuit channel for educational programming. Plans call for the shows to be given by Washington's five universities.

Denver's city council plans hearings on franchise bids from Gene O'Fallon, ex-owner of KTVR, former operator of KFEL and KFEL-TV; TV-Denver, Inc. (headed by J. C. Mullins, operator of KBTV); and McGee Briggs Enterprises.

A few local governments have already given the green light to cable-tv operators. These include Tulsa (to Vumore, and Tulsa Telemovies), Oklahoma City (to Vumore), and Portland, Oregon (to Trans-Video Co. of Oregon).

Until last month, Pacific Telephone and Telegraph's facilities were reported unavailable for toll-tv transmission. Last month they shifted position, opening the way to negotiation.

Meanwhile, subscription television now heads toward wide-scale market tests which will eventually make it or break it as a communications medium.

The Federal Communications Commission laid down its ground rules for three-year tests of broadcast pay tv in 20 major markets. The regulatory body will not act on any applications until next March.

The 20 markets where tests may be run include: Chicago, Dallas-Ft. Worth, Denver, Fresno, Harrisburg, Hartford, Los Angeles, Miami, Minneapolis-St. Paul, New York, Philadelphia, Phoenix, Portland-Vancouver, St. Louis, San Antonio, San Francisco, Seattle, Washington (D. C.), and Wilkes-Barre.

FCC ACTIONS

• **Appoints** John J. Nordberg as chief of its Common Carrier Bureau, succeeding Harold G. Cowgill, now chief of the Broadcast Bureau.

• **Adds** channel 2 to Portland, Ore., giving the city its seventh channel allocation.

• **Inserts** new section into Domestic Public Radio Rules requiring prior notification of use of temporary fixed stations for communication to Canada or Mexico.

• **Expands** authority of chief of the Broadcast Bureau, permitting him to declare a broadcast permit forfeited if the station isn't on the air when specified by the permit, or within an extension period granted by the Commission.

• **Grants** to the Virgin Islands authority to operate five radio stations in the Citizens Radio Service to transmit administrative traffic.

• **Amends** Domestic Public Radio Rules to require specific notice before point-to-point microwave stations begin operation at temporary fixed locations.

• **Permits** Press Wireless to increase rates for message and radiophoto service from England to U. S.

STATION MOVES and PLANS

WAMS, Wilmington, Del., installs new transmitter.

WPFH, Wilmington, Del., adds auxiliary transmitter.

WMBD-TV, Peoria, Ill., begins operations on channel 31 early in January with a 670-foot antenna.

KIRO-TV, Seattle, Wash., installs 820-foot antenna, changes transmitter.

WABF-TV, WBRZ (TV), of Baton Rouge, La., are furnishing home observation crews for a television allocations study now under-

way. Comparisons are being made between measured field strength and actual home reception.

WHVR, Hanover, Pa., plans to increase power and install a third tower for directional daytime operation.

WHC-TV, Pittsburgh, Pa., begins programming over channel 11 and is affiliated with NBC.

WFGA-TV, Jacksonville, Fla., starts operation on channel 12. New station is equipped for local live and film colorcasts.

WJMR-TV, New Orleans, La., is telecasting simultaneously on uhf channel 20 and vhf channel 12, comparing economical and technical advantages of the two systems.

KEPR-TV, Pasco, Wash., increases visual erp to 105 kw.

WKBC, North Wilkesboro, N. C., plans to change antenna and transmitter location, antenna and ground system, transmitter type.

KSEI, Pocatello, Idaho, transfers control from Florence M. Gardner to Pioneer Broadcasters for $213,362 plus stock transfer.

KRUN, Ballinger, Texas, cuts broadcast hours to daytime only.

KZOK, Prescott, Arizona, changes antenna-transmitter location, decreases antenna height.

WJAS, WJAS-FM, Pittsburgh, Pa., sold to National Broadcasting Company by Pittsburgh Radio Supply House, for $725,000.

WSIG, Mount Jackson, Va., plans power increase from 1 to 5 kw.

WSAU-TV, Wausau, Wis., change type transmitted and transmitter location.

WCBS-TV, N. Y. C., airs Sunrise Semester course in comparitive literature in cooperation with New York University. Reaction to the early-morning (6:30) program has been so enthusiastic it will be continued another semester starting in January.

Northeast Plugs R&D

New look for New England's top show this week as manufacturers take over NEREM. Event now sports national tinge

New England's biggest show opens in Boston this week with a new name, increased national emphasis (exhibitors from California), and changed leadership.

NEREM—Northeast Electronics Research & Engineering Meeting—stresses R&D. It runs Friday and Saturday in Mechanics Building. This is new, too; before it was always in hotels.

NEREM ranks fifth in attendance among industry shows. Expected are 5,000 visitors. Previous high: 2,500. Exhibitors' breakdown is now 80 percent manufacturers; 20 percent manufacturers' reps, exact reversal of the mix a few years ago. (NEREM's name then: New England Radio-Electronics Meeting.)

Underlining NEREM's shift from a regional to national convention is this: nearly one-fifth of exhibitors are from outside New England. California's delegation is largest. Washington, Maryland, Indiana, Ohio, Kansas, New York and Jersey also sent exhibitors. The 130 exhibition booths—new high—were sold-out nine weeks after first announcement.

The latest survey of New England electronics by the Federal Reserve Bank of Boston found 123 firms with 158 plants employing 57,000 workers at end of 1955. Annual sales totaled $612 million.

Between 1950 and 1954, the number of firms with R&D programs increased by more than 50 percent. Over the same period annual layout for R&D advanced from $26 million to $42.6 million.

Greater Boston is New England's principal R&D center. MIT, Harvard and other inhabitants of "Research Row" have spawned many of the area's electronic firms as technical personnel moved out of research centers to start their own firms. Nearness to a supply of technical personnel and research organizations is a main attraction for firms moving into the Boston region.

In 1955 the Boston area had 69 plants with 29,000-30,000 employees and annual sales of $326 million, the survey found.

The rest of New England had 69 plants with more than 27,000 employees and sales of $286 million, according to the survey.

Electronic expansion plans in Massachusetts indicate how the industry is benefitting the entire New England region. This year Bay State electronic firms will increase capital spending 18 percent to $52.8 million, while the state's manufacturers as a whole will raise spending only one percent.

Central American Flight Area Set

An air traffic control system for six central American nations went into operation recently, sponsored by the International Civil Aviation Organization.

Known as the Central American Flight Information Region, the new system covers Costa Rica, Nicaragua, Honduras, El Salvador, Guatemala and British Honduras. It is described as "a unified block of airspace from which have been removed the obstacles normally imposed upon civil aviation operations by the existence of national boundaries."

Regional center is at Tegucigalpa in Honduras, but a pilot does not have to call there directly for information or to furnish position reports. He can talk with the flight information station in any of the six countries. Information and messages may be relayed over radiotelephone circuits between the Tegucigalpa station and the others.

FCC Scans Microwave

Manufacturers mark time as Commission readies first hard look at region above 25 mc. For sure: '58 big FCC year

STIMULATED by remarkable electronic advances in recent years, the Federal Communications Commission is making a basic reappraisal of the radio spectrum from 25 megacycles upward to the infinite microwave realm.

Two big dockets are involved, and at the moment neither of them is out of the fact-finding stage. Both will ultimately wind up in rule-making procedures, but neither will reach that procedural point before next year. One certainty: 1958 is going to be a big year at FCC.

This is the situation and the prospect:

• Docket 11866 is an overall study of microwave and other allocation problems above 890 MC. Hearings have been completed on a wide range of questions. Foremost among them is whether common carrier services—the telephone companies, Western Union—should be licensed for virtually exclusive development of service in these high frequencies.

It is 12 years now since FCC last reviewed the allocations above 890 MC. On a more or less experimental basis, microwave service has been made available up to now mainly for government and aviation, fixed point-to-point relay and fixed common carrier operations, with some broadcast and non-broadcast relay also involved.

FCC is waiting now to close formally the record of preliminary hearings. This will occur in about a week. After that, FCC will publish proposed rules and call for hearings on the proposals.

Aside from eligibility standards, look for these rules to establish such things as engineering standards for all point-to-point microwave equipment and whether interconnection of private and common carrier facilities is to be permissible.

• Docket 11997 is a companion overall study of the spectrum between 25 and 890 mc. Whereas the microwave proceeding has its greatest potential impact on the future, this one is immediate, for it is this spectrum range that means the most today to public and business life. Its uses are f-m and tv broadcast, domestic and international public, marine, aeronautical, public safety, industrial, amateur, land transport, and so forth.

No such inquiry has been undertaken by FCC since 1944. Since then, the commission has said, "The use of radio communications for industry, commerce and the general public has expanded so rapidly that it has not achieved status as a leading segment in our nation's economy."

This case started later than the companion docket on microwave, and is not as far advanced. Deadline for filing preliminary comments, after having been extended twice during the summer, was Nov. 1. Now FCC will propose rules that it hopes will (1) take into account the increasing demands of existing and potential users of spectrum space and (2) be geared to engineering and technical advances, making possible not only better but more complete use of this limited range of spectrum.

Once again, FCC will come face-to-face with the politically explosive question of turning the spectrum over to specialized or general common communications carriers.

Rule-making proposals could conceivably be published by FCC before this year ends, but such is not likely. In no event will hearings on whatever rules are suggested be possible before next year, probably up toward spring.

No one in Washington takes very seriously the possibility that FCC will yield spectrum control to common carriers. Political considerations alone almost make even the mere suggestion rhetorical. Indus-

trial, business and private users are powerful and organized—and they oppose this thought with unanimity.

More than that, FCC is already in potential trouble with powerful political elements in Congress. It is one of several regulatory agencies that is under investigation by a House committee that suspects, at very least, the FCC is under the influence of, rather than regulating, the communications industry in this country.

USSR: New Tv and Oil Gear

A TV FILM PROJECTOR actuated by radioactive beams and an electronic integrator for exploiting petroleum finds are new Russian developments reported in a German-language publication of the Soviet embassy in Bonn.

At the tv center in Riga, the publication says, a grain of radioactive material is glued to one of the last pictures of each film roll. The projectors have ion counters with cables to the switch installations of other apparatus.

When the radioactive material passes the counter, the article continues, beta rays actuate an impulse in the tube of the counter which switches in the next projector.

The Soviet publication says the integrator, developed at the Soviet Research Institute for Petroleum and Natural Gas in Moscow, is based on the fact that mathematical formulas for petroleum movement underground are equivalent to those for the movement of current through conductive plates, if the plates are shaped the same way as the earth layers bearing petroleum.

Instead of plates, the integrator uses nets of replaceable resistances to reconstruct the petroleum-bearing layers. The Russians say 750 drillings can be reproduced simultaneously.

The machine, operated by 6-8 engineers, is said to be used to determine minimum number of drills, pressure gradients, position of bore holes, petroleum movements underground, drilling procedures, and also to find oil-bearing underground islands.

British Urge Brain Pool

Scientists see missile cooperation as first step in matching the pace of Soviet technology and education

British scientists last week proposed formation of a coordinating committee for missile and satellite-development in interviews. Prime Minister Macmillian's recent meeting with President Eisenhower dwelled on the same subject.

But this they see only as a first step in Anglo-American cooperation aimed at matching the Soviet Union's totalitarian mobilization of science.

Beyond immediate cooperation in the missile field, they believe that the education of scientists in both countries should be coordinated on the university level. This, they say, would assure balanced distribution of graduate scientists in all fields.

In the missile field certain security regulations must be relaxed, they declare, but the basis for such cooperation already exists. For example, North American Aviation rocket motors for Britain's long-range ballistic missiles are being made under license by Rolls Royce.

This cooperation, says British Interplanetary Society spokesman K. W. Gatland, needs to be extended so that design teams can exchange people. Effectiveness, he adds, cannot be predetermined on the basis of current status in specific fields. What is more important is that ideas could be pooled throughout the design, development and manufacture of missiles.

Gatland envisions a clearing house for theory, design and research ideas that would make it safer to narrow down the alternatives in any project. It would also minimize duplication.

The immediate task is meeting Russia's missile challenge, the scientists emphasize, but the far-reaching problem is coordinating university curricula to train more scientists according to the needs of the various fields. (See New EE Curricula story, pg. 23.)

Metallurgy is cited by the British as the field in which the most immediate cooperation is necessary. They say this is where many missile and nuclear engineering bottlenecks exist. And, pointing up the need for coordination of scientific education, they say, is the fact that comparatively few technical graduates have studied metallurgy in recent years.

DEVELOPMENTS ABROAD

• Soviet block emphasis on tv and radio sets, one gauge of overall electronics development, is being reflected by frequent announcements of production and new goals. Last month Poland and Czechoslovakia admitted being behind their 1957 tv set production quotas, while Bulgaria introduced its first domestic set, a 625-line unit similar to sets made in the USSR, East Germany and Czechoslovakia.

Poland claims output of 6,502 tv sets in the first six months of the year, about 40 percent of its 1957 goal. Czech output of 41,280 sets in the same period represents a 186 percent rise over last year, although behind the quota.

In radio set production, Poland's 329,000 sets in the first six months of 1957 represent a 65 percent jump over last year's rate and 54 percent of this year's quota. Polish goal for 1960: 150,000 tv sets and 950,000 radios. Czechoslovakia turned out 126,264 radios, up 34 percent from January-June 1956.

• **In Zurich** last month the International Electrotechnical Commission accepted a grid spacing of 2.54 mm or ⅒ in. for printed wiring techniques and turned down a counter-proposal based on the metric preferred measure of 2.50 mm. In addition, a subcommittee for semiconductor devices was formed by the technical committee on electronic tubes. More than 100 electronics engineers and physicists attended from 19 countries, including the USSR.

• **In Britain** Mullard announces equipment for fast cleaning of small components in an ultrasonic bath. Action of the waves is directed equally to all sides of the component, allowing cleaning of the whole surface area in one dip, says the firm.

EXPORTS and IMPORTS

Britain's Solartron Electronics Group says it has Pentagon encouragement to bring its transfer function analyzer (TFA), an instrument for testing servomechanisms, to the attention of U.S. missile developers and producers. Solartron says its $5,600-$7,000 TFA's discriminate against noise and unwanted signals, and will measure almost every kind of servomechanism manufactured, detecting imperfections. Firm sees a U.S. market for 3,000 of the test tools and has already sold samples to American missile developers.

In Mexico this month Apeco de Mexico, S.A. begins operations as a sales subsidiary of American Photocopy Equipment Co. (Apeco).

British and New Zealand sales reps have been appointed by Narda Microwave Corp. They are Aveley

Electric Ltd., Essex, England, and W. G. Leatham, Ltd, Wellington, N. Z.

New York last month saw the opening of the Japanese Electronics Exhibition, a permanent showroom for the products of a group of Japanese electronics firms.

In Montreal IT&T Electronics Service Co. of Canada Ltd. has been formed as a new IT&T Canadian subsidiary. The company will engineer, install, operate and maintain telecommunications systems and radar networks.

Canadian subsidiary of the Neptune Meter Co., Neptune Meters Ltd. of Toronto, has acquired Cleveland Meters Ltd. of England, continuing Neptune's expansion program and aiming at world-wide marketing.

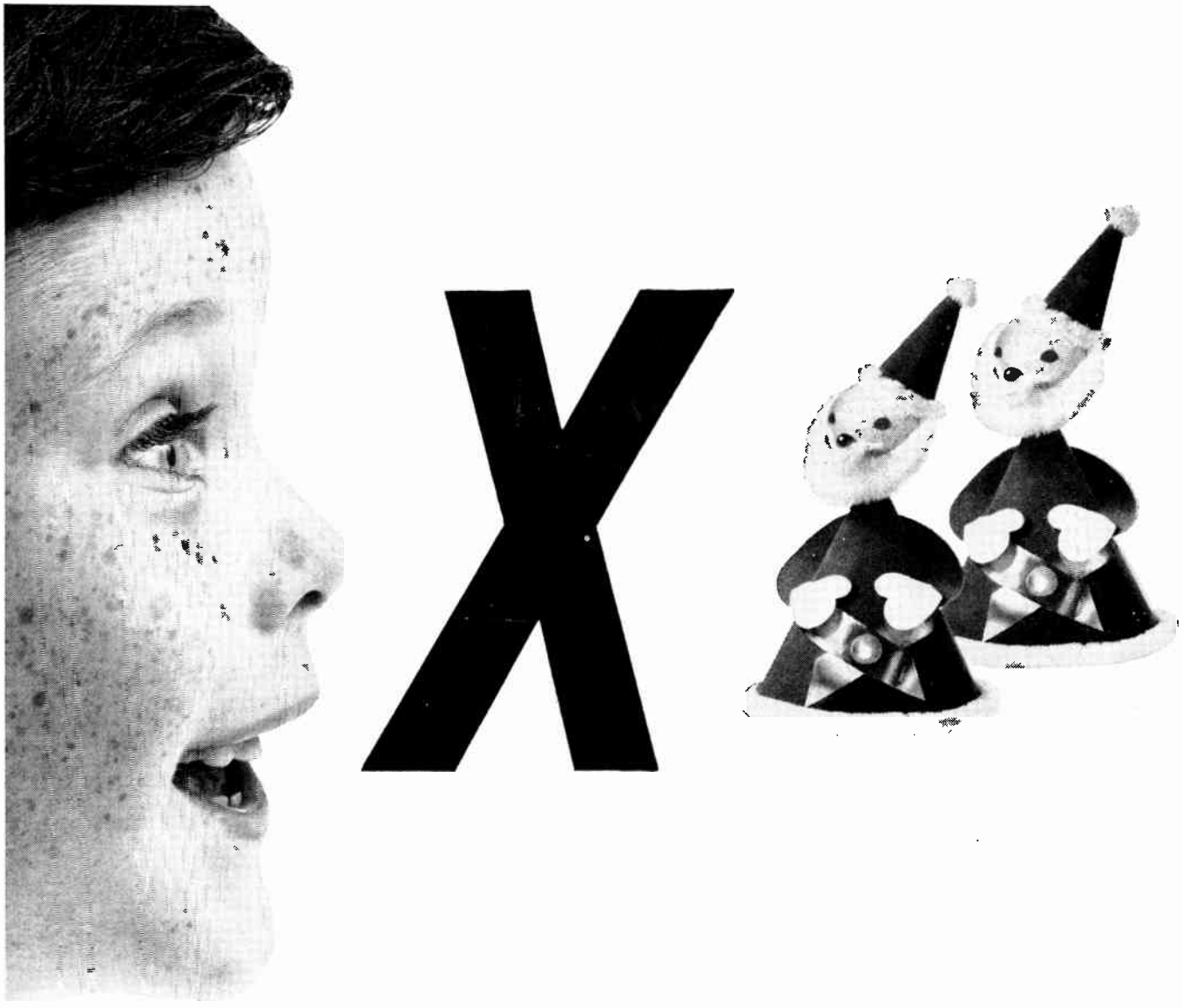
In England last month Texas Instruments Ltd., TI's wholly-owned subsidiary, opened its Bedford plant for the manufacture of transistors and other semiconductor devices.

West German Air Force has awarded a $960,000 contract for automatic direction finders to Lear Electronic GmbH, German subsidiary of Lear, Inc. This brings to $1.5 million the value of Lear's German Air Force orders.

New Zealand's Civil Aviation Administration has awarded a contract to Marconi for the supply and installation of two complete surveillance radar systems.

Chile has ordered 48 mobile and 3 stationary police radiotelephone sets from Telefunken GmbH, Berlin. The German firm expects more orders to follow.

Venezuela has ordered a complete tv station and a medium-frequency sound broadcasting transmitter from Marconi. The British firm is also providing a telecommunications system in Ecuador, a high-power broadcasting station in Argentina, and another tv installation in Venezuela.



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PLANTS and PEOPLE

Hi-fi to Pass $250 Million

BULLISH sentiments marked the opening last month of Rek-O-Cut's new 25,000-sq ft. plant in Corona, N. Y. The $250,000 plant will double former production capacity, officials said. Employees move into new production lines (picture) with up-to-the-minute manufacturing techniques and equipment.

Optimism extended to the future of the hi-fi industry. "This is a hot industry we're in," enthused president George Silber. "If things continue at the present pace, the industry will gross between $250 million and $300 million next year."

Silber went on to discuss stereophonic disc recording, hot topic at last month's High Fidelity Show in New York. "If the stereo disc becomes a commercial reality, as I feel sure it will within the next six months, then sales will certainly exceed present estimates."

Rek-O-Cut started in 1936 as a manufacturer of magnetic phono cartridges with a payroll of four people. Present corporate name was adopted three years later when the firm introduced its lathe-type disc recorder for home use. These recorders used hysteresis synchronous motors, dormant since Steinmetz.

Microgroove recordings hit the market in the late 40's, sparking interest in turntables with minimum wow, flutter and rumble. Hi-fi pioneer Norman Pickering figured hysteresis motors might be Rek-O-Cut to build a playback turntable using the motor. Word-of-mouth reports on the result forced the firm to put the Pickering prototype into production.

Last spring, Rek-O-Cut bought out Audak Co., maker of the Audax tone arm. Audak is now integrated into its parent company as a division.

New Company Makes Contacts

NEW firm in Wethersfield, Conn., is Contacts Incorporated. The company will devote its efforts exclusively to manufacture of electrical contacts.

Contacts Inc. provides engineering services in design and manufacture, aims to answer industry needs for specialized solutions to precision contact problems. President is Robert W. Spellman; K. L. Emmert is vice president and chief engineer.

Firm will shortly move into a new plant with modern manufacturing facilities.

Clevite Revamps Electronics Units

CLEVITE Corporation realigns its electronics activities, sets up three new divisions. Operating units of the firm's electronics group are

now five in number: transistors, instruments, components, ordnance and seismic gear.

Former Brush Electronics sales chief Curtis B. Hoffman is general manager of the new Brush Instruments division. The division develops and produces electronic instruments, including recording oscillographs, amplifiers and industrial production instruments.

James D. Lightbody, who was assistant to Clevite's president, becomes general manager of the electronic components division. The new group was formed from several Brush Electronics departments, produces piezoelectric crystals, ceramics and magnetic heads.

Thomas J. Lynch gets the post of general manager of the ordnance division. This new division combines Clevite Research Center's ordnance department and the special products department of Brush Electronics.

AMA Opens Exec School

AMERICAN Management Association now operates a $2-million management training facility (picture) at what was once the world-famous Trudeau Sanatorium, Saranac Lake, N. Y.

Set in New York's Adirondack State Park, the 90-acre Academy of Advanced Management will give courses in practical business to top and middle executives. First 70-man management training course has already passed through its halls. Courses were formerly given at AMA headquarters in New York.

A new course in executive decision-making uses an electronic computer to simulate the competitive environment of the world of commerce and industry. This latter course embarked on its shakedown cruise last month.

AMA officials point out that more than 1,000 executives have already registered for one or the other of the two courses. Courses at the Academy will run on a weekly starting schedule.

BUSINESS MEETINGS

Nov. 11-13: IRE Instrument Conference, Biltmore Hotel, Atlanta, Ga.

Nov. 13-15: AMA seminar on Product Development (517-91) and Nov. 18-19 on Sales Forecasting for New Products (523-91). Hotel Sheraton Astor, N. Y.

Dec. 2-5: American Rocket Society, annual meeting, Hotel Statler, N. Y.

Aeronutronics Will Build Lab

MULTIMILLION-dollar R&D center will start up soon for Ford Motor's west coast missilemaking subsidiary Aeronautics Inc. The building will rise on the 200-acre mesa near Newport Beach, Calif., where the Boy Scouts jamboreed in 1953.

Aeronautics has bought half of the mesa, has an option on the other half. Ultimate plan is for a 500,000-sq ft. center with pro-

totype manufacturing facilities in addition to research and engineering labs. The Ford subsidiary expects employment to reach 3,000.

The west coast firm developed and built USAF's Farside rocket, recently fired from a balloon 20 miles above Eniwetok Island.

A-C, RCA Get Stellerator Job

PRINCETON University and the Atomic Energy Commission have selected Allis-Chalmers and Radio Corporation of America to design and build "large experimental devices" making up the model C Stellerator for research into controlled thermonuclear reaction.

The model C Stellerator, generating temperatures hotter than the sun to start the fusion process, is not meant to be a thermonuclear pilot plant. It will make possible experimental work which cannot be performed effectively with smaller units.

SRI Vacates Southern Cal

STANFORD Research Institute will close down its Southern California engineering facilities on January 1.

Engineering activities now carried on at Mt. Lee in the Hollywood hills, and in antenna labs in South Pasadena, will go home to Menlo Park. SRI's economics and physical sciences divisions in South Pasadena will continue business as usual.

SRI officials say the decision to retrench was made because of "potential availability of antenna testing facilities . . . on Stanford University land" near Menlo Park. One official hinted that changes in the engineering program also affected the decision.

New Plant for MPB Division

MINIATURE Precision Bearings Inc. will build a new plant on a 15-acre site in Lebanon, N. H. The facility will be new home for MPB's Split Ballbearing division.

Plant will cost $250,000, will provide some 30,000 sq ft of production space. This triples present manufacturing facilities, will double the 75-man force. Construction begins this month.

Split Ballbearing was acquired by MPB last summer. The division makes a line of standard-size bearings for automotive, agricultural and military use. Present division facilities will be leased or sold after the new plant goes up.

Plant Briefs

CONSOLIDATING activities formerly carried on in Stamford, Conn., and New Rochelle, N. Y., **Instrument Motors** division of PM Industries moves into a new facility in Irvington, N. J.

Ballbearing manufacturer **Barden Corp.** is building a $2-million plant in Danbury, Conn. The 125,000-sq ft. plant will be finished in June, will be used for design and production of precision bearings for instruments.

Newly developed industrial park in Pomona, Calif., gets its first tenant as **Hubbard Scientific Laboratories** moves into a new 5,000-sq ft. building.

Executive Moves

CONSULTANT **Walter C. Robertson** moves to American Bosch Arma as v-p for marketing and servicing of defense products.

Donald M. Miller moves up to become executive vice president of Airborne Instrument Laboratories. He was a v-p before moving into the chief-of-staff's job.

Delbert L. Mills leaves A. O. Smith to become executive v-p of IT&T subsidiary Federal Telephone & Radio.

Gramer-Halldorson Transformer Corp. moves **R. E. Cochran** in as v-p in charge of its Crawford Electronics division.

Eckel Valve Co. hires John R. Bly away from Hoffman Laboratories as v-p and general manager, moves Edward P. Martin into sales manager's job.

Reps Selling Controls

COMPUTERS, computation services and automatic controls are starting to go through rep channels from manufacturer to consumer.

Datics Corp. is establishing a network of reps to sell its computing services across the country. First appointments go to **Advance Engineering Inc.**, with offices in Wichita, Kans., and Denver, Colo.; and to **Sanders & Sanders** of Reseda, Calif., serving the Los Angeles area.

Three new reps merchandise the control components of Servomechanisms' Mechatrol division. **Charles J. Kemp**, Dallas, gets the nod for Texas, Oklahoma, Arkansas and Louisiana. **C. W. Mauldin Co.**, Palo Alto, Calif., covers northern California and Nevada; and **Seatronics Inc.**, Seattle serves the great Northwest.

Industrial Components Corp., North Wilbraham, Mass., now Services Magnetic Controls Co.'s line in New England and New York state.

In Seattle, Wash., **Ahmco Sales** becomes Northwest territory rep for Computer-Measurements Corp.

Merit Coil & Transformer Corp. has three new reps in the Midwest. Indianapolis rep **Kenneth G. Reinhardt** takes on territory 16 (pieces of Kentucky and Indiana). C. L. Pugh, Columbus, O., serves Merit's line in four nearby Kentucky counties; and Deerfield, Ill., rep firm **Arnold Litteken Sales** covers Lake Co., Ind.

Transistor Devices appoints Newark, N. J., rep **F. D. Marcy** to cover metropolitan New York and the mid-Atlantic.

Borg-Warner Corp. affiliate BJ Electronics assigns Canadian sales responsibilities for its Detectolab line of nuclear instruments to **Instronics Ltd.**, Stittsville, Ont.

Minneapolis rep **Northern States Sales** takes on the semiconductor line of Radio Receptor Co. The line is now served in upstate New York by **LeRoy & McGuire Inc.**, Phelps, N. Y.

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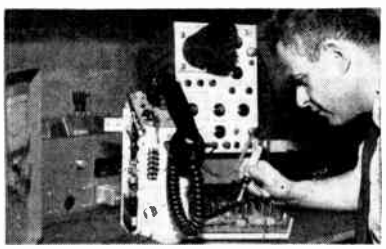
EMPLOYMENT OPPORTUNITIES 55

In Our Nov. 1 Engineering Edition, Don't Miss . . .

• **Stable Oscillators.** Georgia Institute of Technology's S. N. Witt, Jr., has devised a design procedure applicable to oscillators that can be divided into an amplifier and a feedback network. Frequency stability of most oscillators can be improved with this method.

• **Cost Conscious.** Transmitter costs may be trimmed by a series gate modulator developed by R. H. Baer of Transitron. The screen-grid modulator of low audio power has approximately the efficiency of comparable high-level modulators. A controllable clamping circuit holds residual power output to around one-fifth the no-modulation output of a high-level system. Splatter-free speech clipping is inherent in the system.

• **New Horizons.** A comprehensive survey of semiconducting compounds by Abraham Coblenz of Ohmite distinguishes these materials from conventional semiconductors, and discusses their characteristics, unusual properties and present and potential applications. Tables of intermetallic and other semiconducting compounds show important available facts on these materials.



Engineer checks electronic selector circuit of vehicular radiophone

• **No Nightmares.** Cold-cathode trigger tubes in sequential counter circuits supplant "watchmaker's nightmare" in vehicular radiotelephone system. According to W. Ornstein of Canadian Marconi a five-digit code of integers from 2 to 10 permits up to 59,049 subscriber phones on a single channel. Interchange between two audio tones, 600 and 1,500 cps, occurs for each unit of digit dialed. Readout circuit energizes buzzer at receiver for four seconds, then lights indicator lamp if call is not answered. The unit is smaller and less expensive than electromechanical selector used for the same purpose.

• **Coaxial Chart.** Characteristic impedances of coaxial lines are related graphically to dielectric constants and the ratios of outer to inner conductor diameters in the chart designed by H. L. Levin of Federal Tel Labs. Dielectric constants of common materials are also tabulated.

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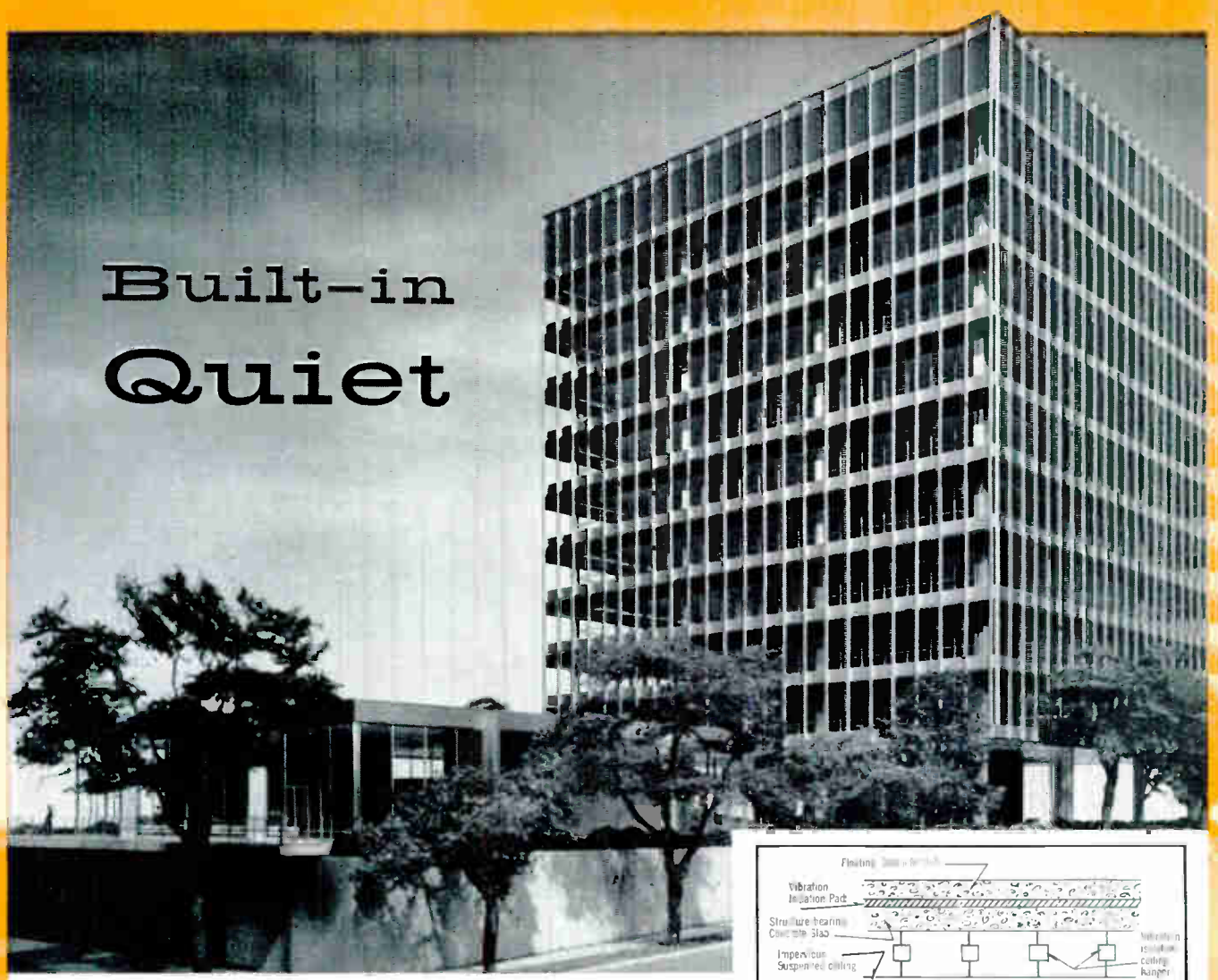

Floor Cross Section above Executive Offices

Noise control is an important goal of modern architectural design. The main objectives — adequate sound isolation between rooms and working areas and the exclusion of unwanted outside noises.

The Warren Petroleum Building at Tulsa, Oklahoma is an example of the acoustical environment that can be achieved through use of modern engineering techniques. The building, designed by Skidmore, Owings, and Merrill, features comfortable working surroundings throughout. Controlled multiple-floor and -wall construction and vibration isolation give 50-70 db noise reduction between the air-conditioning plant on the uppermost floor and the executive offices immediately below. The acoustic effect obtained can best be described as theater-like, in keeping with the decor of executive offices (sound levels are actually below those found in well-designed theaters).

The consulting firm of Bolt Beranek and Newman Inc., long-time user of General Radio sound and vibration-measuring equipment, is responsible for the acoustical design recommendations for this building. Knowledge gained through experience, including technical information obtained from measurements in the field and in experimental laboratories, provides the background needed to assure the desired degree of sound isolation.

Improved acoustics in modern building design has been made possible by the advent of accurate, easily used sound-measuring instruments of the type manufactured by the General Radio Company. The sequence for progress is, today as always . . . Measurement . . . Analysis . . . Improvement.

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Important contributions to commercial and military television include such RCA firsts as the Iconoscope, Image Orthicon, Color Image Orthicon and Vidicon. Development work on camera tubes never stops at RCA. Recent RCA advances are the new low-light-level Image Orthicon—especially useful for "*night*" television, and the new developmental ½-inch Vidicon—useful in compact, lightweight, military cameras.

Whether you are working on surveillance equipment, missile guidance, air traffic control, telemetering, or any other military project where television can perform a vital service—call on RCA for the camera tubes you need. World's largest manufacturer of camera tubes today, RCA is "headquarters" for the most comprehensive line in television.

For more information on RCA camera tubes for military television, call the RCA Field Office nearest you.

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224 N. Wilkinson Street, Dayton, Ohio, HEmlock 5585.
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RCA-5820—Image Orthicon for Black-and-White TV

RCA-6474—Image Orthicon for Color TV

RCA-6198, RCA-6198-A } Vidicons for Industrial TV

RCA-6326, RCA-6326-A } Vidicons for Broadcast TV

RCA-6849—Low-light-level Image Orthicon

Dev. No. C-73456—½-inch Vidicon for Portable TV Cameras

RCA Progress Report on TV Camera Tube "FIRSTS"

1939 RCA announced commercial availability of the Iconoscope—the camera tube that made electronic television possible.

1940 RCA announced the Amateur Iconoscope—opened the television field for experimenters.

1942 RCA introduced the first small Iconoscope—for aerial weapon guidance.

1944 RCA provided the military services with the first Image Orthicon—a supersensitive camera tube.

1946 RCA introduced the first Image Orthicon (the camera tube that revolutionized TV camera techniques)—for studio and outdoor pickup.

1952 RCA produced the first Color Image Orthicon—for use in compatible color television cameras.

1952 RCA announced the first commercial Vidicon—for industrial TV.

1955 RCA announced a developmental ½-inch Vidicon—for miniature portable TV cameras.

1956 RCA designed and built a low-light-level Image Orthicon—a new camera tube especially useful for "night" military operations.